



LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

**MOUNT OLIVE TOWNSHIP
BOARD OF EDUCATION
ADMINISTRATION BUILDING**

**89 ROUTE 46,
BUDD LAKE, NJ, 07828**

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I. EXECUTIVE SUMMARY

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

Mount Olive Township School District
Board of Education Administration Building
89 Route 46,
Budd Lake, NJ, 07828

Municipal Contact Person: Mr. Thomas Scerbo
Facility Contact Person: Mr. Thomas Scerbo

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	\$22,005
Natural Gas	\$18,267
Total	\$40,272

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 $\pm 20\%$. 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	Upgrade Heating System	\$102,840	\$6,669	15.4	127.0%
ECM #2	Install Ductless Split AC Units	\$49,408	\$2,961	16.7	-10.1%
ECM #3	Lighting Upgrade	\$192	\$155	1.2	1114.0%
ECM #4	Lighting Controls	\$2,350	\$514	4.6	227.9%
ECM #5	Computer Monitor Replacement	\$1,100	\$669	1.6	812.9%
ECM #6	Install Condensing Hot Water Heater	\$4,047	\$325	12.5	20.4%
ECM #7	Replace Refrigerator	\$2,500	\$241	10.4	44.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	Solar PV System	\$324,990	\$22,253	14.6	2.7%
Notes:	A. Cost takes into consideration applicable NJ Smart Start TM 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	Upgrade Heating System	0.0	0	3,904
ECM #2	Install Ductless Split AC Units	12.9	18,394	0
ECM #3	Lighting Upgrade	0.5	965	0
ECM #4	Lighting Controls	0.0	3,191	0
ECM #5	Computer Monitor Replacement	0.0	4,158	0
ECM #6	Install Condensing Hot Water Heater	0.0	3,118	(112)
ECM #7	Replace Refrigerator	0.0	1,498	0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Solar PV System	28.9	43,548	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. See below for the recommended ECM summaries:

- **ECM #3:** Lighting Upgrade
- **ECM #4:** Lighting Controls
- **ECM #5:** Computer Monitor Replacement
- **ECM #7:** Replace Commercial Refrigerator

ECM #3 – Interior Lighting Upgrades

The majority of the lighting in the Administration Building was updated to modern fluorescent fixtures. However, there are still incandescent bulbs in a number of the areas such as utility closets and storage areas. Compact fluorescent lamps provide a simple and easy way to reduce electrical energy. Due to the significant efficiency increase of CFL bulbs, this ECM has a simple pay back of approximately 1.2 years. This ECM is recommended for the Administration Building.

ECM #4 –Lighting Controls

The existing lighting controls are comprised of manual wall switches. The proposed lighting controls for this facility include occupancy sensors which detect motion and infrared emitted by people's movement and body heat. These controls provide automatic control of each room's lighting to ensure light energy is not used when the rooms and offices are unoccupied. This ECM saves approximately \$514 per year and has a simple payback in 4.6 years.

ECM #5 – Computer Monitor Replacement

Some of the computers in the Administration Building offices utilize CRT computer monitors. These types of monitors are outdated and have several disadvantages such as; significantly increased higher energy consumption, large amount of desk space usage, poor picture quality, distortions and flickering image, secular glare problems, and high weight, and electromagnetic emissions. Many of the drawbacks are difficult to quantify except for the energy use. CRT monitors use considerably more energy than an alternative flat panel LCD monitor. Replacement of the existing CRT monitors with LCD monitors saves considerable energy as well as provides other ergonomic benefits as well. This ECM has a simple payback in 1.6 years and it is highly recommended for the building.

ECM #7 – Replace Commercial Refrigerator

The Administration Building kitchenette is currently equipped with a large commercial grade refrigerator primarily for storing supplies for the meetings in the conference room. The commercial refrigerator is oversized for the purpose and runs year round. Significant energy

savings will be realized by replacing this refrigerator with a smaller Energy Star rated commercial refrigerator. This ECM has a simple payback of approximately 10 years and it is recommended for the building. More energy savings and a faster payback can be achieved by replacing this commercial refrigerator with a residential grade refrigerator.

Further Considerations:**ECM #1 – Heating System Upgrade**

The steam boilers in the Administration Building are extremely old and inefficient. Although the steam boiler installation does not have a simple pay back at or below 10 years, it is recommended to consider this replacement. Typically, boiler replacements are difficult to justify with the energy savings alone. This ECM would provide an annual savings of approximately \$6,669, which is substantial. Since the boilers expected life is 30 years, this ECM will provide savings long after it has paid for the installation.

To present further savings opportunities, analysis for three other options have been performed in this study. The options include:

- Conversion to Hot Water System (74 Years payback)
- Installation of Packaged AC Units (108 Years payback)
- Geothermal HVAC system (Most savings, 58 Years payback)

All of these options have significantly long payback periods. However, implementation of one these ECM's may be incorporated into a budget, which may eventually have to be created to update the highly outdated heating systems in this building.

Operation and Maintenance Considerations:

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 weather stripping on entrance doors to minimize outside air infiltration.
3. Clean all light fixtures to maximize light output to avoid the use of task lighting at work stations.

4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Seal openings on all air conditioning unit and air handling unit ductwork transitions within the unconditioned attic space to minimize outside air infiltration.
6. Turn off computer monitors and set computers to sleep when not being used. Computer monitors and computers are becoming one of the largest energy consumers in buildings today. Set computers to sleep when not being used and automatically turn off the computer monitors. Do not set computer monitors to “screen saver” mode which saves the screen life, not energy.
7. Set boiler controls to automatic to take advantage of boiler temperature setbacks.

Additional Recommendations

To provide assistance to small public entities in the effort to implement valuable ECMs, the NJ Clean Energy program in combination with the BPU has initiated the “Direct Install Program”. This program provides extremely large incentives to facilities such as Mt. Olive BOE’s Administration building, to jump start energy projects. The direct install program offers incentives up to 60% of the installation costs through the services of pre-approved contractors. The program is directed towards one for one replacement projects that save energy and provide valuable upgrades for the facility for only 40% of the installation cost.

Conclusion

Overall, Mt. Olive Administration Building’s energy use is below average when compared to other similar buildings in the region. With the implementation of the ECMs above, the facility is expected to see further reduction in energy consumption.

II. INTRODUCTION

The comprehensive energy audit covers the 22,000 square foot Administration Building, which includes offices, conference rooms, storage rooms, kitchenettes and mechanical spaces.

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/ft²/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:

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

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

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

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

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

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

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. 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. New Jersey Natural Gas (NJNG) provides natural gas to the facility under the General Service Large (GSL) transport service rate structure. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The third party commodity provider Pepco was responsible for providing the supply of gas to the building. The facility switched to a HESS as the new commodity provider starting from July 2010. Commodity (Supply) and delivery is billed separately for each respective utility service.

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

<u>Description</u>	<u>Average</u>
Electricity	16.1¢ / kWh
Natural Gas	\$1.58 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY			
Utility Provider: Jersey Central Power & Light (JCPL)			
Rate: General Service Secondary			
Meter No: D23620103			
Customer ID No: 10 00 01 0154 84			
Third Party Utility Provider: -			
TPS Meter / Acct No: -			
MONTH OF USE	CONSUMPTION	DEMAND	TOTAL BILL
Sep-09	12,688	50.4	\$2,071
Oct-09	11,374	36.6	\$1,778
Nov-09	11,114	36.2	\$1,739
Dec-09	10,475	40.6	\$1,680
Jan-10	10,751	40.6	\$1,719
Feb-10	10,410	36.1	\$1,643
Mar-10	10,223	39.9	\$1,642
Apr-10	10,080	36.6	\$1,602
May-10	10,394	42.5	\$1,683
Jun-10	12,319	51.4	\$2,027
Jul-10	13,321	58.4	\$2,212
Aug-10	13,393	56.7	\$2,210
Totals	136,542	58.4 Max	\$22,005
AVERAGE DEMAND 43.8 KW average AVERAGE RATE \$0.161 \$/kWh			

Figure 1
Electricity Usage Profile
Mt. Olive BOE
Administration Building
Sep-09 through Aug-10

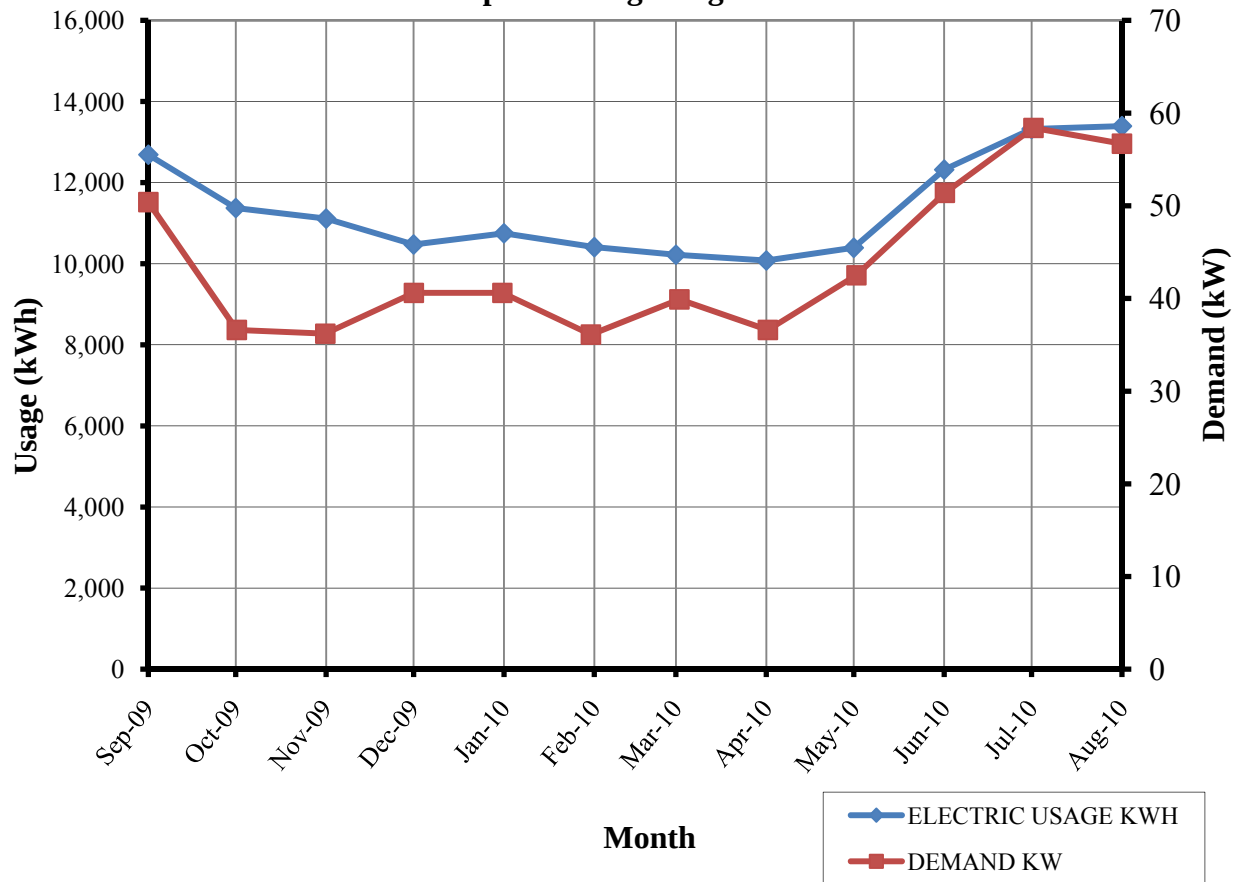
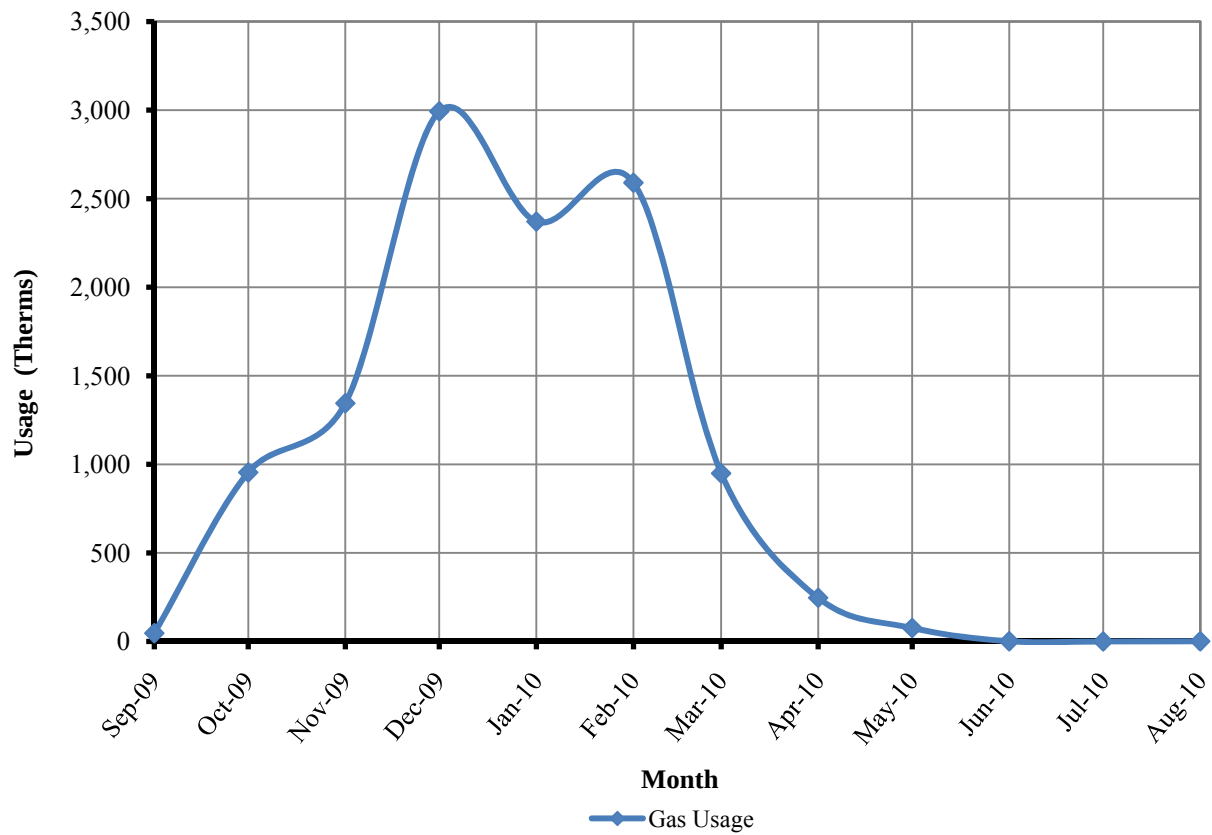


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: New Jersey Natural Gas Rate: GSL Meter No: 00811987 Point of Delivery ID: - Third Party Utility Provider: Pepco, Hess TPS Meter / Acct No: 81129166516, 446646/447325		
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Sep-09	46.70	\$278.23
Oct-09	954.36	\$1,679.85
Nov-09	1,344.89	\$2,190.03
Dec-09	2,993.14	\$4,136.88
Jan-10	2,370.90	\$3,319.60
Feb-10	2,590.07	\$3,648.56
Mar-10	949.07	\$1,405.52
Apr-10	246.38	\$596.46
May-10	76.21	\$327.81
Jun-10	1.05	\$228.47
Jul-10	0.00	\$227.08
Aug-10	1.06	\$228.12
TOTALS	11,573.83	\$18,266.61
AVERAGE RATE:	\$1.58	\$/THERM

Figure 2
Natural Gas Usage Profile
Mt. Olive BOE
Administration Building
Sep-09 through Aug-10



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:

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

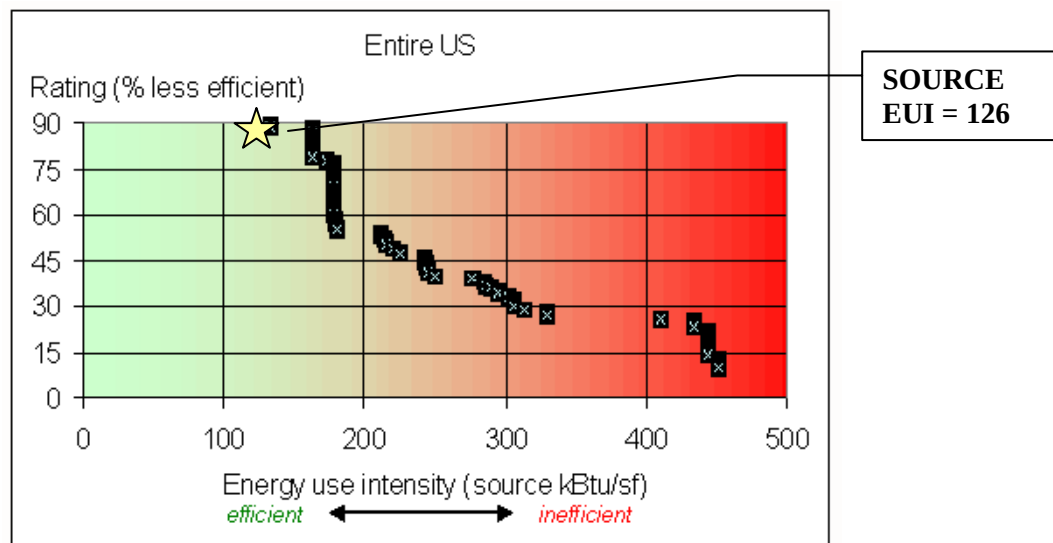
$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Gas Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	136,542			466,154	3.340	1,556,956
NATURAL GAS		11,574		1,157,383	1.047	1,211,780
TOTAL	136,542	11,574		1,623,537		2,768,736
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	22,000 SQUARE FEET					
BUILDING SITE EUI	74 kBtu/SF/YR					
BUILDING SOURCE EUI	126 kBtu/SF/YR					

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

Figure 3
Source Energy Use Intensity Distributions: Public Order Buildings



C. EPA Energy Benchmarking System

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

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

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

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

User Name: mtoliveschools

Password: lgeaceg2010

Security Question: What city were you born in?

Security Answer: Mount Olive

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
Board of Education Administration Office	76	50

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

V. FACILITY DESCRIPTION

The 22,000 SF Mount Olive Board of Education Administration Building is a two story facility comprised of administration offices, conference rooms, storage spaces, kitchenette, custodial spaces and mechanical spaces. The typical hours of operation for this facility are between 8:00 am and 5:00 pm on weekdays. The facility is closed on weekends.

The building is a concrete block structure with brick and stucco siding on a concrete slab foundation. The amount of insulation within the wall could not be verified. The windows throughout the facility are in fair condition. Typical windows throughout the facility are double pane, 1/4" clear glass with aluminum frames. Blinds are utilized through the facility per occupant comfort. The blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer. The roof is built up with hard foam and rock covering. The amount of insulation below the roofing is reported to be minimal. The facility was built in 1924 and extended in 1954.

HVAC Systems

The administration building heating is provided via two antique gas fired steam boilers located in the lower level mechanical room. The boilers were made by Richards and National Boiler Companies in 1925 and 1950. The boilers were originally designed to burn coal. They were retrofitted with gas burners. Actual fuel conversion date could not be confirmed. Each boiler is equipped with a single speed PowerFlame gas burner. The boilers are enabled manually by the maintenance personnel.

Steam is distributed in the building to the cast iron steam radiators and fan coil units. There are four (4) active heating zones in the building. Each heating zone is controlled via a thermostat located in the zone and a valve feeding steam to corresponding zone. The boilers are controlled via end switches on each motorized valve. Some of the cast iron steam radiators are equipped with thermostatic control valves while others are controlled with manual shut off valves. The steam convectors are equipped with motorized valves and fans. The controls for the valves and the fan speed are located locally on each convector.

The cooling for the offices in the Administration Building is provided with a variety of unitary air conditioning units. The Curriculum and the Instructors Unit cooling is provided with a ducted 2-ton split air conditioning system made by Dayton. The Buildings and the Grounds office is also conditioned with a ducted air conditioning system made by Lennox. In addition, the conference room, server room and one of the offices are conditioned with ductless split air conditioning systems made by Sanyo and Fujitsu. The remaining offices are cooled with window air condition units. There are a total of eighteen (18) 1-ton and four (4) 2-ton window A/C units serving various offices in the building.

Exhaust System

Air is exhausted from the toilet rooms through local exhaust fans. The fans are interlocked with the lights in the bathroom.

HVAC System Controls

The air conditioning systems within the facility are controlled manually through on-board controls on each unit. The staff is instructed to turn off air conditioners when they leave the office. The split A/C units in the Buildings and Ground Office and the Curriculum Office are controlled via digital programmable thermostats. The heating zones valves are controlled with digital programmable thermostats located in the corridors. The boiler is interlocked with the end switches on the steam zone valves.

Domestic Hot Water

Domestic hot water for the restrooms and office lounge is provided by a 50 gallon A.O. Smith electric hot water heater with heating capacity of 4,500 Watts. The domestic hot water is circulated throughout the building by a hot water circulation pump. The circulation pump is controlled by an aqua stat. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout the building is fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. Storage rooms and closets are 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: Heating System Upgrade

Description:

The heating for the Administration Building is provided via two gas fired cast iron steam boilers made in 1925 and 1950. The boilers are well beyond their expected useful service life, which is 35 years per ASHRAE. The boilers were originally designed for burning coal. They were first retrofitted with oil burners and then retrofitted with gas burners. It is reported that a single boiler can satisfy the load throughout the year. This means boilers often run at partial load conditions. Current average combustion efficiency of each boiler is estimated to be 55% due to limited turn down ratio and cycling losses, age of the equipment, rusting and sediment build-up on the heat transfer surfaces, deteriorating or missing insulation, outdated design and controls.

This ECM's energy savings are based on multiple alternative HVAC systems. The calculation results should be used for comparative purposes between system alternatives, not as a basis for overall building energy use or operating cost. The owner should have a professional engineer verify heating and cooling loads prior to moving forward with this ECM.

Alternative #1: Replace one of the Steam Boilers

CEG recommends replacing one of the two (2) original steam boilers with a 70 BHP high-efficiency, fire-tube steam boiler to carry the steam load during the entire heating season. The natural gas to steam efficiency for a new fire-tube steam boiler with digital burner controls is approximately 84% over its operating range. With the advanced digital controls, the boiler shall have a minimum 10:1 turn down ratio.

This energy conservation measure will replace one of the gas fired steam boilers serving the facility. Calculations are based on Cleaver Brooks CBE model boilers or equivalent. The owner should consult with a professional engineer prior to pursuing with this ECM.

Energy Savings Calculations:

Gas consumption of the steam boiler plant is gathered in order to calculate the estimated annual steam production of the boiler plant. Then, the steam production info is used in a reverse calculation to obtain proposed annual gas consumption based on improved efficiency.

$$\text{Net Heat Production, MMBTU} = \frac{\text{Gas Consumption (Therms)} \times \text{Boiler Efficiency}}{10 \frac{\text{Therms}}{\text{MMBTU}}}$$

$$\text{Gas Consumption, Therms} = \frac{\text{Net Heat Production, MMBTU} \times 10 \frac{\text{Therms}}{\text{MMBTU}}}{\text{Boiler Efficiency}}$$

Total annual gas consumption of the boiler is obtained from the natural gas billing data, which is summarized in the Table 4 in section IV. Calculations are summarized in the table below.

STEAM BOILER REPLACEMENT CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Existing Cast Iron Steam Boiler	New Firetube Steam Boiler	
Natural Gas (Therms)	11,573		
Boiler Efficiency (%)	55%	83%	28%
Net Produced Heat (MMBTUs)	637	637	
Gas Cost (\$/Therm)	1.58	1.58	
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Natural Gas Usage (Therms)	11,573	7,669	3,904
Energy Cost (\$)	\$18,285	\$12,117	\$6,169
COMMENTS:	New steam boiler with advanced burner control features including high turn down ratio, excess air control, accurate-repeatable air/fuel ratios etc.		

Project Cost, Incentives and Maintenance Savings

Estimated cost for removing one of the existing boilers and installing a fire-tube steam boiler with advanced controls is \$105,000. The cost does not include any asbestos abatement requirements.

Estimated maintenance savings achieved with this ECM is \$500/Year based on annual cleaning and repair fees.

From the **New Jersey Smart Start[®] Program Incentives Appendix**, installation of a high efficiency steam boiler falls under the category “Gas Heating” and warrants an incentive based on efficiency at or above 83% for this type of equipment. The program incentives are calculated as follows:

GAS FIRED BOILER REBATE SUMMARY - ALT 1				
UNIT DESCRIPTION	UNIT EFFICIENCY	REBATE \$/MBH	PROPOSED CAPACITY MBH	TOTAL REBATE \$
>1500 - ≤ 4000 MBH	83% AFUE for Steam boilers	\$1	2160	\$2,160
TOTAL			2160	\$2,160

Alternative #2: Install Hot Water Heating System

Steam heating is an inherently inefficient process due to the higher operation temperature of the system. An alternative to further reduce the heating energy consumption of the building is to convert the entire heating system into hot water. A hot water heating system with a condensing hot water boiler will allow the system to run at over 90% efficiency.

The retrofit includes installation of a new condensing hot water boiler, all new hot water piping throughout the building, hot water pumps, hot water radiators and controls.

Energy Savings Calculations:

Similar to Alternative #1, gas consumption of the steam boiler plant is gathered in order to calculate an estimated heat production of the boiler plant. Then, the heat production info is used in a reverse calculation to obtain proposed annual gas consumption based on improved efficiency.

$$\text{Net Produced Heat, MMBTU} = \frac{\text{Gas Consumption (Therms)} \times \text{Boiler Efficiency}}{10 \frac{\text{Therms}}{\text{MMBTU}}}$$

$$\text{Gas Consumption, Therms} = \frac{\text{Net Heat Production, MMBTU} \times 10 \frac{\text{Therms}}{\text{MMBTU}}}{\text{Boiler Efficiency}}$$

Energy savings calculations include pumping energy losses with the introduction of the hot water circulation into the heating system. The circulation energy is calculated with the equation below. Although minimal, energy consumption of the existing steam condensate return pumps are included in the calculation as well.

$$\text{Pumping Energy, kWh} = \frac{\text{Pump HP} \times \text{Conversion, } 0.746 \frac{\text{kWh}}{\text{HP}} \times \text{Hours of Operation}}{\text{Power Factor}}$$

Total annual gas consumption of the boiler is obtained from the natural gas billing data, which is summarized in Table 4, section IV. Calculations are summarized in the table below.

HOT WATER BOILER CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Equipment	Existing Steam Heating System	Hot Water Heating System	
Nat Gas Usage (Therms)	11,573		
Boiler Efficiency (%)	55%	90%	35%
Steam condensate Pump HP	1/4	-	
Estimated Circulation Pump HP	-	1	
Pump Operation Hours	1,000	3,000	
Electric Power Factor	0.9	0.9	
Gas Cost (\$/Therm)	1.58	1.58	
Electricity Cost (\$/kWh)	0.161	0.161	
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Net Produced Heat (MMBTUs)	637	637	
Pumping Energy (kWh)	207	2,487	
Natural Gas Usage (Therms)	11,573	7,072	4,501
Heating Energy Cost (\$)	\$18,285	\$11,174	\$7,111
Pumping Energy Cost (\$)	\$33	\$400	(\$367)
Total Operation Cost (\$)	\$18,319	\$11,575	\$6,744
COMMENTS:	New hot water system includes high efficiency condensing boilers and controls, hot water radiators, pipes and circulation pumps.		

Project Cost, Incentives and Maintenance Savings

Estimated cost for replacing the existing steam heating system with a new hot water heating system including a high efficiency condensing hot water boiler, circulation pumps, hot water piping, radiators, insulation and controls is \$535,000. The cost does not include any asbestos abatement requirements.

Estimated maintenance savings: \$500/Year based on annual cleaning and repair fees.

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 - ALT 2				
UNIT DESCRIPTION	UNIT EFFICIENCY	REBATE \$/MBH	PROPOSED CAPACITY, MBH	TOTAL REBATE
>1500 - ≤ 4000 MBH	84% AFUE for Hot Water boilers	\$1	2160	\$2,160
TOTAL			2160	\$2,160

Alternative #3: Install Rooftop Packaged Air Conditioning Units

Another alternative for upgrading the heating and air conditioning system in the Administration Building is to install a new central multi-zone ducted air conditioning system. Typical systems of this type include packaged roof-top air conditioning units, network of ducts and variable air volume (VAV) boxes throughout the spaces.

This ECM represents a full system change from the existing heating and cooling for the building. It includes the installation of packaged air conditioning units on the roof of the building, ductwork throughout the office spaces and terminal VAV boxes. The rooftop units should be equipped with gas burners and heat exchangers for primary air preheating. Basis for the calculation is Rheem Prestige Series packaged rooftop air conditioners or similar.

Energy Savings Calculations:

The calculations are based on the efficiency of cooling and heating via packaged rooftop air conditioners.

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Consumption, kWh} = \frac{\text{Cooling (Tons)} \times 12,000 \frac{\text{BTU}}{\text{TonHr}}}{1000 \frac{\text{W}}{\text{kWh}}} \times \frac{\text{F. L. Hours}}{\text{Cooling EER}}$$

Where:

F.L. Hours: The net equivalent full load cooling hours of the cooling system

EER: Energy Efficiency Ratio

Gas consumption of the steam boiler plant is gathered in order to calculate an estimated heat production of the boiler plant. Then, the net produced heat is used in a reverse calculation to obtain proposed annual gas consumption based on improved efficiency.

$$\text{Net Produced Heat, MMBTU} = \frac{\text{Gas Consumption (Therms)} \times \text{Boiler Efficiency}}{10 \frac{\text{Therms}}{\text{MMBTU}}}$$

$$\text{Gas Consumption, Therms} = \frac{\text{Net Heat Production, MMBTU} \times 10 \frac{\text{Therms}}{\text{MMBTU}}}{\text{RTU Furnace Efficiency}}$$

Total annual gas consumption of the boiler is obtained from the natural gas billing data, which is summarized in Table 4, section IV. Total installed cooling capacity is estimated based on the number and the sizes of window air conditioning units and split air conditioning units serving the facility. Calculations are summarized in the table below.

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Equipment	Existing Steam Heating System and Various AC Units	Ducted A/C System with Heat	
Boiler Gas Usage (Therms)	11,573	-	
Boiler Efficiency (%)	55%	-	
Furnace Efficiency (%)	-	80%	
Estimated Cooling Capacity, Tons	40	40	
Cooling Efficiency, EER	9	11.0	
Full Load Cooling Hours	800	800	
Gas Cost (\$/Therm)	1.58	1.58	
Electricity Cost (\$/kWh)	0.161	0.161	
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Net Produced Heat, MMBTU	637	637	
Heating Enrgy Consumption, MMBTU	1,157	796	362
Natural Gas Usage for Heating(Therms)	11,573	7,956	3,617
Electric Usage for Heating, kWh	0	5,371	(5,371)
Electric Usage for Cooling, kWh	42,667	34,909	7,758
Heating Energy Cost (\$)	\$18,285	\$13,436	\$4,849
Cooling Energy Cost (\$)	\$6,869	\$5,620	\$1,249
Total Energy Cost (\$)	\$25,155	\$19,056	\$6,098
COMMENTS:	New system includes packaged rooftop units, ductwork, VAV boxes, and digital zone controls with time of the scheduling, set-back etc.		

Project Cost and Incentives

Estimated cost for removing the existing system and installing a forced air heating and cooling system including a ductwork throughout the spaces, variable air volume boxes and controls is 660,000. The cost does not cover asbestos abatement requirements.

From the **New Jersey Smart Start[®] Program Incentives Appendix**, installation of a central air conditioning system falls under the category “Central DX AC Systems” and warrants an incentive based on efficiency rating (EER) at or above 9.5 for this type of equipment. The program incentives are calculated as follows:

CENTRAL AC SYSTEM REBATE SUMMARY - ALT 3				
SYSTEM DESCRIPTION	UNIT EFFICIENCY	REBATE \$/TONS	PROPOSED CAPACITY, MBH	TOTAL REBATE \$
>30 to 63 tons	≥ 9.5 EER	\$40	40	\$1,600
TOTAL			40	\$1,600

Alternative #4: Install Geothermal Heat Pump System

The Administration Building poses an opportunity for a geothermal heating and cooling system. Currently both the heating and cooling systems in the building are inefficient. The internal heat gain of the interior zones as well as the heat loss from building extremities allow heat pumps to efficiently transfer heat from one zone to another without any supplemental heating or cooling. In addition, utilization of this system will not only replace the current outdated heating system, but also add air conditioning to the offices with improved zone control and occupancy comfort throughout the building.

This ECM represents a full system change from the existing heating and cooling for the building. It includes removing existing steam boilers, pipes and radiators, installation of water source heat pumps throughout the building and excavating trenches for drilling bore holes for the geothermal bore field.

Energy Savings Calculations:

The calculations are based on the efficiency of cooling and heating via ground source heat pumps. The basis for the calculations is Climatemaster TR series Water Source Heat Pumps or equivalent.

Seasonal energy consumption of the heat pumps at the cooling mode is calculated with the equation below:

$$\text{Energy Consumption, kWh} = \frac{\text{Cooling (Tons)} \times 12,000 \frac{\text{BTU}}{\text{TonHr}}}{1000 \frac{\text{W}}{\text{kWh}}} \times \frac{\text{F. L. Hours}}{\text{Cooling EER}}$$

Where:

F.L. Hours: The net equivalent full load cooling hours of the cooling system

EER: Energy Efficiency Ratio

Seasonal energy consumption of the heat pumps at the heating mode is calculated with the equation below:

$$\text{Energy Consumption, kWh} = \frac{\text{Total Heating Energy Consumption, Therms} \times \text{Existing System Efcy, \%}}{\text{Heat Pump COP} \times \frac{\text{Therms}}{29.3 \text{ kWh}}}$$

Where:

COP: The coefficient of performance of the heat pump system

Total annual gas consumption of the boiler is obtained from the natural gas billing data, which is summarized in Table 4, in section IV. Total installed cooling capacity is estimated based on the number and the sizes of window air conditioning units and split air conditioning units serving the

facility. Pumping energy consumption is negligible in comparison to the condensate pumps on the existing heating system. Calculations are summarized in the table below.

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Equipment	Existing Steam Heating System and Various AC Units	Geothermal Heat Pump System	
Natural Gas Usage (Therms)	11,573	-	11,573
Boiler Efficiency (%)	55%	-	
Heating System COP	-	3.5	
Estimated Cooling Capacity, Tons	40	40	
Cooling Efficiency, EER	9	19	
Full Load Cooling Hours	800	800	
Gas Cost (\$/Therm)	1.58	1.58	
Electricity Cost (\$/kWh)	0.161	0.161	
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Net Produced Heat, MMBTU	637	637	
Heating Emrgy Consumption, MMBTU	1,157	182	975
Natural Gas Usage for Heating(Therms)	11,573	0	11,573
Electric Usage for Heating, kWh	0	53,285	(53,285)
Electric Usage for Cooling, kWh	42,667	20,211	22,456
Heating Energy Cost (\$)	\$18,285	\$8,579	\$9,706
Cooling Energy Cost (\$)	\$6,869	\$3,254	\$3,615
Total Energy Cost (\$)	\$25,155	\$11,833	\$13,322
COMMENTS:			

Project Cost and Incentives

Estimated cost for demolishing existing system and installing a ground source heat pump system including a vertical bore field, condenser water loop and water source heat pump is \$825,000. The cost does not include any asbestos abatement requirements.

From the **New Jersey Smart Start[®] Program Incentives Appendix**, installation of a Ground Source Heat Pump system falls under the category “Ground Source Heat Pump” and warrants an incentive based on efficiency rating (EER) of the equipment. The program incentives are calculated as follows:

GROUND SOURCE HEAT PUMP REBATE SUMMARY - ALT 3				
UNIT DESCRIPTION	UNIT EFFICIENCY	REBATE \$/TON	PROPOSED CAPACITY TONS	TOTAL REBATE \$
Small Heat Pump Units	≥20 EER	\$750	40	\$30,000
TOTAL			40	\$30,000

Energy Savings Summary

Below is a summary of cost, savings and payback for each alternative improvement for comparison.

ECM #1 - ENERGY SAVINGS SUMMARY				
	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Installation Cost (\$):	\$105,000	\$535,000	\$660,000	\$825,000
NJ Smart Start Equipment Incentive (\$):	\$2,160	\$2,160	\$1,600	\$30,000
Net Installation Cost (\$):	\$102,840	\$532,840	\$658,400	\$795,000
Maintenance Savings (\$/Yr):	\$500	\$500	\$0	\$0
Energy Savings (\$/Yr):	\$6,169	\$6,744	\$6,098	\$13,322
Total Yearly Savings (\$/Yr):	\$6,669	\$7,244	\$6,098	\$13,322
Estimated ECM Lifetime (Yr):	35	35	15	24
Simple Payback	15.4	73.6	108.0	59.7
Simple Lifetime ROI	127.0%	-52.4%	-86.1%	-59.8%
Simple Lifetime Maintenance Savings	\$17,500	\$17,500	\$0	\$0
Simple Lifetime Savings	\$233,399	\$253,539	\$91,476	\$319,726
Internal Rate of Return (IRR)	5%	-4%	-18%	-6%
Net Present Value (NPV)	\$40,448.57	(\$377,187.11)	(\$585,597.99)	(\$569,386.29)

ECM #2: Install Ductless Split Air Conditioners

Description:

Air conditioning for the majority of the administration buildings is provided via window air conditioning units. There are a total of eighteen (18) 1-ton and four (4) 2-ton window A/C units serving various offices in the building. Majority of the window A/C units are standard efficiency units. In addition, some of these units are attached to the windows in a permanent fashion such that they cannot be easily removed from the windows during winter months. This causes infiltration of unconditioned cold air into the spaces in the heating season. An alternative method of air conditioning for these spaces is the ductless split air conditioning systems. Typical system of this type is comprised of a single or multiple indoor fan coil unit(s) and an outdoor condensing unit. Efficiencies of typical systems vary between SEER 13 - 25.

This ECM includes replacing window air conditioning units with ductless mini split heat pump systems. A preliminary strategy of implementation can be found in the table below:

IMPLEMENTATION SUMMARY			
ECM INPUTS	Number of Units	Cooling Capacity	Total Capacity
Single Zone 1-Ton Unit	3	12000	3
Single Zone 2-Ton Unit	4	24000	8
Dual Zone Unit	3	24000	6
Tri Zone Unit	3	36000	9
Total	13		26

The basis for this ECM is Fujitsu Halycon Series split systems with single and multiple wall mounted indoor units and ground or roof mounted outdoor units. Heat pump units will provide heating in the mild winter days. This will improve zone temperature controls and reduce discomfort due to under heated or overheated spaces. The owner should have a professional engineer verify configuration, heating and cooling loads prior to moving forward with this ECM.

Energy Savings Calculations:

Cooling Energy Savings:

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \frac{\text{Operation Hours}}{1000 \frac{\text{W}}{\text{kWh}}}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

ECM #2 DUCTLESS MINI-SPLIT AC UNIT							
ECM INPUTS	COOLING CAPACITY, BTU/Hr	ANNUAL COOLING HOURS	SEER WINDOW UNITS	SEER SPLIT UNITS	# OF UNITS	ENERGY SAVINGS kWh	DEMAND SAVINGS kW
Single Zone 1-Ton Unit	12,000	1,430	10	25	3	3,089	2
Single Zone 2-Ton Unit	24,000	1,430	10	18	4	6,101	4
Dual Zone Unit	24,000	1,430	10	16.5	3	4,056	3
Tri Zone Unit	36,000	1,430	10	15	3	5,148	4
Total					13	18,394	13

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity, } \left(\frac{\$}{\text{kWh}} \right)$$

Project Cost, Incentives and Maintenance Savings

From the NJ Smart Start® Program appendix, the replacement of window AC units with ductless mini split AC units falls under the category “Unitary HVAC Split System” and warrants an incentive based on efficiency (SEER) at or above 14 for this type of systems. The program incentives are calculated as follows:

$$\text{Smart Start® Incentive} = (\text{Cooling Tons} \times \$/\text{Ton Incentive})$$

DUCTLESS MINI SPLIT AC UNITS REBATE SUMMARY				
UNIT DESCRIPTION	UNIT EFFICIENCY	REBATE \$/TON	TOTAL CAPACITY TONS	TOTAL REBATE \$
5.4 tons or less Unitary AC and Split System	≥14 SEER	\$92	26	\$2,392
TOTAL			26	\$2,392

Summary of cost, savings and payback for this ECM is below.

COST SAVINGS SUMMARY							
ECM INPUTS	INSTALLED COST	# OF UNITS	TOTAL COST	REBATES	NET COST	ENERGY SAVING	PAY BACK YEARS
Single Zone 1-Ton Unit	\$2,500	3	\$7,500	\$276	\$7,224	\$497	15
Single Zone 2-Ton Unit	\$3,200	4	\$12,800	\$736	\$12,064	\$982	12
Dual Zone Unit	\$4,500	3	\$13,500	\$552	\$12,948	\$653	20
Tri Zone Unit	\$6,000	3	\$18,000	\$828	\$17,172	\$829	21
Total		13	\$51,800	\$2,392	\$49,408	\$2,961	17

There is no significant maintenance savings due to implementation of this ECM.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$51,800
NJ Smart Start Equipment Incentive (\$):	\$2,392
Net Installation Cost (\$):	\$49,408
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$2,961
Total Yearly Savings (\$/Yr):	\$2,961
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.7
Simple Lifetime ROI	-10.1%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$44,422
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	(\$14,054.34)

ECM #3: Interior Lighting Upgrades

Description:

Lighting in the Administration Building is already updated with modern fluorescent fixtures with T-8 lamps and electronic ballasts. There are only a few spaces where inefficient lighting fixtures or lamps such as incandescent lamps are being utilized.

Compact fluorescent lamps (CFL's) were designed to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 26-Watt CFL for a 100-Watt incandescent lamp. The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures.

This ECM includes replacement of all incandescent bulbs to compact fluorescent bulbs. Where the existing fixture is controlled by a dimmer switch, the CFL bulb must be compatible with a dimmer switch. In some locations the bulb replacement will need to be tested to make sure the larger base of the CFL will fit into the existing fixture. The energy usage of an incandescent compared to a compact fluorescent is 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. However, the maintenance savings due to reduced lamp replacement is offset by the higher cost of the CFL's compared to the incandescent lamps.

Energy Savings Calculations:

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

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$192
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$192
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$155
Total Yearly Savings (\$/Yr):	\$155
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.2
Simple Lifetime ROI	1114.0%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$2,331
Internal Rate of Return (IRR)	81%
Net Present Value (NPV)	\$1,663.12

ECM #4: Lighting Controls Upgrade - Occupancy Sensors

Description:

In some areas the lighting is 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 storage 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 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. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

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 achieved for “Occupancy Sensors for Lighting Control” average 20%-28%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total light energy controlled by occupancy sensors.

This ECM includes replacement of standard wall switches with occupancy sensor wall switches for individual offices and the use of ceiling mounted occupancy sensors for open areas or restrooms. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent.

The **Investment Grade Lighting Audit Appendix** of this report includes a summary of the rooms recommended for lighting controls implementation as calculated in this ECM.

Energy Savings Calculations:

Energy Savings = 10% × Occupancy Sensored Light Energy (kWh/Yr)

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

Cost and Incentives:

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

Dual Technology Occupancy Sensor - Switch Mount = \$75/unit

Dual Technology Occupancy Sensor - Remote Mount = \$160/unit

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 Mounted (existing facility only) = \$20 per sensor.

Occupancy Sensor Remote Mounted (existing facility only) = \$35 per sensor

Smart Start® Incentive = (# of wall mount × \$ 20) + (# of ceiling mount × \$35)

Smart Start® Incentive = (0 wall mount × \$ 20) + (10 ceiling mount × \$35) = \$750

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$3,100
NJ Smart Start Equipment Incentive (\$):	\$750
Net Installation Cost (\$):	\$2,350
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$514
Total Yearly Savings (\$/Yr):	\$514
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.6
Simple Lifetime ROI	227.9%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$7,706
Internal Rate of Return (IRR)	21%
Net Present Value (NPV)	\$3,783.13

ECM #5: Computer Monitor Replacement

Description:

Some of the computers throughout the Administration Building offices utilize CRT computer monitors. These computer monitors are outdated and have several disadvantages such as; significantly increased higher energy consumption, uses large amount of desk space, poor picture quality, distortions and flickering image, secular glare problems, and high weight, and electromagnetic emissions. Many of the drawbacks are difficult to quantify except for the energy use. CRT monitors use considerably more energy than an alternative flat panel LCD monitor. Replacement of the existing CRT monitors with LCD monitors saves considerable energy as well as provides other ergonomic benefits as well.

Based on the site survey it was noted that a number of the computers were left on and allowed to run 24 / 7. The majority of the monitors were left in screen saver mode, which is deceiving since this mode only saves the computer screen from image burn in, however it does not save on energy consumption. The average operating hours for all computers and monitors is estimated based on the site survey observations. Energy consumption of computer monitors are based on manufacture's specifications.

This ECM includes replacement of all existing CRT monitors with LCD flat panel monitors throughout the building. Installation costs were neglected for this ECM with the intention that this ECM would be replaced by the Administration Building IT team. The calculations are based on the following operating assumptions:

Energy Savings Calculations:

# of Computers:	11
Run Time %:	90%
Weeks per Yr:	50
Hrs per Week:	168

$$\text{Electric Usage} = \frac{\# \text{ of Computers} \times \text{Run Time \%} \times \text{Monitor Power (W)} \times \text{Operation (Hrs)}}{1000 \left(\frac{\text{W}}{\text{KW}} \right)}$$

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

COMPUTER MONITOR CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	CRT Monitors	LCD Monitor	
# of Computers	11	11	
Monitor Power Cons. (W)	75	25	
Run Time %	90%	90%	
Operating Hrs per Week	168	168	
Operating Weeks per Yr	50	50	
Elec Cost (\$/kWh)	0.161	0.161	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Usage (kWh)	6,237	2,079	4,158
Energy Cost (\$)	\$1,004	\$335	\$669
COMMENTS:			

Installation cost of new monitors is estimated based on current pricing for a 17" LCD monitor on the market today. No labor costs were included for replacing the existing monitors with the new monitors. No incentives are available for installation of computer monitors. Net cost per monitor was estimated to be \$100.

Installation Costs: # Monitors X Cost per Monitor
 11 Monitors X \$100 per Monitor
 \$1100

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$1,100
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$1,100
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$669
Total Yearly Savings (\$/Yr):	\$669
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.6
Simple Lifetime ROI	812.9%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$10,042
Internal Rate of Return (IRR)	61%
Net Present Value (NPV)	\$6,891.71

ECM #6: Condensing Domestic Hot Water Heater

Description:

The primary source for domestic hot water for the building is provided by a 50 Gallon, 4.5 KW electric hot water heater. The heater provides hot water for the lavatories, utility sinks and the kitchenette. This form of hot water heating is very expensive due to the high cost of electricity. Condensing hot water heaters provide substantially improved operating costs over electric hot water heaters. The thermal efficiency of condensing hot water heaters is approximately 95%.

This ECM includes installation of a new central tank type condensing hot water heater to replace the existing electric hot water heater. The basis for this ECM is the AO Smith condensing hot water heater model number BTX 80 to replace the existing tank style hot water heater.

Energy Savings Calculations:

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

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

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

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

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

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

CONDENSING DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Existing Electric Hot Water Heater	High Efficiency Condensing Htr	
Number of People	40	40	
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)	10,641,575	10,641,575	
Heating Efficiency	100%	95%	
Total Usage (BTU)	10,641,575	10,641,575	
Electric Cost (\$/kWh)	0.161	0.161	
Nat Gas Cost (\$/Therm)	1.58	1.58	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Consumption (kWh)	3,118	0	3,118
Nat Gas Consumption (Therms)	0	112	(112)
Energy Cost (\$)	\$502	\$177	\$325
COMMENTS:	*Savings are based on LEED-NC Version 2.2 Reference Guide for faucet and shower flow rates. Usage per person is estimated.		

Typical installed cost for a condensing hot water heater is estimated to be \$4,097.

From the **New Jersey Smart Start® Program Incentives Appendix**, the hot water heater installation falls under the category “Gas Water Heating” and warrants an incentive as follows:

$$\text{Smart Start® Incentive} = (\# \text{ of HWHs} \times \$ 50) = (1 \times \$50) = \$50$$

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$4,097
NJ Smart Start Equipment Incentive (\$):	\$50
Net Installation Cost (\$):	\$4,047
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$325
Total Yearly Savings (\$/Yr):	\$325
Estimated ECM Lifetime (Yr):	15
Simple Payback	12.5
Simple Lifetime ROI	20.4%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	\$4,875
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	(\$167.57)

ECM #7: Replace Commercial Refrigerator

The Administration Building kitchenette is currently equipped with an approximately 46 cubic-foot commercial refrigerator primarily for storing supplies for the meetings in the conference room. An additional residential grade refrigerator is located in the same kitchenette for the office employee's usage. The commercial refrigerator is oversized for the purpose and runs year round. Savings could be realized by replacing this refrigerator with a smaller Energy Star rated commercial refrigerator.

Based on the Energy Star savings calculator, the proposed swap out would be a one-for-one replacement with a unit of smaller size and dimensions that has the most up-to-date Energy Star Rating. The model selected is a 24 cu. ft. Traulsen G10000 Commercial Stainless Steel Refrigerator unit. A list of Energy Star Qualified Commercial Refrigerators can be found here: http://www.energystar.gov/ia/products/prod_lists/commer_refrig_prod_list.pdf

Energy Savings Calculations:

Calculations are based on the average energy consumption of a 52 Cu-ft conventional commercial refrigerator and that of a smaller 24 Cu-ft Energy Star rated commercial refrigerator over a period of one year.

COMMERCIAL REFRIGERATOR CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Equipment	Existing Commercial Refrigerator	New Energy Star rated refrigerator	
Volume (Cu-ft)	52	24	
Energy Consumption, kWh/Day	7.20	3.10	
Operation Days	365	365	
Electricity Cost (\$/kWh)	0.161	0.161	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Usage, kWh/Yr	2,628	1,130	1,498
Cooling Energy Cost (\$/Yr)	\$423	\$182	\$241
COMMENTS:	Calculations are based on Energy Star Refrigerator Energy Savings Spreadsheet Calculation Tool		

Daily energy consumption of conventional refrigerators and Energy Star rated refrigerators are obtained from the Savings Calculation tool at the following webpage:

<http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator>

Installed cost of a 24 Cu-ft double-door, reach-in, vertical commercial refrigerator is \$2,500.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$2,500
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$2,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$241
Total Yearly Savings (\$/Yr):	\$241
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.4
Simple Lifetime ROI	44.7%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$3,618
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	\$379.79

Note:

It should be noted that a residential grade refrigerator can also be used for the same purpose with even lower cost and lower energy consumption leading to a much faster payback. A third party lock mechanisms can be purchased and installed for less than \$25 for most residential refrigerators to secure the contents of the refrigerator.

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

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

CEG has reviewed 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 2550 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 36.11 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 43,548 KWh annually, reducing the overall utility bill by approximately 31.9% 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 not 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 facility 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	INTERNAL RATE OF RETURN
Direct Purchase	14.6 Years	5.3%

*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 Mt. Olive BOE to invest in a solar system through a Direct Purchase CEG does not recommend the facility to pursue this route. It would be more advantageous for the BOE 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 facility at a reduced rate compared to their existing electric rate.

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 is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) 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 for facilities that have occupancy during the summer months. Historical usage is relatively steady throughout the year with an average monthly usage of 11,379 kWh and an average monthly demand of 44kW. Largest consumption months were July and August.

The historical usage profile is beneficial and will allow for more competitive energy prices when shopping for alternative suppliers mainly due to the relatively flat load profile and reduction of summer load. Third Party 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 2,050 therms and the average summer (Apr-Oct) consumption is 189 therms. The largest consumption month is December at 2,993 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 a firm, fixed price or market based rate with basis lock in for 100% of the facilities 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 \$0.1180/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 New Jersey Natural Gas (NJNG) on rate schedule GSL (General Service - Large) and has contracted a Third Party Supplier (TPS) to provide natural gas commodity service.

NJNG 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

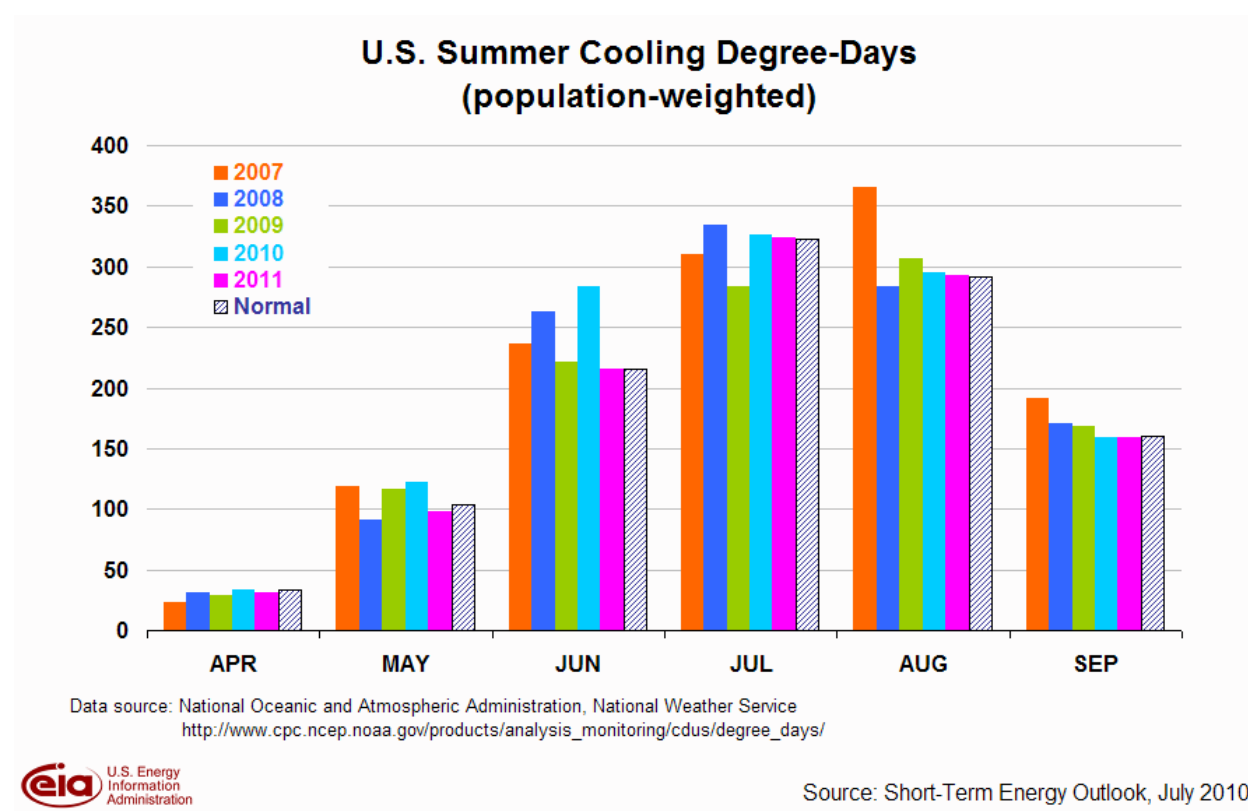
natural gas BGSS charges from New Jersey Natural Gas for rate schedule GSL.
<http://www.njng.com/pdf/Oct2010LargeCommercialPriceTable.pdf>

The utility, NJNG is responsible for maintaining the existing network of pipes that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. New Jersey Natural's delivery service rate includes the following charges: Customer Service Charge, Demand Charge and Delivery Charge.

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 (10/13/2010):

U.S. Natural Gas Prices. The Henry Hub spot price averaged \$3.89 per MMBtu in September, \$0.43 per MMBtu lower than the average spot price in August. Prices are expected to remain below \$4 per MMBtu in October but rise to \$4.68 per MMBtu by January as space-heating demand increases this winter. EIA has revised its projections for natural gas prices downward through 2011. Expectations are now for a price of \$4.16 per MMBtu for the last quarter of 2010, \$0.27 per MMBtu (6 percent) lower than last month's Outlook, based on several weeks of strong inventory builds. Price expectations for 2011 are \$4.58 per MMBtu, which is \$0.18 per MMBtu (4 percent) lower than last month's forecast, primarily due to a stronger domestic production forecast.

Uncertainty over future natural gas prices is lower this year compared with last year at this time. Natural gas futures for December 2010 delivery for the 5-day period ending October 7 averaged \$4.07 per MMBtu, and the average implied volatility over the same period was 39 percent. This produced lower and upper bounds for the 95-percent confidence interval of \$3.09 per MMBtu and \$5.37 per MMBtu, respectively. At this time last year, the natural gas December 2009 futures contract averaged \$5.59 per MMBtu and implied volatility averaged 56 percent. The corresponding lower and upper limits of the 95-percent confidence interval were \$3.70 per MMBtu and \$8.50 per MMBtu.

U.S. Electricity Retail Prices. Although the average U.S. residential retail price of electricity fell by nearly 1 percent during the first half of 2010 compared with the same period last year, prices are expected to increase by 1.5 percent year-over-year during the second half of 2010. Higher generation fuel costs this year are expected to be passed through to retail consumers during 2011, pushing up residential prices by 1.4 percent next year

Recommendations:

CEG recommends an aggregated approach for 3rd party commodity supply procurement strategies for electric supply service. Aggregating all school facilities along with the Administration Building for electricity supply service would allow this facility to achieve a reduction in electric 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 electricity supply costs, if it were to aggregate usage with the other school 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 facility in conjunction with the other school facilities utilize the advisement of 3rd party unbiased Energy Consulting Firm experienced in the aggregation of facilities and procurement of retail electricity commodity. The Energy Consulting Firm should incorporate a rational, defensible strategy for purchasing commodity in volatile markets based upon the following:

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

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 pay 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 show at least 15% reduction in the building’s current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

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

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant \$0.10 per square foot between \$5,000 and \$50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)
 2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example \$0.11 / kWh for 15% savings, \$0.12/ kWh for 17% savings, ... and \$1.10 / Therm for 15% savings, \$1.20 / Therm for 17% saving, ...) Increased incentives result from projected savings above 15%.
 3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example \$0.07 / kWh for 15% savings, \$0.08/ kWh for 17% savings, ... and \$0.70 / Therm for 15% savings, \$0.80 / Therm for 17% saving, ...) Increased incentives result from verified savings above 15%.
- v. *Direct Install Program* – The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 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 MeansTM 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.
- G. 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

Mt. Olive BOE - Administration Building

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Saving * 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)	(\$)	(\$)
ECM #1	Upgrade Heating System	\$105,000	\$0	\$2,160	\$102,840	\$6,169	\$500	\$6,669	35	\$233,399	\$17,500	127.0%	15.4	5.48%	\$40,448.57
ECM #2	Install Ductless Split AC Units	\$51,800	\$0	\$2,392	\$49,408	\$2,961	\$0	\$2,961	15	\$44,422	\$0	-10.1%	16.7	-1.30%	(\$14,054.34)
ECM #3	Lighting Upgrade	\$77	\$115	\$0	\$192	\$155	\$0	\$155	15	\$2,331	\$0	1114.0%	1.2	80.92%	\$1,663.12
ECM #4	Lighting Controls	\$1,860	\$1,240	\$750	\$2,350	\$514	\$0	\$514	15	\$7,706	\$0	227.9%	4.6	20.53%	\$3,783.13
ECM #5	Computer Monitor Replacement	\$1,100	\$0	\$0	\$1,100	\$669	\$0	\$669	15	\$10,042	\$0	812.9%	1.6	60.81%	\$6,891.71
ECM #6	Install Condensing Hot Water Heater	\$1,844	\$2,254	\$50	\$4,047	\$325	\$0	\$325	15	\$4,875	\$0	20.4%	12.5	2.42%	(\$167.57)
ECM #7	Replace Refrigerator	\$2,500	\$0	\$0	\$2,500	\$241	\$0	\$241	15	\$3,618	\$0	44.7%	10.4	5.02%	\$379.79
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar PV System	\$324,990	\$0	\$0	\$324,990	\$7,011	\$15,242	\$22,253	15	\$333,795	\$228,627	2.7%	14.6	0.34%	(\$59,334.80)

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 $\geq$ 16 \$600 per ton, EER $\geq$ 18 \$750 per ton, EER $\geq$ 20
-------------------------	--

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

Gas Fired Boilers < 300 MBH	\$300 per unit
Gas Fired Boilers $\geq$ 300 - 1500 MBH	\$1.75 per MBH
Gas Fired Boilers $\geq$ 1500 - $\leq$ 4000 MBH	\$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	\$300 - \$400 per unit, AFUE $\geq$ 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 $\leq$ 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 $\geq$ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	\$50 per fixture
HID $\geq$ 100w Replacement with new HID $\geq$ 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%



STATEMENT OF ENERGY PERFORMANCE Administration Building

Building ID: 2404053
For 12-month Period Ending: July 31, 2010
Date SEP becomes ineligible: N/A

Date SEP Generated: September 24, 2010

Facility
Administration Building
89 Route 46
Budd Lake, NJ 07828

Facility Owner
Public Schools of Mt. Olive
89 Route 46
Budd Lake, NH 07828

Primary Contact for this Facility
Thomas Scerbo
89 Route 46
Budd Lake, NJ 07828

Year Built: 1925
Gross Floor Area (ft²): 22,000

Energy Performance Rating² (1-100) 76

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	469,812
Natural Gas (kBtu) ⁴	1,157,393
Total Energy (kBtu)	1,627,205

Energy Intensity⁵

Site (kBtu/ft ² /yr)	74
Source (kBtu/ft ² /yr)	126

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	133
---	-----

Electric Distribution Utility

FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	102
National Average Source EUI	174
% Difference from National Average Source EUI	-27%
Building Type	Office

Stamp of Certifying Professional

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

Meets Industry Standards⁶ for Indoor Environmental Conditions:

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

Certifying Professional

Michael Fischette
520 S. Burnt Mill Rd.
Voorhees, NJ 08043

Notes:

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.

NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☒
Building Name	Administration Building	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	Is this an accurate description of the space in question?		☐
Location	89 Route 46, Budd Lake, NJ 07828	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Office Spaces (Office)				
CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☒
Gross Floor Area	22,000 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Weekly operating hours	45 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	35	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 5.3 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	35	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

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

Fuel Type: Electricity		
Meter: Main Electric Meter (kWh (thousand Watt-hours)) Space(s): Entire Facility Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
06/23/2010	07/22/2010	13,321.00
05/25/2010	06/22/2010	12,319.00
04/27/2010	05/24/2010	10,394.00
03/26/2010	04/26/2010	10,080.00
02/25/2010	03/25/2010	10,223.00
01/27/2010	02/24/2010	10,410.00
12/24/2009	01/26/2010	10,751.00
11/26/2009	12/23/2009	10,475.00
10/27/2009	11/25/2009	11,114.00
09/26/2009	10/26/2009	11,374.00
08/26/2009	09/25/2009	12,688.00
Main Electric Meter Consumption (kWh (thousand Watt-hours))		123,149.00
Main Electric Meter Consumption (kBtu (thousand Btu))		420,184.39
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		420,184.39
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐
Fuel Type: Natural Gas		
Meter: Gas Meter (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
06/08/2010	07/08/2010	1.05
05/08/2010	06/07/2010	76.21
04/02/2010	05/07/2010	246.38
03/10/2010	04/01/2010	949.07
02/05/2010	03/09/2010	2,590.07
01/08/2010	02/04/2010	2,370.90
12/05/2009	01/07/2010	2,993.14
11/04/2009	12/04/2009	1,344.89
10/04/2009	11/03/2009	954.36
09/02/2009	10/03/2009	46.70
08/04/2009	09/01/2009	1.06

Gas Meter Consumption (therms)	11,573.83
Gas Meter Consumption (kBtu (thousand Btu))	1,157,383.00
Total Natural Gas Consumption (kBtu (thousand Btu))	1,157,383.00
Is this the total Natural Gas consumption at this building including all Natural Gas meters?	☐

Additional Fuels

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

☐
On-Site Solar and Wind Energy

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

☐
Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Page 5 of 6

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

Facility

Administration Building
89 Route 46
Budd Lake, NJ 07828

Facility Owner

Public Schools of Mt. Olive
89 Route 46
Budd Lake, NH 07828

Primary Contact for this Facility

Thomas Scerbo
89 Route 46
Budd Lake, NJ 07828

General Information

Administration Building	
Gross Floor Area Excluding Parking: (ft ²)	22,000
Year Built	1925
For 12-month Evaluation Period Ending Date:	July 31, 2010

Facility Space Use Summary

Office Spaces	
Space Type	Office
Gross Floor Area(ft ²)	22,000
Weekly operating hours	45
Workers on Main Shift	35
Number of PCs	35
Percent Cooled	50% or more
Percent Heated	50% or more

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 07/31/2010)	Baseline (Ending Date 06/30/2010)	Rating of 75	Target	National Average
Energy Performance Rating	76	75	75	N/A	50
Energy Intensity					
Site (kBtu/ft ²)	74	74	75	N/A	102
Source (kBtu/ft ²)	126	126	128	N/A	174
Energy Cost					
\$/year	N/A	N/A	N/A	N/A	N/A
\$/ft ² /year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
MtCO ₂ e/year	133	133	135	N/A	183
kgCO ₂ e/ft ² /year	6	6	6	N/A	8

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

Notes:

o - This attribute is optional.

d - A default value has been supplied by Portfolio Manager.

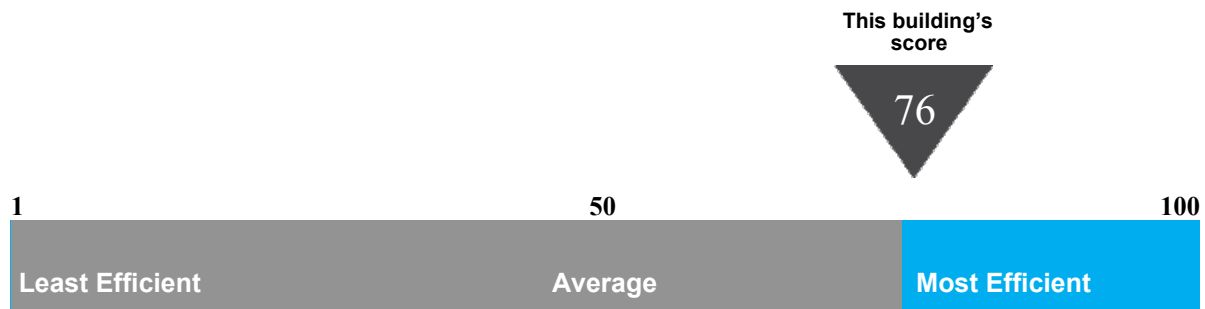
Statement of Energy Performance

2010

Administration Building
89 Route 46
Budd Lake, NJ 07828

Portfolio Manager Building ID: 2404053

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



This building uses 126 kBtu per square foot per year.*

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

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

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

Date of certification



MAJOR EQUIPMENT LIST

Concord Engineering Group

Mt. Olive BOE Administration Building

Hot Water Boilers

Tag	Steam Boiler #1	Steam Boiler #2
Unit Type	Cast iron boiler. Originally designed for coal	Cast iron boiler. Originally designed for coal
Qty	1	1
Location	Boiler Room	Boiler Room
Area Served	Steam radiators and convectors	Steam radiators and convectors
Manufacturer	Richards	National
Model #	0	0
Serial #	01908	112448
Input Capacity (MBH)	2219	2219
Rated Output Capacity (MBH)	-	-
Approx. Efficiency %	~55%	~55%
Fuel	Natural Gas	Natural Gas
Approx Age	85	60
Ashrae Service Life	35	35
Remaining Life	-50	-25
Burner	Power Flame	Power Flame
Model #	J50A-15	J50A-15
Serial #	109307047	109307047
Type	Single Speed	Single Speed
Firing Rate (MBH)	2219	2219
Comments	The boilers are in poor condition.	

MAJOR EQUIPMENT LIST

Concord Engineering Group

Mt. Olive BOE Administration Building

Domestic Hot Water Heater

Tag		
HWH-1		
Unit Type	Electric HWH	
Qty	1	
Location	Boiler Room	
Area Served	Faucets and sinks	
Manufacturer	AO Smith	
Model #	EES 52 100	
Serial #	V202172000	
Size (Gallons)	50	
Input Capacity (MBH/KW)	4.5 kW	
Recovery (Gal/Hr)	N/A	
Efficiency %	100%	
Fuel	Electric	
Approx Age	10	
Ashrae Service Life	12	
Remaining Life	2	
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group

Mt. Olive BOE Administration Building

Duplex Condensate Pumps

Tag	CRU	
Location	Boiler Room	
Area Served	Steam radiators	
Manufacturer	Weinstein	
Qty.	1	
Model #	-	
Serial #	-	
HP	2 x 1/2 HP	
RPM	3450	
GPM	-	
Pumping Head (Feet)	-	
Motor Frame Size	48Y	
Volts / Phase	230/1	
Approx. Age	10	
ASHRAE Service Life	15	
Remaining Life	5	
Notes	Good condition	

MAJOR EQUIPMENT LIST

Concord Engineering Group

Mt. Olive BOE Administration Building

A/C Units

Tag	Split CU	Split CU	Mini Split CU	Mini Split CU
Unit Type	Air cooled condensing unit	Air cooled condensing unit	Air cooled heat pump unit	Air cooled condensing unit
Qty	1	1	1	3
Location	Ground	Ground	Ground	Ground
Area Served	AHU in the Curriculum Office	Buildings and Grounds Office	Offices	Offices
Manufacturer	York	Lennox	Fujitsu	Sanyo
Model #	AC030X1222A	12ACB24 - 4P	A0U24RML1	C1822
Serial #	WCLM034722	5898C 43996	DXN 007111	-
Cooling Capacity (Tons)	2.5	2	2	1.5
Voltage / Phase	208 - 1	208 - 1	208 - 1	208 - 1
Efficiency (SEER)	10	10	13	13
Indoor Unit	Dayton AHU in the Curriculum Office	AHU in Buildings and Grounds Office	2 wall hung indoor units	Wall Unit
Capacity (Ton)	2 Ton	2 Ton	1 Ton x 2	1
Approx Age	10	10	2	15
Ashrae Service Life	15	15	15	15
Remaining Life	5	5	13	0
Comments			High efficiency inverter unit	

CU = Condensing Unit

MAJOR EQUIPMENT LIST

Concord Engineering Group

Mt. Olive BOE Administration Building

A/C Condensing Units and Window AC Units

Tag	Mini Split CU	Window Unit	Window Unit	
Unit Type	Air cooled heat pump	Air cooled condensing unit	Air cooled condensing unit	
Qty	2	4	18	
Location	Ground	Perimeter Offices	Perimeter Offices	
Area Served	Conference room	Perimeter Offices	Perimeter Offices	
Manufacturer	Sanyo	Freidrich, --	Freidrich, --	
Model #	CH1222	KL25J30A	-	
Serial #	-			
Cooling Capacity (Tons)	1	2	1	
Voltage / Phase	208 - 1	208 - 1	208 - 1	
Efficiency (SEER)	13	8 to 10 EER	8 to 10 EER	
Indoor Unit	Wall hung indoor units	-	-	
Capacity (Ton)	1	2	1	
Approx Age	15	10	10	
Ashrae Service Life	15	15	15	
Remaining Life	0	5	5	
Comments				

CU = Condensing Unit

Investment Grade Lighting Audit

APPENDIX E1
1 of 6

CEG Job #: 9C10050

Project: BOE Admin

Address: 89 Rt. 46, Budd Lake, NJ, 07828

BOE Admin

KWH COST: \$0.161

Bldg. Sq. Ft. 22,000

ECM #3: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS					
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback	
3520	Women's Rest Room	1200	1	2	15" Round White Globe, 2 13w CFL Lamps	26	0.03	31.2	\$5.02	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
1	H.C. Rest Room	1200	1	1	Fan/Light Combo, 26w CFL Lamp	26	0.03	31.2	\$5.02	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
227.21	Men's Rest Room	1200	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.06	69.6	\$11.21	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
227.21	Hall Rest Room	1200	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.06	69.6	\$11.21	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
211.11	Special Service Hall	2600	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.06	156.0	\$25.12	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
211.11	File Storage	2600	5	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.15	390.0	\$62.79	5	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Special Service Office	2600	5	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.29	754.0	\$121.39	5	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Superintendent's Front Office	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.46	1,206.4	\$194.23	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
221.21	Superintendent's Office	2600	8	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Acrylic Lens	58	0.46	1,206.4	\$194.23	8	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Lower Hall	3000	14	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.81	2,436.0	\$392.20	14	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
211.14	Custodian Storage	1200	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.03	36.0	\$5.80	1	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
221.14		1200	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.12	139.2	\$22.41	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
211.14	Boiler Room	1200	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.06	72.0	\$11.59	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Payroll Department	2600	10	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.58	1,508.0	\$242.79	10	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Tech. Closet	2600	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.17	452.4	\$72.84	3	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Business Administrator Receptionist	2600	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.35	904.8	\$145.67	6	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Assistant Business Administrator	2600	9	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.52	1,357.2	\$218.51	9	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	
222.21	Accounts Payable	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.70	1,809.6	\$291.35	12	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00	

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221.11	Tech.Closet	2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.12	301.6	\$48.56	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
232.211	Operations Office	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.52	1,341.6	\$216.00	6	2	Remove 1 Lamp - No Ballast Change Required	58	0.35	904.8	\$145.67	\$22.00	\$132.00	0.17	436.8	\$70.32	1.88
232.21	Operations Supervisor	2600	4	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.34	894.4	\$144.00	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Conference Room	2600	18	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	1.04	2,714.4	\$437.02	18	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Kitchen	2600	5	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.29	754.0	\$121.39	5	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
617	Kitchen Hood	400	1	1	Hood Light w/Globe & Cage, 100w A19 Lamp	100	0.10	40.0	\$6.44	1	1	(1) 26w CFL Lamp	26	0.03	10.4	\$1.67	\$20.00	\$20.00	0.07	29.6	\$4.77	4.20
222.21	Reception	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.12	301.6	\$48.56	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Office	2600	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.35	904.8	\$145.67	6	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Front Stairwell	3000	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.12	348.0	\$56.03	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Curriculum & Instruction	2600	16	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.93	2,412.8	\$388.46	16	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Math Supervisor	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.23	603.2	\$97.12	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Language Supervisor	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.23	603.2	\$97.12	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Storage Closet	1200	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.23	278.4	\$44.82	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Assist. Supervisor for Instruction	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.23	603.2	\$97.12	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Director of Fine Arts	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.23	603.2	\$97.12	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
232.21	Back Stairwell	3000	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.17	516.0	\$83.08	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
221.11	Men's Rest Room	3000	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.12	348.0	\$56.03	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	7 Special Services	2600	14	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.81	2,111.2	\$339.90	14	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
221.11	Ladies' Rest Room	1200	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.12	139.2	\$22.41	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Technical Training	2600	9	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.52	1,357.2	\$218.51	9	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
232.21	Side Stairwell	3000	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.17	516.0	\$83.08	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00

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222.21	Record Storage	800	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.70	556.8	\$89.64	12	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Tech. Services	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.70	1,809.6	\$291.35	12	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	3 Special Services	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.23	603.2	\$97.12	4	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Director of Special Services	2600	9	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.52	1,357.2	\$218.51	9	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Special Services Records Room	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.70	1,809.6	\$291.35	12	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
9	Storage Closet	400	1	1	200w A Lamp, Porcelain Socket	200	0.20	80.0	\$12.88	1	1	(1) 42w CFL Lamp	42	0.04	16.8	\$2.70	\$20.00	\$20.00	0.16	63.2	\$10.18	1.97
222.21	2nd Floor Hall	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.70	2,088.0	\$336.17	12	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
2	Exterior	4400	1	1	Wall Mnt., Globe & Wire Cage, 100w A Lamp	100	0.10	440.0	\$70.84	1	1	26w CFL Lamp	1	0.00	4.4	\$0.71	\$20.00	\$20.00	0.10	435.6	\$70.13	0.29
725		4400	2	1	150w HPS Wallpack	188	0.38	1,654.4	\$266.36	2	0	No Change	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	\$0.00	0.00
	Totals		269	91			16.14	40,720	\$6,556	269	5			0.4	936	\$151		\$192	0.5	965	\$155	1.24

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

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

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CEG Job #: 9C10050

Project: BOE Admin

Address: 89 Rt. 46, Budd Lake, NJ, 07828

Building SF: 22,000

BOE Admin

KWH COST: \$0.161

ECM #4: 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
3520	Women's Rest Room	1200	1	2	15" Round White Globe, 2 13w CFL Lamps	26	0.026	31.2	\$5.02	1	0	No Change	26	0.03	0%	31.2	\$5.02	\$0.00	\$0.00	0.00	0	\$0.00	0.00
1	H.C. Rest Room	1200	1	1	Fan/Light Combo, 26w CFL Lamp	26	0.026	31.2	\$5.02	1	0	No Change	26	0.03	0%	31.2	\$5.02	\$0.00	\$0.00	0.00	0	\$0.00	0.00
227.21	Men's Rest Room	1200	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.058	69.6	\$11.21	1	0	No Change	58	0.06	0%	69.6	\$11.21	\$0.00	\$0.00	0.00	0	\$0.00	0.00
227.21	Hall Rest Room	1200	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.058	69.6	\$11.21	1	0	No Change	58	0.06	0%	69.6	\$11.21	\$0.00	\$0.00	0.00	0	\$0.00	0.00
211.11	Special Service Hall	2600	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.06	156	\$25.12	2	0	No Change	30	0.06	0%	156	\$25.12	\$0.00	\$0.00	0.00	0	\$0.00	0.00
211.11	File Storage	2600	5	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.15	390	\$62.79	5	1	Dual Technology Occupancy Sensor - Switch Mnt.	30	0.14	10%	351	\$56.51	\$75.00	\$75.00	0.02	39	\$6.28	11.94
222.21	Special Service Office	2600	5	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.29	754	\$121.39	5	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.26	10%	678.6	\$109.25	\$75.00	\$75.00	0.03	75.4	\$12.14	6.18
222.21	Superintendent's Front Office	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.464	1206.4	\$194.23	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.42	10%	1085.76	\$174.81	\$75.00	\$75.00	0.05	120.64	\$19.42	3.86
221.21	Superintendent's Office	2600	8	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Acrylic Lens	58	0.464	1206.4	\$194.23	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.42	10%	1085.76	\$174.81	\$75.00	\$75.00	0.05	120.64	\$19.42	3.86
222.21	Lower Hall	3000	14	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.812	2436	\$392.20	14	0	No Change	58	0.81	0%	2436	\$392.20	\$0.00	\$0.00	0.00	0	\$0.00	0.00
211.14	Custodian Storage	1200	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.03	36	\$5.80	1	0	No Change	30	0.03	0%	36	\$5.80	\$0.00	\$0.00	0.00	0	\$0.00	0.00
221.14		1200	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.116	139.2	\$22.41	2	0	No Change	58	0.12	0%	139.2	\$22.41	\$0.00	\$0.00	0.00	0	\$0.00	0.00
211.14	Boiler Room	1200	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	30	0.06	72	\$11.59	2	0	No Change	30	0.06	0%	72	\$11.59	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Payroll Department	2600	10	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.58	1508	\$242.79	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.52	10%	1357.2	\$218.51	\$160.00	\$160.00	0.06	150.8	\$24.28	6.59
222.21	Tech. Closet	2600	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.174	452.4	\$72.84	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.16	10%	407.16	\$65.55	\$75.00	\$75.00	0.02	45.24	\$7.28	10.30
222.21	Business Administrator Receptionist	2600	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.348	904.8	\$145.67	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.31	10%	814.32	\$131.11	\$75.00	\$75.00	0.03	90.48	\$14.57	5.15
222.21	Assistant Business Administrator	2600	9	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.522	1357.2	\$218.51	9	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.47	10%	1221.48	\$196.66	\$75.00	\$75.00	0.05	135.72	\$21.85	3.43
222.21	Accounts Payable	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.696	1809.6	\$291.35	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.63	10%	1628.64	\$262.21	\$160.00	\$160.00	0.07	180.96	\$29.13	5.49
221.11	Tech.Closet	2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.116	301.6	\$48.56	2	0	No Change	58	0.12	0%	301.6	\$48.56	\$0.00	\$0.00	0.00	0	\$0.00	0.00
232.211	Operations Office	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.516	1341.6	\$216.00	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.46	10%	1207.44	\$194.40	\$75.00	\$75.00	0.05	134.16	\$21.60	3.47

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232.21	Operations Supervisor	2600	4	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.344	894.4	\$144.00	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.31	10%	804.96	\$129.60	\$75.00	\$75.00	0.03	89.44	\$14.40	5.21
222.21	Conference Room	2600	18	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	1.044	2714.4	\$437.02	18	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.94	10%	2442.96	\$393.32	\$160.00	\$160.00	0.10	271.44	\$43.70	3.66
222.21	Kitchen	2600	5	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.29	754	\$121.39	5	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.26	10%	678.6	\$109.25	\$75.00	\$75.00	0.03	75.4	\$12.14	6.18
617	Kitchen Hood	400	1	1	Hood Light w/Globe & Cage, 100w A19 Lamp	100	0.1	40	\$6.44	1	0	No Change	100	0.10	0%	40	\$6.44	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Reception	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.116	301.6	\$48.56	2	0	No Change	58	0.12	0%	301.6	\$48.56	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Office	2600	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.348	904.8	\$145.67	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.31	10%	814.32	\$131.11	\$75.00	\$75.00	0.03	90.48	\$14.57	5.15
222.21	Front Stairwell	3000	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.116	348	\$56.03	2	0	No Change	58	0.12	0%	348	\$56.03	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Curriculum & Instruction	2600	16	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.928	2412.8	\$388.46	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.84	10%	2171.52	\$349.61	\$160.00	\$160.00	0.09	241.28	\$38.85	4.12
222.21	Math Supervisor	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.232	603.2	\$97.12	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.21	10%	542.88	\$87.40	\$75.00	\$75.00	0.02	60.32	\$9.71	7.72
222.21	Language Supervisor	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.232	603.2	\$97.12	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.21	10%	542.88	\$87.40	\$75.00	\$75.00	0.02	60.32	\$9.71	7.72
222.21	Storage Closet	1200	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.232	278.4	\$44.82	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.21	10%	250.56	\$40.34	\$75.00	\$75.00	0.02	27.84	\$4.48	16.73
222.21	Assist. Supervisor for Instruction	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.232	603.2	\$97.12	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.21	10%	542.88	\$87.40	\$75.00	\$75.00	0.02	60.32	\$9.71	7.72
222.21	Director of Fine Arts	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.232	603.2	\$97.12	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.21	10%	542.88	\$87.40	\$75.00	\$75.00	0.02	60.32	\$9.71	7.72
232.21	Back Stairwell	3000	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.172	516	\$83.08	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.15	10%	464.4	\$74.77	\$75.00	\$75.00	0.02	51.6	\$8.31	9.03
221.11	Men's Rest Room	3000	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.116	348	\$56.03	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.10	10%	313.2	\$50.43	\$75.00	\$75.00	0.01	34.8	\$5.60	13.39
222.21	7 Special Services	2600	14	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.812	2111.2	\$339.90	14	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.73	10%	1900.08	\$305.91	\$160.00	\$160.00	0.08	211.12	\$33.99	4.71
221.11	Ladies' Rest Room	1200	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.116	139.2	\$22.41	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.10	10%	125.28	\$20.17	\$75.00	\$75.00	0.01	13.92	\$2.24	33.47
222.21	Technical Training	2600	9	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.522	1357.2	\$218.51	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.47	10%	1221.48	\$196.66	\$160.00	\$160.00	0.05	135.72	\$21.85	7.32
232.21	Side Stairwell	3000	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.172	516	\$83.08	2	0	No Change	86	0.17	0%	516	\$83.08	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	Record Storage	800	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.696	556.8	\$89.64	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.63	10%	501.12	\$80.68	\$160.00	\$160.00	0.07	55.68	\$8.96	17.85
222.21	Tech. Services	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.696	1809.6	\$291.35	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.63	10%	1628.64	\$262.21	\$160.00	\$160.00	0.07	180.96	\$29.13	5.49
222.21	3 Special Services	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.232	603.2	\$97.12	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.21	10%	542.88	\$87.40	\$75.00	\$75.00	0.02	60.32	\$9.71	7.72
222.21	Director of Special Services	2600	9	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.522	1357.2	\$218.51	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.47	10%	1221.48	\$196.66	\$160.00	\$160.00	0.05	135.72	\$21.85	7.32

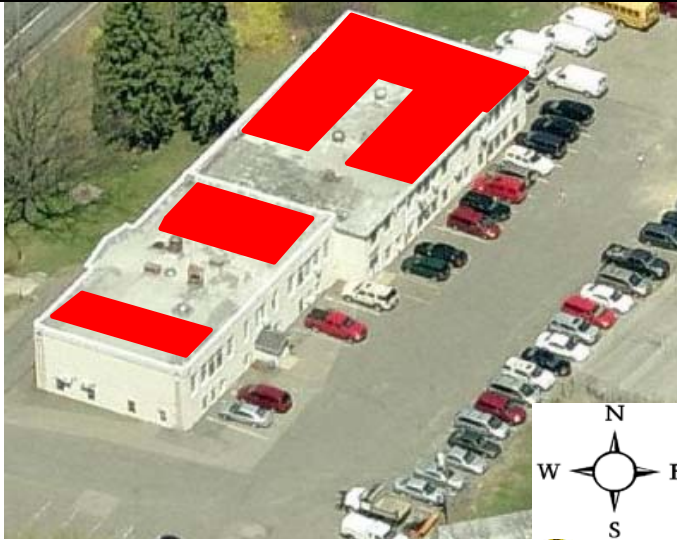
Investment Grade Lighting Audit

APPENDIX E2
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222.21	Special Services Records Room	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.696	1809.6	\$291.35	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.63	10%	1628.64	\$262.21	\$160.00	\$160.00	0.07	180.96	\$29.13	5.49
9	Storage Closet	400	1	1	200w A Lamp, Porcelain Socket	200	0.2	80	\$12.88	1	0	No Change	200	0.20	0%	80	\$12.88	\$0.00	\$0.00	0.00	0	\$0.00	0.00
222.21	2nd Floor Hall	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	0.696	2088	\$336.17	12	0	No Change	58	0.70	0%	2088	\$336.17	\$0.00	\$0.00	0.00	0	\$0.00	0.00
2	Exterior	4400	1	1	Wall Mnt., Globe & Wire Cage, 100w A Lamp	100	0.1	440	\$70.84	1	0	No Change	100	0.10	0%	440	\$70.84	\$0.00	\$0.00	0.00	0	\$0.00	0.00
725		4400	2	1	150w HPS Wallpack	188	0.376	1654.4	\$266.36	2	0	No Change	188	0.38	0%	1654.4	\$266.36	\$0.00	\$0.00	0.00	0	\$0.00	0.00
	Totals		269	91			15.8	39,066.0	\$6,290	267	30			14.5		35,875.0	\$5,775.88		\$3,100		3,191	\$514	6.03

Project Name: LGEA Solar PV Project - Mt. Olive BOE Admin Bldg.							
Location: Budd Lake, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
		Photovoltaic System - Direct Purchase					
Total Construction Cost		\$324,990					
Annual kWh Production		43,548					
Annual Energy Cost Reduction		\$7,011					
Annual SREC Revenue		\$15,242					
First Cost Premium		\$324,990					
Simple Payback:		14.60					Years
Life Cycle Cost Analysis							
Analysis Period (years):		25		Financing %:		0%	
Financing Term (mths):		0		Maintenance Escalation Rate:		3.0%	
Average Energy Cost (\$/kWh)		\$0.161		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	\$324,990	0	0	0	\$0	(324,990)	0
1	\$0	43,548	\$7,011	\$0	\$15,242	\$22,253	(\$302,737)
2	\$0	43,330	\$7,222	\$0	\$15,166	\$22,387	(\$280,350)
3	\$0	43,114	\$7,438	\$0	\$15,090	\$22,528	(\$257,822)
4	\$0	42,898	\$7,661	\$0	\$15,014	\$22,676	(\$235,146)
5	\$0	42,684	\$7,891	\$440	\$14,939	\$22,391	(\$212,755)
6	\$0	42,470	\$8,128	\$437	\$14,865	\$22,555	(\$190,200)
7	\$0	42,258	\$8,372	\$435	\$14,790	\$22,727	(\$167,474)
8	\$0	42,046	\$8,623	\$433	\$14,716	\$22,906	(\$144,567)
9	\$0	41,836	\$8,882	\$431	\$14,643	\$23,093	(\$121,474)
10	\$0	41,627	\$9,148	\$429	\$14,569	\$23,289	(\$98,185)
11	\$0	41,419	\$9,423	\$427	\$14,497	\$23,493	(\$74,693)
12	\$0	41,212	\$9,705	\$424	\$14,424	\$23,705	(\$50,988)
13	\$0	41,006	\$9,996	\$422	\$14,352	\$23,926	(\$27,062)
14	\$0	40,801	\$10,296	\$420	\$14,280	\$24,156	(\$2,906)
15	\$0	40,597	\$10,605	\$418	\$14,209	\$24,396	\$21,490
16	\$0	40,394	\$10,923	\$416	\$14,138	\$24,645	\$46,135
17	\$0	40,192	\$11,251	\$414	\$14,067	\$24,904	\$71,039
18	\$0	39,991	\$11,588	\$412	\$13,997	\$25,173	\$96,213
19	\$0	39,791	\$11,936	\$410	\$13,927	\$25,453	\$121,666
20	\$0	39,592	\$12,294	\$408	\$13,857	\$25,744	\$147,409
21	\$1	39,394	\$12,663	\$406	\$13,788	\$26,045	\$173,455
22	\$2	39,197	\$13,043	\$404	\$13,719	\$26,358	\$199,813
23	\$3	39,001	\$13,434	\$402	\$13,650	\$26,683	\$226,496
24	\$4	38,806	\$13,837	\$400	\$13,582	\$27,020	\$253,515
25	\$5	38,612	\$14,252	\$398	\$13,514	\$27,369	\$280,884
Totals:		1,025,815	\$255,624	\$8,785	\$359,035	\$605,874	(\$528,244)
Net Present Value (NPV)						\$280,909	
Internal Rate of Return (IRR)						5.3%	

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
Board of Education Administration Building	2550	Sunpower SPR230	157	14.7	2,309	36.11	43,548	5,181	15.64



AC Energy
&
Cost Savings



(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	36.1 kW
DC to AC Derate Factor:	0.800
AC Rating:	28.9 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation (kWh.m ² .day)	AC Energy (kWh)	Energy Value (\$)
1	2.58	2315	3.73
2	3.33	2734	4.40
3	4.31	3819	6.15
4	5.20	4350	7.00
5	5.85	4969	8.00
6	6.14	4836	7.79
7	6.06	4885	7.86
8	5.54	4489	7.23
9	4.85	3860	6.21
10	3.76	3151	5.07
11	2.65	2207	3.55
12	2.23	1933	3.11
Year	4.38	43548	70.11

 = Proposed PV Layout

Notes:

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