LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

MONTVILLE TOWNSHIP SCHOOLS
86 RIVER ROAD, MONTVILLE, NJ 07045

ATTN: JAMES T. TEVIS,
SCHOOL BUSINESS ADMINISTRATOR

PREPARED BY:

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

CEG CONTACT:

ERSIN GERCEK, PE, CEM, LEED AP
LEAD MECHANICAL ENGINEER
EGERCEK@CONCORD-ENGINEERING.COM

REPORT ISSUANCE: **FINAL, MARCH 1, 2012**

PROJECT NO: **9C11046**

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY 3

II. INTRODUCTION 9

III. METHOD OF ANALYSIS 11

IV. HISTORIC ENERGY CONSUMPTION/COST 13

A. ENERGY USAGE 13

B. ENERGY USE INDEX (EUI) 15

C. EPA ENERGY BENCHMARKING SYSTEM 18

V. RENEWABLE/DISTRIBUTED ENERGY MEASURES 20

VI. ENERGY PURCHASING AND PROCUREMENT STRATEGY 24

VII. INSTALLATION FUNDING OPTIONS 31

A. INCENTIVE PROGRAMS 31

B. FINANCING OPTIONS 34

VIII. ENERGY AUDIT ASSUMPTIONS 36

Enclosures:

Document 1 – High School Energy Report

Document 2 – Lazar Middle School Energy Report

Document 3 – Valley View Elementary School Energy Report

Document 4 – Woodmont Elementary School Energy Report

Document 5 – Hilldale Elementary School Energy Report

REPORT DISCLAIMER

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

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

I. EXECUTIVE SUMMARY

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

Entity: Montville Township Board of Education

Facilities: High School
Lazar Middle School
Valley View Elementary School
Woodmont Elementary School
Hilldale Elementary School

Municipal Contact Person: James T. Tevis
Facility Contact Person: Steven Toth

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program for Montville Township Public Schools. The purpose of this analysis is to provide the township insight into the energy savings potential that exists within facilities at Montville Township School District. Energy Efficiency changes and upgrades requires support from the building occupants, operations personnel and the administrators of the school district in order to maximize the savings and overall benefit. The efficiency improvement of public buildings provides a benefit for the environment and the residence of New Jersey. Through this report it has been demonstrated that there is a great potential for energy savings and infrastructure improvements at Montville Township School District.

Fast Payback Energy Conservation Measures:

The Energy Conservation Measures (ECMs) identified within the reports represent the potential annual savings at each facility. It is recommended to consider all ECMs as part of the township's initiative to save energy, reduce emissions, and lower operating costs. Several ECMs shown within this report represent significant savings relative to the cost to implement. The ECMs shown with a simple payback of 10 years and less are considered very cost effective for a public entity such as Montville and should be considered a high priority for Montville Township Schools. The following ECMs are highly recommended throughout the schools.

- Lighting Upgrades (All facilities)

Lighting retrofits throughout the school district buildings are a straight forward conservation measure that is prescriptive in nature and provides substantial savings for the investment. Lighting retrofits are a good example of ECMs that can be implemented with "in house" staff to reduce the installation cost and further reduce paybacks. In many facilities such as the Classrooms and Libraries, the measure includes replacing existing 700 series T-8 fluorescent lamps with new higher efficiency T-8 lamps. In other facilities, a whole fixture replacement

provides much more energy savings. Overall lighting upgrades represent one of the most easily implemented ECMs and are highly recommended throughout all Montville Schools.

- Lighting Controls (All facilities)

Similar to lighting upgrades, lighting controls are very prescriptive in nature and can save considerable energy. Lighting controls do not require replacement of the fixture and typically can save more energy than lighting fixture upgrades. For the purpose of this energy audit, each ECM is calculated as stand-alone ECMs. The maximum savings can be achieved through the implementation of both the lighting upgrades and lighting controls ECMs. Lighting controls will automatically turn off lights when spaces and rooms are not occupied. It is important to note that ECMs are calculated as stand-alone ECMs and therefore the total savings will be slightly less than the sum of both individual ECMs (Lighting Upgrade and Lighting Controls). The discrepancy between additive ECMs is within the tolerances for this level of analysis (+/- 20%). Lighting controls provide the maximum savings in spaces that have changing occupancy schedules throughout the day. Offices with standard operating hours will also see substantial savings because all spaces are not occupied continuously. Lighting controls throughout Montville Schools is highly recommended in addition to the lighting upgrade ECMs.

- Computer Monitor Replacement (All facilities)

Plug loads within buildings is becoming a larger and larger portion of the total energy use for commercial facilities. Plug loads are most dominant in combination with computers and computer equipment. Modern computer monitors are flat screen LCD panels that are far more efficiency than older style cathode ray-tube (CRT) monitors. Typical energy use of a flat screen monitor is approximately 1/3 of the energy used by a CRT monitor. The majority of computer monitors within the facilities are LCD style monitors. However, almost all of the Montville Schools utilize some CRT monitors. It is highly recommended to replace the existing CRT monitors with flat screen monitors to take advantage of the energy savings as well as other ergonomic benefits of modern LCD monitors.

- Computer Power Management (All facilities)

It was noticed that computers were left ON due to long booting times of the older computers. Many personal computers (PC) came equipped with automatic Stand-by or Hibernate (power down) features. Normally computers boot up from Stand-by or Hibernate modes much faster than powering up from Shut Down position. It is recommended to set up the PCs at this facility to switch into Stand-by Mode after a short period of inactivity and Hibernate mode after a long period of inactivity.

- Vending Machine Controls (High School)

Montville High School currently utilizes vending machines with standard controls in select areas within the building. The installation of a vending machine control system will help reduce the operating hours of vending machines by utilizing occupancy sensors.

- Timers and Programmable Thermostats (Woodmont Elementary School)

Standard non-programmable thermostats do not allow a building to save energy during unoccupied periods. In the heating season the highest building loads on an HVAC system are at night when the building is empty. Programmable thermostats allow the system to set-back the temperature when the building is empty to limit the unnecessary energy use. Since programmable thermostats are a very small portion of the overall system cost, the energy savings far outweighs the cost to implement. The payback for programmable thermostat installations is typically within 1-2 months of the heating or cooling season. Similarly, timers can reduce unnecessary operation of exhaust fans during unoccupied periods to eliminate discharge of heated and/or conditioned air from the interior spaces.

- High Efficiency Domestic Hot Water Heaters (All facilities)

Older and outdated gas fired domestic hot water heaters can be replaced with high efficiency condensing hot water heaters. In addition, electric domestic hot water heaters cost over three (3) times more than gas fired domestic hot water heaters. It is recommended to upgrade older inefficient domestic hot water heaters.

Capital Improvement Energy Conservation Measures:

The ECMs that have much longer paybacks are considered capital improvement ECMs. These ECMs typically have high installation costs that are more difficult to justify the savings based solely on the energy savings associated with the improvement. Despite the long paybacks, these ECMs in many cases provide valuable and much needed infrastructure improvements for the facility. These ECMs include boiler upgrades, HVAC equipment upgrades, control system upgrades, unit ventilator upgrades as well as other large HVAC equipment replacements. The savings identified for the following ECMs provides additional incentive for Montville BOE's capital improvement projects.

- New Unit Ventilators with Energy Recovery
- Condensing Hot Water Boilers
- Domestic Hot Water Heating System Upgrades
- HVAC System Upgrades
- NEMA Premium Efficiency Motors
- Demand Controlled Ventilation
- DDC Control Expansion / Upgrades
- Water Efficiency Improvement

Combined Project Approach:

Although individual projects with a simple payback of 10 years and less are considered financially self-sustaining, it is important to consider how multiple projects can be combined together. When ECMs are aggregated into a single project, the lower cost ECMs provides valuable savings to offset the higher cost ECMs. Likewise when multiple facilities are

aggregated together into a single entity energy efficiency project, the same benefits are seen on a larger scale.

The Energy Savings Improvement Program (ESIP) allows for financing of any combination of energy efficiency projects across multiple facilities into one large project. The term of the financing must be under 15 years and the savings provides the revenue for the financing cost. The combination of all facilities into one large energy efficiency project provides Montville BOE with the opportunity to implement all ECMs identified within this report with an overall simple payback of 13 years. This option allows Montville BOE to implement much needed infrastructure improvements. The program financing allows for the implementation with no upfront cost for Montville BOE. Implementation of an ESIP provides significant benefits and should be strongly considered for Montville. The Total Entity Project Summary table below shows the savings, costs, incentives and paybacks for all ECMs at Montville Schools.

Table 1
ESIP -Total Entity Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
High School	$76,897	$1,080,394	$26,591	$1,053,803	13.7
Lazar Middle School	$32,876	$337,120	$7,583	$329,537	10.0
Valley View Elementary School	$16,506	$239,245	$2,265	$236,980	14.4
Woodmont Elementary School	$21,540	$301,556	$2,238	$299,318	13.9
Hilldale Elementary School	$16,616	$177,028	$4,320	$172,708	10.4
Total Entity Project	**$164,434**	**$2,135,343**	**$42,997**	**$2,092,346**	**12.7**

Total Entity Energy Costs:	**$1,085,089**
Est. Total Entity Energy Savings:	**$164,434**
Overall Entity Percent Reduction:	**15.2%**

Montville BOE has the option to utilize the Direct Install program for their Woodmont and Hilldale Elementary School facilities. These facilities fall within the Direct Install program's 150 kW demand requirement and have projects that can utilize the program's generous 70% state incentive to further reduce the project costs. When utilizing Direct Install in lieu of the Smart Start incentive for eligible measures, the BOE is eligible for a $75,000 maximum incentive.. The eligibility of the ECMs are dependent on the facility evaluation through the program and must be verified through the program contractor. This approach maximizes the savings for Montville BOE and will aid in reducing the overall project payback. It is highly recommended to utilize all available incentives including Direct Install by contacting the Direct Install Contractor to perform the site evaluation for the noted facilities.

Implementation of all ECMs identified within the ESIP - Entity Total Project Summary table represents a total annual savings of approximately $79,500 for Montville Schools. The individual facility project summaries are shown within each facility energy audit report.

Other Considerations:

- Maintenance and Operational Measures

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 when moving forward with energy efficiency upgrades:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors to limit unnecessary infiltration.
3. Clean all light fixtures to maximize light output to provide better light output and avoid the use of task lighting where otherwise not necessary.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

- Renewable Energy Measures

Renewable Energy Measures (REMs) were also reviewed for implementation at Montville Schools. CEG utilized a combination of roof mounted solar arrays and canopy style parking lot solar arrays to house PV systems throughout the school buildings. The total solar electric production potential for these systems is approximately 1,440,000 kWh, which would reduce schools' grid purchased electric energy by 31%. The system's calculated simple payback of approximately 13 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. Concord Engineering recommends the Owner review all funding options available with the implementation of this renewable energy measure.

Overall Assessment:

Overall, most of the Montville Schools are maintained and operating slightly below the average efficiency of similar type of facilities. There are numerous ECMs that can be implemented to further reduce energy use and save on the individual facility's operating costs. The total energy cost of $1,085,089 could be reduced by approximately 7.3% through the implementation of the ECMs recommended in this audit. Montville Board of Education is in a unique position to implement energy efficiency improvements and still include large capital projects. Since the total project is capable of being funded through the savings, CEG highly recommends the Board to take advantage of this opportunity.

II. INTRODUCTION

The comprehensive energy audit covers the following Schools in Montville Township:

- High School
- Lazar Middle School
- Valley View Elementary School
- Woodmont Elementary School
- Hilldale Elementary School

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.

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

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

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

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

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

III. METHOD OF ANALYSIS

This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

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.

The project / Entity summary tables are based on the implementation of multiple measures. The analysis is reviewed and determined if the nature of the ECMs will cause a major conflict of the overall savings. When additive measures do not cause a major effect on the overall savings the ECMs are included. Where a major conflict is identified, the combined savings is evaluated appropriately to ensure the overall estimates are ± 20%.

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

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

ECM Calculation Equations:

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

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

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

$$Lifetime\ \ Maintenanc\ e\ Savings\ \ = (Yearly\ \ Maintenanc\ e\ Savings\ \times ECM\ \ Lifetime\ )$$

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage

The energy usage for the facilities is tabulated and plotted in graph form as depicted within each facility report (see the individual facility energy audit reports for details). Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner. The electric and natural gas utilities are shown below in Table 2 & 3 for all facilities:

Table 2
Electric Utility Summary

ELECTRIC UTILITY USAGE PER FACILITY			
FACILITY	**ANNUAL ELECTRIC UTILITY**		
DESCRIPTION	**USAGE (KWH)**	**COST ($)**	**AVE RATE ($/KWH)**
High School	2,508,768	$410,949	$0.164
Lazar Middle School	967,850	$175,054	$0.181
Valley View Elementary School	533,820	$87,884	$0.165
Woodmont Elementary School	304,753	$54,118	$0.178
Hilldale Elementary School	313,440	$52,525	$0.168
Total	**4,628,631**	**$780,530**	**$0.169**

Table 3
Natural Gas Summary

NATURAL GAS UTILTY USAGE PER FACILITY			
FACILITY	**ANNUAL NATURAL GAS UTILITY**		
DESCRIPTION	**USAGE (THERMS)**	**COST ($)**	**AVE RATE ($/THERM)**
High School	119,642	$123,830	$1.04
Lazar Middle School	79,810	$93,935	$1.18
Valley View Elementary School	32,331	$38,595	$1.19
Woodmont Elementary School	21,693	$28,791	$1.33
Hilldale Elementary School	15,035	$19,408	$1.29
Total	**268,511**	**$304,559**	**$1.13**

B. Energy Use Index (EUI)

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

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

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

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

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

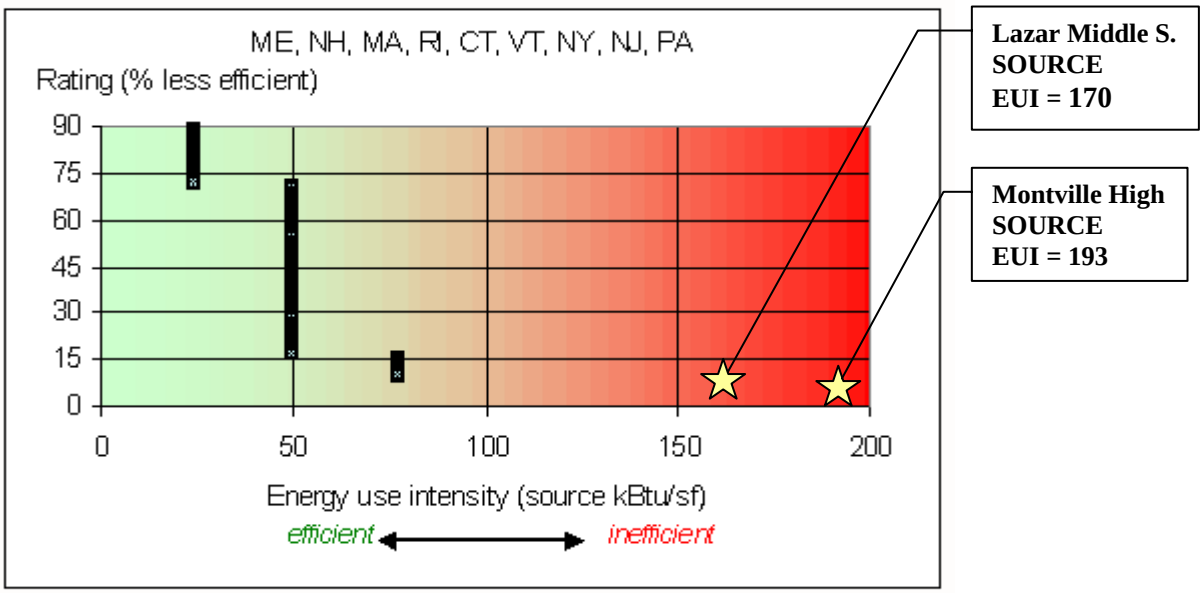
Table 4
Energy Use Index Summary

ENERGY USE INDEX PER FACILITY				
FACILITY	**BUILDING AREA**	**ENERGY USE INDEX**		
DESCRIPTION	**(SF)**	**SITE (KBTU/SF/YR)**	**SOURCE (KBTU/SF/YR)**	**ELECTRIC (KWH/SF/YR)**
High School	213,000	96	193	11.8
Lazar Middle School	114,000	99	170	8.5
Valley View Elementary School	55,000	92	172	9.7
Woodmont Elementary School	39,000	82	147	7.8
Hilldale Elementary School	38,000	68	135	8.2

See the Appendix C - Statement of Energy Performance for comparason to other facilities

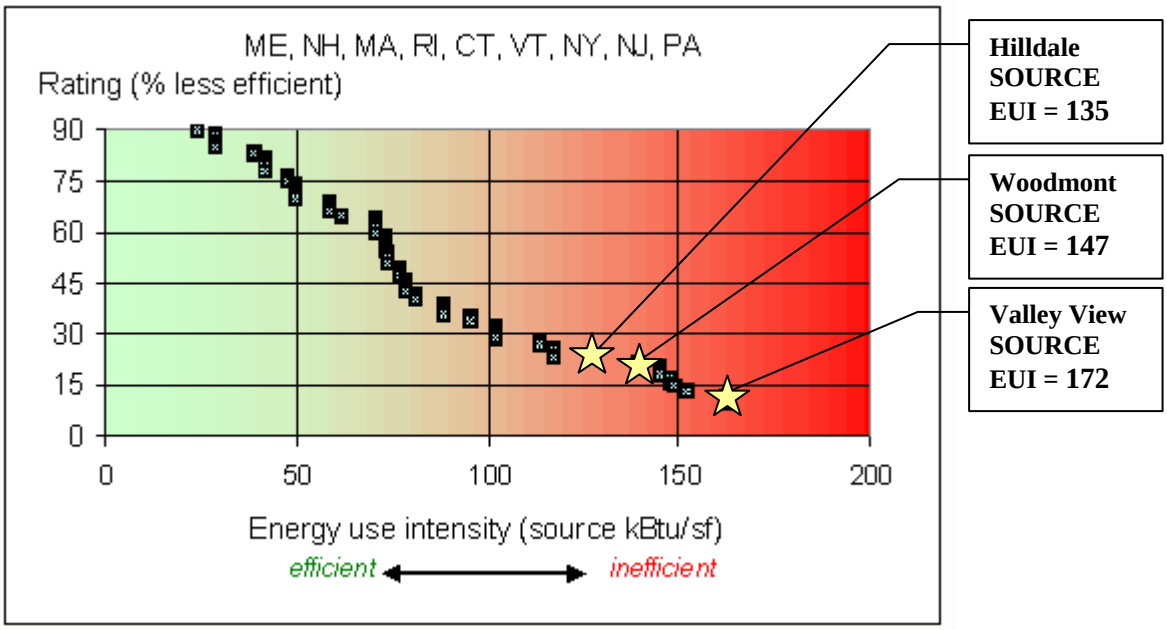
Figure 1 and Figure 2 below depicts a national EUI grading for the source energy use of various types of schools buildings similar to the Montville Township Schools.

Figure 1
Source Energy Use Intensity Distributions: High School Buildings



Source Energy Use Intensities are not available for Middle Schools; therefore data for High Schools was used as a basis for comparison.

Figure 2
Source Energy Use Intensity Distributions: Elementary Schools



Overall the Montville Township School buildings are below average in terms of their energy use performance. The Montville Schools are below 30% for source energy use which means over 70% of the similar facilities in the region are more efficient than these facilities.

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:	MontvilleBOE
Password:	lgeaceg2011
Security Question:	What city were you born in?
Security Answer:	Montville

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 5
Energy Star Performance Summary

ENERGY STAR PERFORMANCE RATING PER FACILITY			
FACILITY	**ENERGY STAR PERFORMANCE RATING**		
DESCRIPTION	**SCORE**	**AVERAGE**	**POTENTIAL CERTIFICATIONS**
High School	30	50	None
Lazar Middle School	25	50	None
Valley View Elementary School	34	50	None
Woodmont Elementary School	59	50	None
Hilldale Elementary School	22	50	None

See the Appendix C - Statement of Energy Performance for comparative facilities
Score: "N/A" represents facility that could not receive a rating. See Energy Star website for details.

Refer to **Statement of Energy Performance Appendix** located within the individual facility reports for the detailed energy summary for each facility.

V. 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.

Solar Generation

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which are mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). Parking lots can also be utilized for the installation of a solar array. A truss system can be installed that is high enough to park vehicles under the array and no parking lot area is lost.

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 used in our financial calculations is $204 per MWH. This equates to $0.204 per kWh generated.

CE has reviewed the existing roof area and parking lot canopy area potential of the facilities included in this audit for the purposes of determining a potential for a photovoltaic system. Where applicable a parking lot canopy system was reviewed due to the large amount of parking space available on the campus. Some areas were not included due to potential shading from campus buildings and surrounding trees. A depiction of the area utilized at each facility is shown in Renewable / Distributed Energy Measures Calculation Appendices in the building reports. The system sizes are shown below for each building where installation of a solar PV system is feasible. The total KWH production for all facilities combined is 1,440,790 kWh annually, reducing the overall utility bill for the campus by approximately 31% percent. A detailed financial analysis can be found in the Renewable / Distributed Energy Measures Calculation Appendix within each facility report. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

Table 6
Renewable Energy Summary

POWER PRODUCTION SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	**PRODUCTION SUMMARY**		
DESCRIPTION	**ELECTRIC PRODUCTION (KWH)**	**TOTAL FACILITY USE (KWH)**	**% REDUCTION**
High School	670,738	2,508,768	27%
Lazar Middle School	347,589	967,850	36%
Valley View Elementary School	160,760	533,820	30%
Woodmont Elementary School	127,365	304,753	42%
Hilldale Elementary School	134,338	313,440	43%
Total	**1,440,790**	**4,628,631**	**31%**

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 based on available roof space or canopy style system area available at each existing facility. Estimated solar array generation is 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** within each facility report.

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

Direct purchase involves School District paying for 100% of the total project cost upfront in lieu of 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. The financial summary per facility is as follows:

Table 7
Renewable Financial Summary

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	**DIRECT PURCHASE FINANCIAL SUMMARY**		
DESCRIPTION	**INSTALATION COST ($)**	**TOTAL SAVINGS ($)**	**INTERNAL RATE OF RETURN**
High School	$3,592,794	$248,400	0.5%
Lazar Middle School	$1,844,044	$133,939	1.1%
Valley View Elementary School	$844,155	$59,374	0.7%
Woodmont Elementary School	$673,405	$48,697	1.0%
Hilldale Elementary School	$661,838	$50,019	1.6%
Total	**$7,616,237**	**$540,429**	

CEG recommends Montville BOE to review all options available for installation of solar PV systems at their facilities including a Power Purchase Agreement (PPA). This option utilizes 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 district at a reduced rate compared to their existing electric rate.

Wind Generation

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed of 5 m/s is not adequate, and available space is very limited for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

VI. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facilities in the Montvile Township BOE. 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 individual 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 the individual facility's report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The electricity usage profile demonstrates a steady year long load profile for facilities that have occupancy during the summer months. The average monthly usage for all accounts combined is 385,709 kWh.

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 and higher winter usage load profile. 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 JCPL's BGS-FP default rate are recommended.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile for all facilities. The average monthly winter (Nov-Mar) consumption is 44,893 therms and the average monthly summer (Apr-Oct) consumption is 6,292 therms.

This load profile will yield less favorable natural gas fixed 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 a product structure to include either 1) a fixed basis rate with a market based Nymex/commodity rate or 2) a fixed basis rate with fixed Nymex/commodity winter rate (Nov – March) and market based Nymex/commodity rate for the summer months (April – October) for 100% of the facilities **metered** natural gas requirements are both recommended due to current market pricing.

Tariff Analysis:

Electricity:

Every facility receives electrical service through JCP&L's rate tariff, General Service Secondary (GSS). All facilities are currently not under a Third Party Supplier (TPS) to provide electric commodity service and are receiving electric distribution and electric commodity service directly from the utility. 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 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:

All facilities currently receive natural gas distribution service through New Jersey Natural Gas (NJNG) on rate schedules GSS (General Service Small) and GSL (General Service Large). The facilities are currently receiving natural gas supply service from Hess Energy, a Third Party Supply Contractor. For natural gas supply service, the client has a choice to either use NJNG's default service rate BGSS or contract with a Third Party Supplier (TPS) to supply natural gas.

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 links below for a recap of monthly natural gas BGSS charges from NJNG.

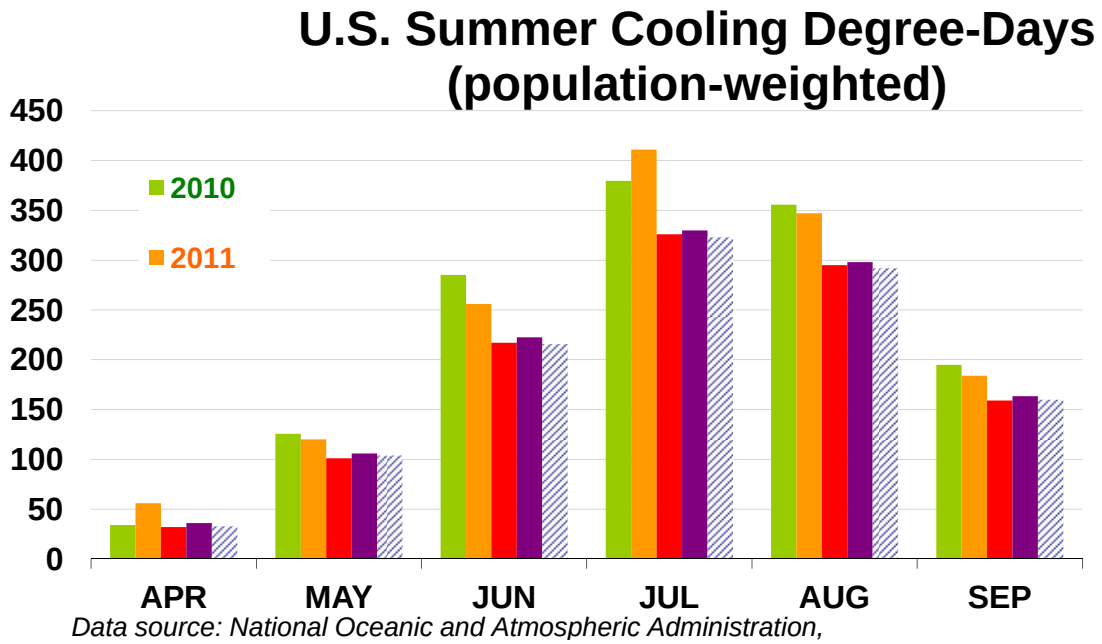
https://www.njng.com/pdf/Dec2011SmallComPrices.pdf
https://www.njng.com/pdf/Dec2011LargeComPrices.pdf

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

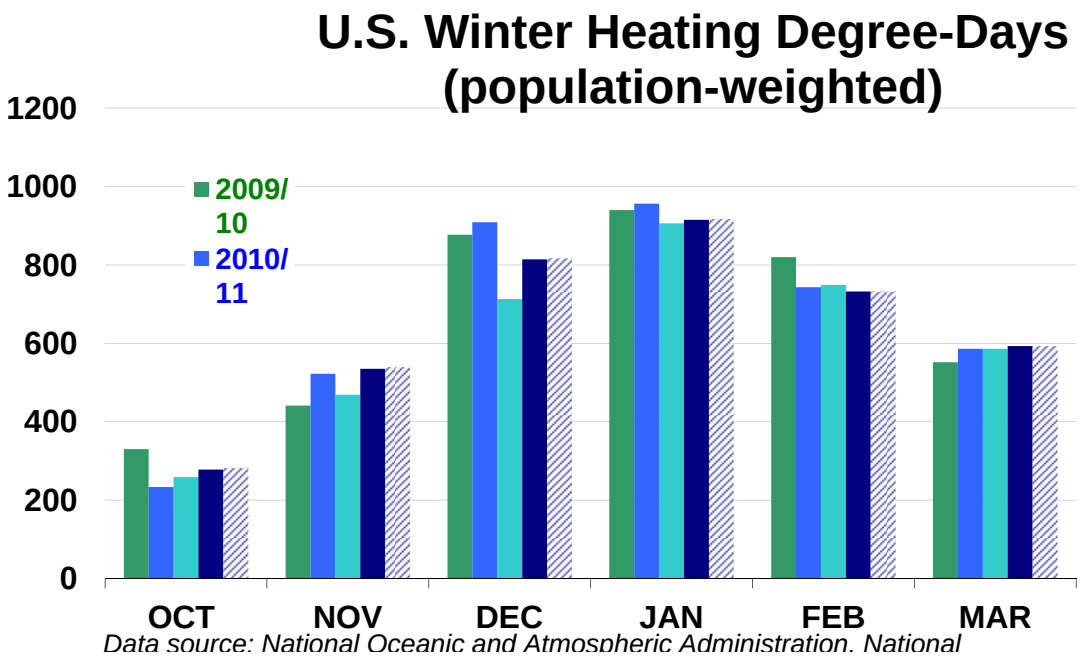
Electric and Natural Gas Commodities Market Overview:

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 2011, 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.



Source: Short-Term Energy Outlook,

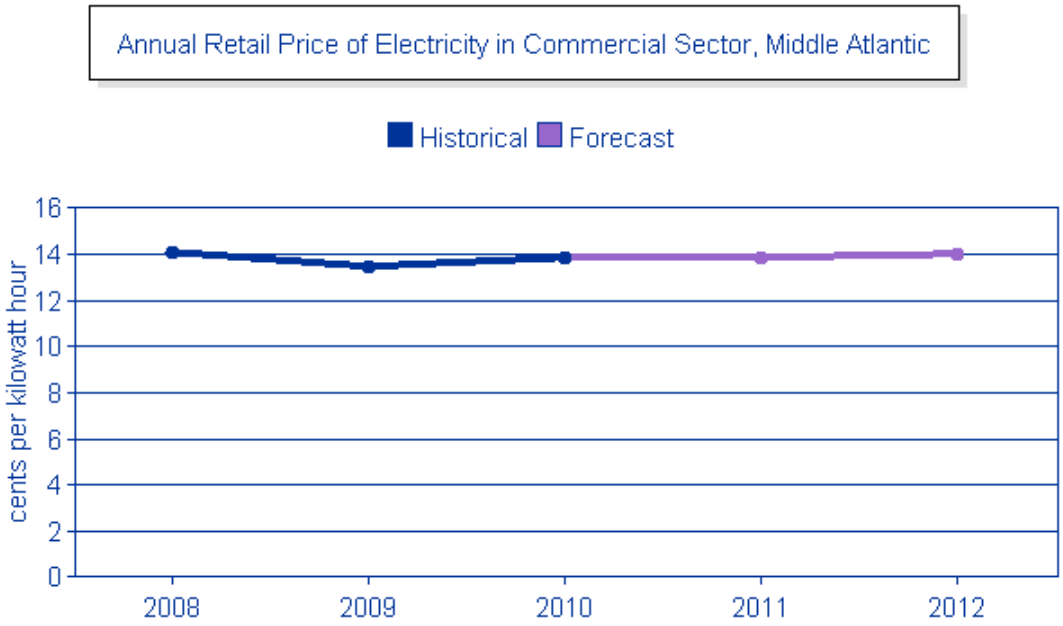


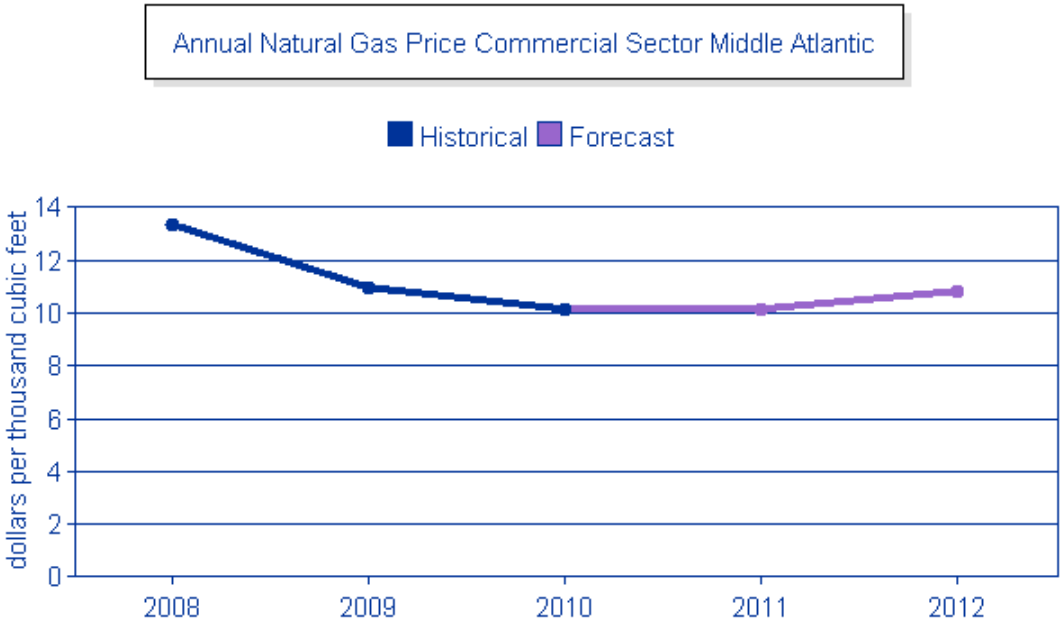
Source: Short-Term Energy Outlook,

Short Term Energy Outlook - US Energy Information Administration (1/10/2012):

U.S. Natural Gas Prices. *At this time last year, EIA had projected that the Henry Hub natural gas spot price would average $4.02 per MMBtu in 2011, rising to an average $4.50 per MMBtu in 2012. The final average Henry Hub spot price for 2011 was $4.00 per MMBtu. The current forecast for 2012 natural gas prices is significantly lower than at this time last year, as continued growth in production and a very warm start to the winter have contributed to record-high natural gas inventories. EIA now expects the Henry Hub spot price will average $3.53 per MMBTU in 2012. In 2013, the forecast spot price rises to an average of $4.14 per MMBtu. Natural gas futures prices for March 2012 delivery (for the 5-day period ending January 5, 2012) averaged $3.05 per MMBtu, and the average implied volatility was 40 percent. The lower and upper bounds for the 95-percent confidence interval for March 2012 contracts are $2.29 per MMBtu and $4.06 per MMBtu. At this time last year, the March 2011 natural gas futures contract averaged $4.39 per MMBtu and implied volatility averaged 43 percent. The corresponding lower and upper limits of the 95-percent confidence interval were $3.21 per MMBtu and $6.02 per MMBtu.*

U.S. Electricity Retail Prices. *After having risen by 2.1 percent between 2010 and 2011, EIA expects average U.S. residential electricity prices to rise only 0.6 percent in 2012 and then stay flat in 2013.*





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

Recommendations:

1. CEG recommends an aggregated approach for 3rd party commodity supply procurement strategies for electricity supply service. Aggregating all Montville Board of Education facilities for electricity would allow for all facilities to achieve cost reductions on electricity supply costs. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The facilities could realize up to a 30% reduction in energy supply costs, if it were to aggregate all facilities usage 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 Montville BOE either consider joining the NJSBA "ACES" energy consortium or explore the utilization and advisement of their own 3rd party unbiased Energy Consulting Firm. This firm should be experienced in the procurement of electricity commodity, New Jersey procurement laws, aggregation of facilities and energy supply risk and commodity management. In addition, the firm should be able to provide full service advisement over the term of the contract to identify additional opportunities to further reduce costs. Many of these opportunities may include: energy rates; utility bill auditing; energy data analytics; and efficiency improvements.

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

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

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

3. CEG recommends that Montville BOE explore an aggregated Demand Response Program that may be available in aggregate for its facilities. Demand response is the action of end users lowering their demand for electric (reducing consumption) in order to help balance supply and demand on the electric grid and ensure stability. The greatest need for demand response typically occurs during times of peak electricity demand, between the hours of 11 am and 6 pm, when extra strain is placed on the grid from situations such as increased air conditioning use on hot days or downed power lines resulting from a storm. Significant incentives are available for clients enrolled in demand

response programs. It is strongly recommended that Montville BOE utilize an experienced 3rd party unbiased energy consulting firm prior to initiating any demand response programs. This is recommended due to the potential conflicts with existing and/or future electric supply service agreements and transparency created by the evaluation of current programs and incentives available.

4. A list of 3rd party commodity suppliers in the Montville Township's corresponding utility territory can be found in the Third Party Commodity Suppliers Appendix (Appendix A) at the end of this section.

The recommendations and projected savings presented by CEG are based on current information provided by Montville BOE for its facilities utility usage. Any projected savings presented with these recommendations are estimates only based on that information. It is recommended that further analysis and review of more recent utility data and actual Third Party Suppler invoices and contracts be performed prior to performing any of the presented recommendations.

VII. 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:

A. Incentive Programs:

Pay For Performance

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

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

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

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

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

$0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …)
Increased incentives result from verified savings above 15%.

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 150 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 70% 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. The following measures are potential candidates for Direct Install:

- Lighting Upgrade – All Facilities
- Lighting Controls – All Facilities
- NEMA Premium Efficiency Motors
- Programmable Thermostats – Woodmont ES

Smart Start Program

Prescriptive Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include unit pricing incentives for installation of energy efficient equipment and controls. Proposed equipment and controls must meet the minimum efficiency requirements as well as other application requirements. The Smart Start prescriptive incentives applicable for new construction, renovations, remodeling and equipment replacements, for a wide range of equipment including:

- Electric Chillers
- Gas Cooling
- Electric Unitary HVAC
- Ground Source Heat Pumps
- Gas Heating
- Variable Frequency Drives
- Gas Water Heating
- Premium Motors
- Prescriptive Lighting
- Lighting Controls
- Technical Studies

Custom Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include all measures not identified in the prescriptive measures category or measures that must have savings verified through additional analysis such as energy model simulations. Custom measures are intended to include savings as a result of unique

energy efficiency measures, which are typically facility specific such as waste heat recovery. Custom incentives are provided based on the amount of energy saved and minimum internal rate of return in order to be eligible.

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.

B. Financing Options:

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.

Power Purchase Agreement

Public Law 2008, Chapter 3 authorizes contracts of up to fifteen (15) years for energy purchase 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.

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. This program provides public entities to make valuable facility infrastructure improvements that are associated with energy savings. All energy savings projects are eligible as long as the financing period does not extend beyond 15 years. The financing can be utilized for all aspects of energy efficiency project implementation including, energy savings plan development, engineering, construction management, construction management, commissioning, and measurement and verification.

This program provides the much needed financing for energy efficiency projects without the burden of increased debt. The program allows for procurement of financing without voter approval or extending existing dept. The program requires evaluation to ensure a positive cash-flow through the entire 15 year financing period. The first phase of implementing an ESIP is the development of an Energy Savings Plan (ESP) to verify the energy savings, construction costs, and overall financial model.

The underlining program requirement is the limitation of the project term to 15 years. The ESIP project size is open for multiple buildings to be included within one project. In addition all applicable incentive programs can also be utilized to help reduce the overall construction cost.

The following breakdown is an estimated project scope with the potential to qualify for the ESIP. An ESP is required to verify the costs and savings as part of an ESIP project.

Table 8
ESIP -Total Entity Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
High School	$76,897	$1,080,394	$26,591	$1,053,803	13.7
Lazar Middle School	$32,876	$337,120	$7,583	$329,537	10.0
Valley View Elementary School	$16,506	$239,245	$2,265	$236,980	14.4
Woodmont Elementary School	$21,540	$301,556	$2,238	$299,318	13.9
Hilldale Elementary School	$16,616	$177,028	$4,320	$172,708	10.4
Total Entity Project	**$164,434**	**$2,135,343**	**$42,997**	**$2,092,346**	**12.7**

Total Entity Energy Costs:	**$1,085,089**
Est. Total Entity Energy Savings:	**$164,434**
Overall Entity Percent Reduction:	**15.2%**

VIII. ENERGY AUDIT ASSUMPTIONS

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

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

JCP&L SERVICE TERRITORY
Last Updated: 1/10/12

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL**

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC 103 Carnegie Center Suite 300 Princeton, NJ 08540	(877) 30-AMBIT (877) 302-6248 www.ambitenergy.com	**R/C** **ACTIVE**
BlueStar Energy Solutions 309 Fellowship Road, Fl. 2 Mount Laurel, NJ 08054	(866) 258-3782 (BLUESTAR) www.bluestarenergy.com	**C/I** **ACTIVE**
Champion Energy Services, LLC 72 Avenue L Newark, NJ 07105	(877) 653-5090 www.championenergyservices.com	**R/C/I** **ACTIVE**
Clearview Electric, Inc. 505 Park Drive Woodbury, NJ 08096	(888) CLR-VIEW (888) 257-8439 www.clearviewenergy.com	**R/C/I** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 www.directenergybusiness.com	**C/I** **ACTIVE**

Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **ACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, NJ 08002	(800) 282-3331 www.discountenergysavings.com	**R/C** **ACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route 70, Suite 125 Lakewood, NJ 08701	(866) 645-9802 www.dom.com/products	**R/C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
EnerPenn USA, LLC 89 Headquarters Plaza North #1463 Morristown, NJ 07960	855-243-3596 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Exelon Energy Company 116 Village Blvd., Suite 200 Princeton, NJ 08540	1-800-261-4301 www.exelonenergy.com	**C/I** **ACTIVE**
FirstEnergy Solutions Corp. 300 Madison Avenue Morristown, NJ 07962	(800) 977-0500 www.fes.com	**C/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08837	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 75 Route 15 Building E Lafayette, NJ 07848	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**

Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
HOP Energy, LLC d/b/a Metro Energy, HOP Fleet Fueling, HOP Energy Fleet Fueling 1011 Hudson Avenue Ridgefield, NJ 07657	(877) 390-7155 www.hopenergy.com	**R/C/I** **ACTIVE**
Independence Energy Group, LLC 3711 Market Street, 10th Floor Philadelphia, PA 19104	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com	**C/I** **ACTIVE**
Liberty Power Delaware, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**

Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
NJ Gas & Electric 1 Bridge Plaza fl.2 Fort Lee, NJ 07024	(866) 568-0290 www.NJGandE.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
North American Power and Gas, LLC 222 Ridgedale Ave. Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**C/I** **ACTIVE**
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) ENERGY-9 (363-7499) www.pepco-services.com	**R/C** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Public Power & Utility of New Jersey, LLC 39 Old Ridgebury Rd. Suite 14 Danbury, CT 06810	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com/pjm	**R/C/I** **ACTIVE**

ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescomenergy.com	**R/C** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
UGI Energy Services, Inc. d/b/a GASMARK 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	(800) 388-3862 www.lowcostpower.com	**R/C/I** **ACTIVE**
Viridian Energy 2001 Route 46 Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 1/10/12

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL**

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552	**C** **ACTIVE**
Colonial Energy, Inc. 3975 Fair Ridge Dr. Suite T 10 N Fairfax, Va. 22033	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Compass Energy Services, Inc. 1085 Morris Avenue, Suite 150 Union, NJ 07083	866-867-8328 908-638-6605 www.compassenergy.net	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 900A lake Street, Suite 2 Ramsey, NJ 07466	800-900-1982 www.newenergy.com	**R/C/I** **ACTIVE**
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	800-6-BUYGAS (6-289427) www.cooperativenet.com	**C/I** **ACTIVE**
Core Energy Inc. 37W 55th Street Suite 200 Ocean City, NJ 08226	877-329-3495 www.core-energy.net	**R/C** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route 70, Suite 125 Lakewood, NJ 08701	866-275-4240 www.dom.com/products	**R/C/I** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center, Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane	800-805-8586	**R/C/I**

Lakewood, NJ 08701	www.gesc.com	**ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C** **ACTIVE**
UGI Energy Services, Inc. d/b/a/ GASMARK 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-724-1880 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	800-828-9427 www.metromediaenergy.com	**C/I** **ACTIVE**
MxEnergy, Inc. 510 Thornall Street, Suite 270Edison, NJ 08837	800-375-1277 www.mxenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, NJ 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290	**R/C/I**

	www.NJGandE.com	**ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C** **ACTIVE**
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
SBR Energy LLC 36 West Main St., Suite 204 Freehold, NJ 07728	(888) 391-0499 www.sbrenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	800-225-1560 www.spragueenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	800-388-3862 www.lowcostpower.com	**R** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street, P.O. Box 777 Bridgeton, NJ 08302	856-455-1111 800-557-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

Back to main supplier information page

MONTVILLE TOWNSHIP
BOARD OF EDUCATION

MONTVILLE HIGH SCHOOL

100 HORSENECK ROAD
MONTVILLE, NEW JERSEY 07045

FACILITY ENERGY REPORT

TABLE OF CONTENTS

I. HISTORIC ENERGY CONSUMPTION/COST 2

II. FACILITY DESCRIPTION 7

III. MAJOR EQUIPMENT LIST 11

IV. ENERGY CONSERVATION MEASURES 12

V. ADDITIONAL RECOMMENDATIONS 58

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start® Program Incentives

Appendix C – Portfolio Manager "Statement of Energy Performance"

Appendix D – Major Equipment List

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

Appendix G – Vending Machine Controls Calculations

I. HISTORIC ENERGY CONSUMPTION/COST

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.

Electric Utility Provider:	Jersey Central Power and Light (JCP&L)
Electric Utility Rate Structure:	General Service Secondary Three-Phase
Third Party Supplier:	None

Natural Gas Utility Provider:	New Jersey Natural Gas
Utility Rate Structure:	General Service Large (GSL)
Third Party Supplier:	Amerada HESS

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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

Description	Average
Electricity	16.4¢ / kWh
Natural Gas	$1.04 / Therm

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Jersey Central Power & Light
Rate: General Service Secondary 3 Phase
Meter No: G28159779 / G28159779 / G17904115 / L74026923
Account # 1000023623091 / 100007548520 / 100007548645 / 100076053105
Third Party Utility Provider: N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Sep-10	228,632	842	$39,047
Oct-10	203,615	709	$34,426
Nov-10	223,026	764	$37,668
Dec-10	262,685	748	$42,977
Jan-11	218,876	757	$35,629
Feb-11	132,376	729	$22,456
Mar-11	233,760	686	$35,160
Apr-11	219,589	867	$34,783
May-11	208,535	931	$35,474
Jun-11	211,143	788	$33,284
Jul-11	193,669	868	$31,431
Aug-11	172,862	864	$28,614
Totals	**2,508,768**	**931 Max**	**$410,949**

AVERAGE DEMAND **796.1 KW average**
AVERAGE RATE **$0.164** **$/kWh**

Figure 1
Electricity Usage Profile
Montville High School
Sep -10 through August- 11

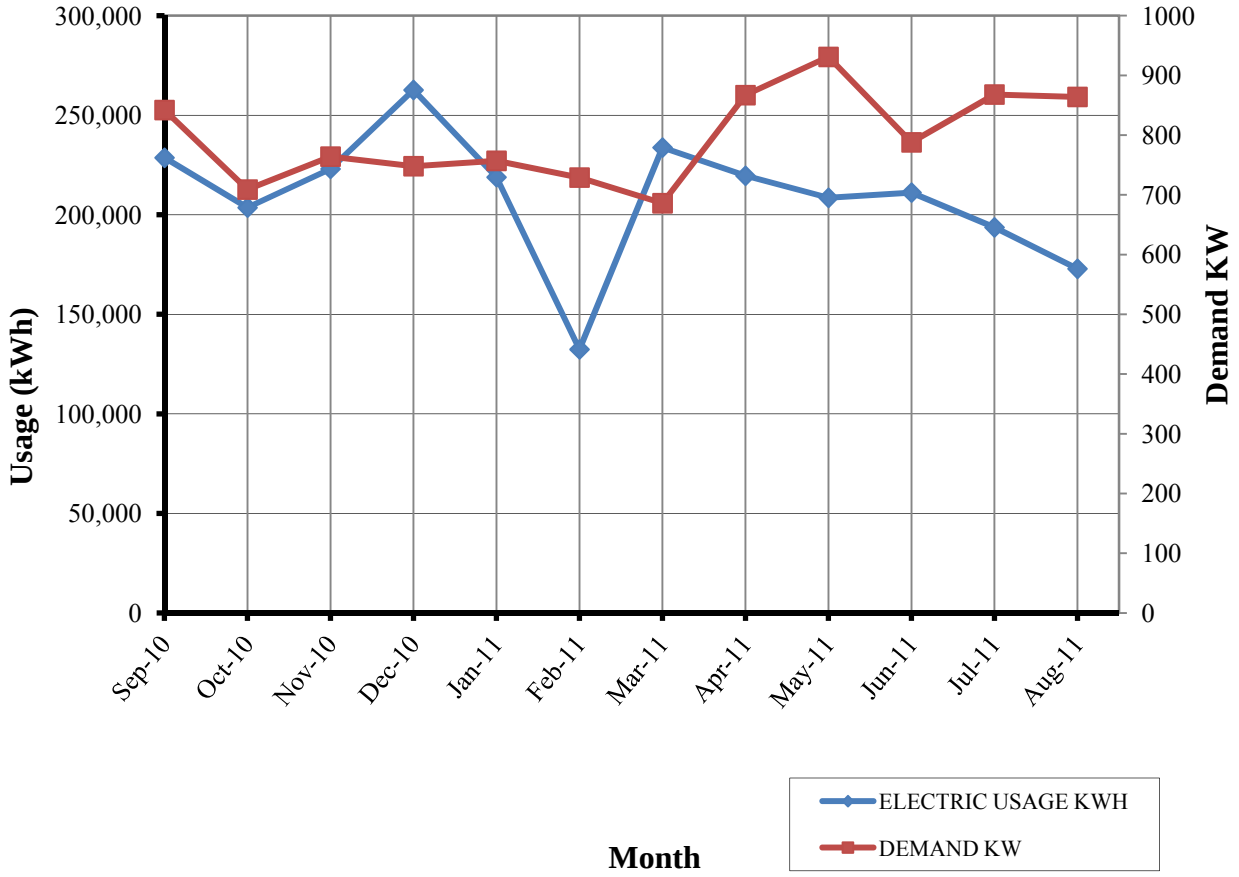
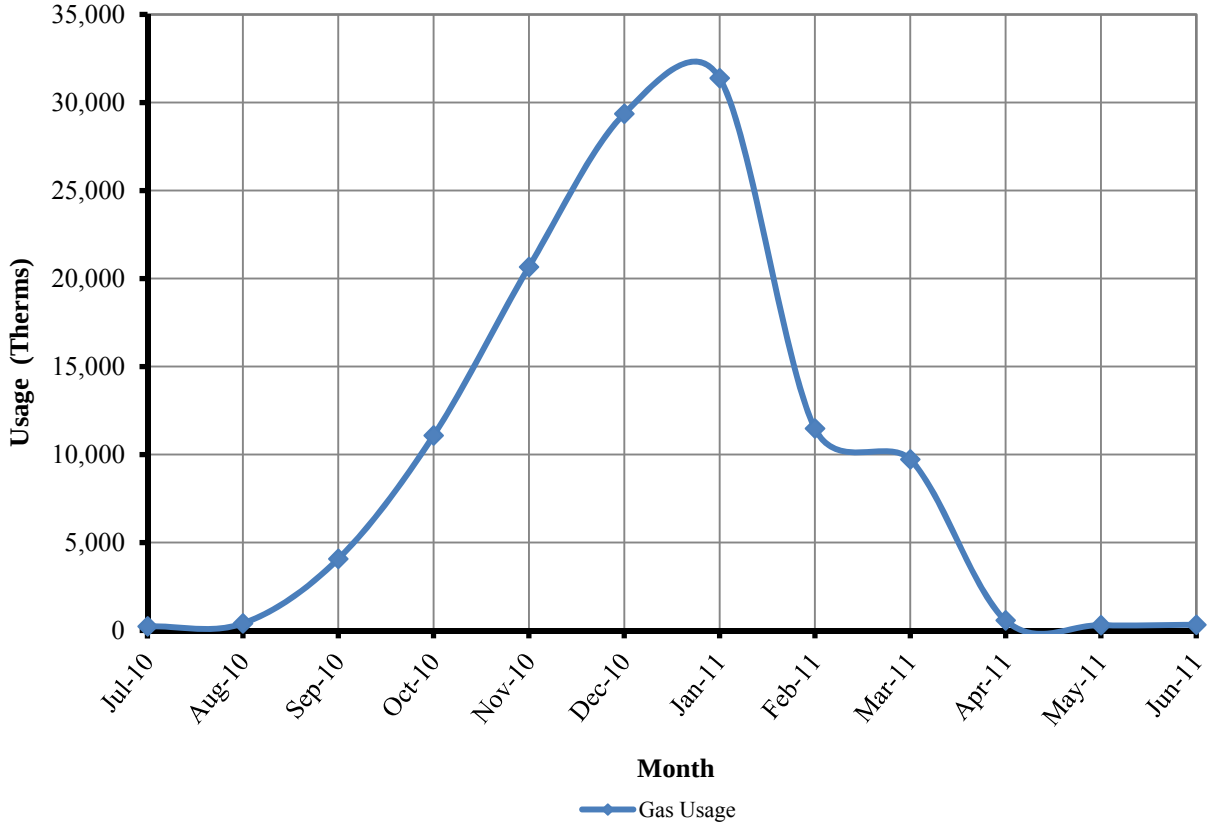


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: NJ Natural Gas		
Rate: GSS / GSL		
Meter No: 00489058 / 00508990		
Point of Delivery ID: 04-1219-0915-11 / 04-1219-0916-18		
Third Party Utility Provider: Amerada Hess		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jul-10	241	$1,804
Aug-10	409	$1,942
Sep-10	4,076	$5,663
Oct-10	11,085	$12,794
Nov-10	20,659	$23,389
Dec-10	29,362	$31,874
Jan-11	31,388	$17,019
Feb-11	11,482	$8,327
Mar-11	9,726	$11,586
Apr-11	579	$5,686
May-11	306	$1,966
Jun-11	329	$1,780
TOTALS	**119,642**	**$123,830**
AVERAGE RATE:	**$1.04**	**$/THERM**

Figure 2
Natural Gas Usage Profile
Montville High School
July - 10 through June - 11



II. FACILITY DESCRIPTION

The 213,000 SF High School is a multi story facility comprised of classrooms, science laboratories, workshops, media center, computer rooms, cafeteria, kitchen, two (2) gymnasium, auditorium, administration offices, restrooms, mechanical rooms and storage spaces. The High School was built in 1970 and expanded in 2003 with the addition of the north block.

Building Profile

The normal hours of operation for the school students and teachers are between 7:30 AM and 2:20 PM on the weekdays. The facility remains occupied till 11:00 PM for various after school activities, sports practices and detention as well as the custodial services. The facility is utilized on Saturdays and Sunday for various sports activities. The student enrollment at the Montville High School is approximately 1350. Estimated total number of staff is 150.

Building Envelope

The facility is constructed of multiple levels of integrated structures with varying roof heights. There are three major roof levels in this facility which are constructed of built up metal roof decking system with asphalt and gravel covering. All of the major HVAC systems are located on the roof of the facility. The new gymnasium and the auditorium roofs are built up with slightly pitched, standing seam metal roofing system. There is estimated 1" of rigid insulation within the roof structure, which could not be verified.

The facility exterior consists of a masonry block construction with brick and metal panel façade. Insulation within the walls is estimated to consist of 1" of rigid insulation.

There are limited amount of windows throughout this facility. The existing windows consist of double pane, tinted, operable windows with aluminum frames in good condition. The facility has over 10 entrance and exit doors. The exit doors are in good condition.

HVAC Systems

Heating is provided by two central hot water heating systems. The original building boiler room provides heat for the majority of the school's heating equipment with the exception of the 500/600 wing added in 2003. The new boiler plant services the 500/600 wing terminal and rooftop equipment.

The original boiler plant is comprised of two fire tube boilers. Each of the Cleaver Brooks CB Series boilers has an input capacity of 12,554 MBH. These boilers provide heating hot water to baseboards, unit ventilators, heating and ventilation units and packaged rooftop heating and air conditioning units throughout the school. The boilers are in good condition and appear to be well maintained. The boilers utilize a total of six (6) constant speed, base mounted, end suction pumps serving three (3) heating zones. The pumps are driven with 15, 10 and 5 Horse power standard efficiency motors. The end suction pumps are in good to fair condition.

The newer boiler room is comprised of four condensing boilers made by Aerco. Each boiler has an input capacity of 2,000 MBH. The boiler water is circulated through the building by two end

suction constant speed pumps driven by 20 HP premium efficiency motors. The new boiler room and equipment within the new boiler plant is in excellent condition.

Terminal heating equipment consists of unit ventilators made by Nesbitt in combination with hydronic baseboard heat. These units serve the classrooms throughout the school. The unit ventilators in the original portion appear to be in poor condition. The unit ventilators are controlled by the building pneumatic system. In many cases these controls are not functioning correctly due to leaks in the system or failure of the control valves resulting in lack of temperature control. As a result of these issues, the poorly controlled classrooms as well as other spaces have windows open in the winter to maintain comfortable temperatures.

The newer classrooms in the building addition utilize vertical style packaged heating and cooling units made by Airedale. Each classroom has a dedicated packaged heating and cooling unit with overhead ductwork for air distribution. The newer Airedale units are installed in the 500/600 wing. Heat is provided by hot water heating coils fed from the central boiler plant. Cooling is packaged within the unit and heat is rejected through an exterior wall louver. Each unit is installed within an enclosed cabinet in the corner of the classroom. These units can be removed from the cabinet for service. The packaged Airedale units are loud and seem to be in fair condition despite their recent installation within the building additions.

The facility also utilizes large heating, ventilation and air conditioning systems for larger spaces like original gymnasium and the auditorium. The gym unit is a large heating and ventilation unit with hot water coils. The unit appears to be original to the building and in poor condition. Similarly, the auditorium unit is a large heating, ventilation and air conditioning unit with hot water coils for heating and DX (direct expansion) coils for cooling. These units appear to be original to the building and in poor condition. The units within the gymnasium and the auditorium utilize the pneumatic control system with 3-way control valves.

In addition to the central heating system, several spaces utilize packaged rooftop heating and air conditioning units. The packaged units provide heat and air conditioning for various spaces such as; main office, library, team rooms, sports rooms, music rooms, cafeteria and some of the classrooms. The packaged rooftop units are made by various manufacturers such as Carrier, Lennox, McQuay and Trane. The units range from new and excellent condition to old and poor condition. The units are equipped with supply fans with standard efficiency motors. Majority of the units over 5 ton capacity have built-in 100% outside air economizer functionality.

Cooling is provided for the majority of the spaces within the school except the 300/400 block classrooms, original gymnasium and utility rooms. All of the new addition classrooms have air conditioning units provided by the package Airedale units. Packaged rooftop units with air conditioning provide cooling for additional spaces listed above. In addition, some of the smaller spaces such as computer rooms small offices and utility closets are air conditioned with split air conditioning systems. These units include ductless split systems made by Airedale and Fujitsu well as standard split systems made by Trane. These units vary in age and condition.

A separate split Computer Room Air Conditioning (CRAC) unit serves computer server room within this facility. The CRAC unit is in good condition and appears to be maintained well.

Conditioned air is delivered to the classrooms and the offices via constant volume ducts through ceiling diffusers. Temperature zone control is achieved via building management system.

Kitchen and Cafeteria

The Montville High School houses a full service kitchen and cafeteria. The kitchen prepares full meals for the students of the School. The kitchen operates between the hours of 5:30AM and 2:30 PM.

The kitchen houses two (2) walk-in refrigerators and two (2) walk-in freezers in addition to several reach-in type refrigerators. The walk-in units and the condensing units are in good condition. The school cafeteria has two (3) refrigerated wending machines, which operate year round.

Exhaust System

Air is exhausted from the toilet rooms, gymnasium, auditorium, lockers rooms, storage areas and corridors through roof mounted exhaust fans. The exhaust fans are interlocked with the rooftop units and controlled via building management system. Labs and science rooms utilize small dedicated exhaust systems located on the roof.

The kitchen utilizes two (2) 4’ x 14’ exhaust hoods, which are connected to an approximately 12,000 CFM exhaust fan located on the roof. The commercial dishwasher within the facility also utilizes an exhaust hood, which is connected to a smaller exhaust fan located on the roof. The range hood exhaust fans are controlled via manual switches and operate as needed. The exhaust equipment appears to be in good condition.

HVAC System Controls

Majority of the building HVAC systems are controlled by a DDC Building Management System (BMS) made by Honeywell. The BMS provides control over all HVAC equipment throughout the building and determines scheduling, temperature sensors, equipment start stop, supply air temperature reset etc. The digital control system appears to be providing adequate control for conditioning of the building and occupant comfort. The BMS currently does not have optimal start/stop controls.

The unit ventilators in the original building as well as the older heating and ventilation units are controlled via the original pneumatic control system. The old and outdated pneumatic controller and actuators for the unit ventilators are deteriorated therefore do not function properly. There appears to be a set-back system for the pneumatic controls but the proper operation could not be verified. It was reported that the unit ventilators do not have set back capability. It is recommended to upgrade the remaining old and outdated pneumatic controls to a state of the art DDC control system.

Domestic Hot Water

Domestic hot water for the original High School building is provided with two (2) 1,000 MBH instant hot water systems with two (2) 318 gallon hot water retainer tanks. The boilers are

Lochinvar Power-fin series high efficiency non-condensing boilers with 87% thermal efficiency. The system provides domestic hot water for the kitchen and bathrooms throughout the facility. The domestic hot water is distributed throughout the building by small circulation pumps. The hot water heater, piping, and insulation are in good condition.

Lighting

Typical lighting throughout the building is fluorescent tube fixtures with T-8 lamps and electronic ballasts. Several spaces use incandescent lamps in recessed fixtures. The Main Gymnasium uses 250W metal halide lamps with electronic ballasts. The Auxiliary Gym utilizes high bay fixtures with T5 fluorescent lamps. The Auditorium utilizes incandescent lighting for dimming control. A space by space breakdown of the lighting throughout the facility is provided in the **Investment Grade Lighting Appendix**.

III. 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.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 3 - ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	General Lighting Equipment Upgrade	$365	$464	1	1808%
ECM #2	Lighting Upgrade – LED Lights for Auditorium	$10,450	$3,467	3.0	398%
ECM #3	Lighting Controls - Upgrade	$25,625	$9,662	2.7	466%
ECM #4	Gymnasium Lighting Equipment and Controls	$6,930	$1,007	7	118%
ECM #5	Unit Ventilator with Energy Recovery	$546,000	$12,098	45	-67%
ECM #6	RTU Upgrades	$434,064	$14,583	30	-50%
ECM #7	NEMA Premium Efficiency Motors	$18,076	$689	26	-43%
ECM #8	Demand Controlled Ventilation	$108,000	$10,738	10.1	49%
ECM #9	CRT Monitor Upgrades	$5,880	$743	7.9	26%
ECM #10	Automatic Computer Stand-by / Hibernate	$408	$1,240	0.3	2938%
ECM #11	DDC Controls Upgrade	$305,000	$33,341	9	64%
ECM #12	Vending Miser Controls	$695	$963	0.7	1978%
ECM #13	Water Efficiency	$115,600	$4,243	27	-45%
ECM #14	Boiler Upgrade	$754,500	$20,087	37.6	-20%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	580 KW Solar System	$3,592,794	$248,400	14.5	3.7%

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

Table 4
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	General Lighting Equipment Upgrade	0.9	2,835	-
ECM #2	Lighting Upgrade – LED Lights for Auditorium	8.1	21,164	-
ECM #3	Lighting Controls - Upgrade	-	58,983	-
ECM #4	Gymnasium Lighting Equipment and Controls	1.2	6,146	-
ECM #5	Unit Ventilator with Energy Recovery	-	8,405	9,926
ECM #6	RTU Upgrades	73.2	87,849	-
ECM #7	NEMA Premium Efficiency Motors	2.2	4,153	-
ECM #8	Demand Controlled Ventilation	-	32,208	5,246
ECM #9	CRT Monitor Upgrades	-	4,528	-
ECM #10	Automatic Computer Stand-by / Hibernate	-	7,563	-
ECM #11	DDC Controls Upgrade	-	125,894	11,964
ECM #12	Vending Miser Controls	-	5,800	-
ECM #13	Water Efficiency	-	-	899
ECM #14	Boiler Upgrade	-	-	19,314
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	580 KW Solar System	420.2	670,738	-

Table 5
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
General Lighting Equipment Upgrade	$464	$385	$20	$365	0.8
Lighting Upgrade – LED Lights for Auditorium	$3,467	$12,650	$2,200	$10,450	3.0
Lighting Controls - Upgrade	$9,662	$28,950	$3,325	$25,625	2.7
Gymnasium Lighting Equipment and Controls	$1,007	$8,000	$1,070	$6,930	6.9
~~Unit Ventilator with Energy Recovery~~	~~$12,098~~	~~$546,000~~	~~$0~~	~~$546,000~~	~~45.1~~
RTU Upgrades	$14,583	$453,500	$19,436	$434,064	29.8
NEMA Premium Efficiency Motors	$689	$18,616	$540	$18,076	26.2
Demand Controlled Ventilation	$10,738	$108,000	$0	$108,000	10.1
CRT Monitor Upgrades	$743	$5,880	$0	$5,880	7.9
Automatic Computer Stand-by / Hibernate	$1,240	$408	$0	$408	0.3
DDC Controls Upgrade	$33,341	$305,000	$0	$305,000	9.1
Vending Miser Controls	$963	$695	$0	$695	0.7
~~Water Efficiency~~	~~$4,243~~	~~$115,600~~	~~$0~~	~~$115,600~~	~~27.2~~
~~Boiler Upgrade~~	~~$20,087~~	~~$772,500~~	~~$18,000~~	~~$754,500~~	~~37.6~~
Design / Construction Extras (15%)	*$0*	*$138,310*	*$0*	*$138,310*	
Total Project	**$76,897**	**$1,080,394**	**$26,591**	**$1,053,803**	**13.7**

ECMs marked with strikethrough font are not included in total.

Design / Construction Extras is shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: General Lighting Equipment Upgrade – Incandescent Lamps

Description:

The ECM include replacement of the incandescent lamps found in various spaces with compact fluorescent lamps. 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 energy usage of an incandescent lamp compared to a compact fluorescent lamp 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.

This ECM also includes retrofit of the vanity lights in the display cases with more efficient T8 lamps and electronic ballasts.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

Rebates and Incentives:

There are no NJ Smart Start® Program Incentives for replacement of screw-in incandescent lamps with compact fluorescent lamps.

Retrofit of the vanity fixtures warrant following incentives:

Retrofit of T-12 fixture to T-8 with electric ballasts	$10 per fixture (1-4 lamp retrofits)

$$\text{Smart Start® Incentive} = (\#\ \text{of fixtures} \times \$10) = 2 \times \$10 = \$20$$

NJ Smart Start® Program Incentives are calculated using the **Smart Start® Incentive Appendix**.

Replacement and Maintenance Savings from this ECM is negligible.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$385
NJ Smart Start Equipment Incentive ($):	$20
Net Installation Cost ($):	$365
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$464
Total Yearly Savings ($/Yr):	$464
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.8
Simple Lifetime ROI	1808.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$6,965
Internal Rate of Return (IRR)	127%
Net Present Value (NPV)	$5,178

ECM #2: Lighting Upgrade – LED Lights for the Auditorium

Description:

The lighting for the Montville High School Auditorium is provided with incandescent flood lamps.

The incandescent lighting is a very inefficient lighting technology and have a relatively short life, yet when compared to other lighting options, incandescent lighting contain superior light quality, color and dimming ability. CFL (Compact Fluorescent Lamps) and LED (Light Emitting Diode) are both viable options for incandescent fixture replacements. Although compact fluorescent lighting does not hold the same lighting quality as an incandescent fixture, they are superior in bulb life ranging from 8,000 to 12,000 hours. However, CFL's do not have the ability to sustain a constant color temperature while dimming. In addition, the minimum capacity range of CFL's is 15-20% of their full capacity.

LED's are small light sources that are readily associated with electronic equipment. The LED lighting has far superior lighting quality and a lifetime ranging from 50,000 to 60,000 hours. Although, typically the LED's lumen output in comparison to incandescent fixtures is approximately equal, industry is yet to produce single compact LED fixtures with large lumen outputs. Therefore, existing inefficient light fixtures are often replaced with multiple LED fixtures to maintain the amount of lighting.

This ECM replaces the 90W (estimated) incandescent flood lamps in the Auditorium with dimmable LED lamps. The retrofit installation cost represents a considerable up-front investment with very profitable savings to be realized in the long run. Owner should consult a lighting professional prior to going forward with this ECM.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

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

Install LED Screw-based & Pin-based (PAR, MR, BR, R) Standards (A-Style) and Decorative (globe, candelabra, etc.) Lamps= $20 per fixture.

$$\text{Smart Start® Incentive} = (\#\ \text{of LED Fixtures} \times \$20)$$

$$\text{Smart Start® Incentive} = (110 \times \$20) = \underline{\$2{,}200}$$

Maintenance Savings

Typical LED lamp life is 5 to 50 times longer than incandescent fixtures ranging from 50,000 to 60,000 burn-hours compared to incandescent fixtures ranging from 1,000 to 10,000 burn-hours for this type and size of lamps. However, the maintenance savings due to reduced lamp replacement is offset by the higher cost of the LED's compared to the incandescent lamps.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$12,650
NJ Smart Start Equipment Incentive ($):	$2,200
Net Installation Cost ($):	$10,450
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,467
Total Yearly Savings ($/Yr):	$3,467
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.0
Simple Lifetime ROI	397.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$52,002
Internal Rate of Return (IRR)	33%
Net Present Value (NPV)	$30,936

ECM #3: Lighting Controls Upgrade – Occupancy Sensors

Description:

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

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

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

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

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

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

Energy Savings Calculations:

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

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

Total number of rooms to be retrofitted is 118. Remote mounted sensors are to be used in 75 rooms and switch mounted sensors are to be used in 43 rooms. The total cost to install sensors is $28,950.

Incentives:

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

Occupancy Sensor Fixture Mounted = $20 per sensor
Occupancy Sensor Remote Mounted = $35 per sensor

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$28,950
NJ Smart Start Equipment Incentive ($):	$3,325
Net Installation Cost ($):	$25,625
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$9,662
Total Yearly Savings ($/Yr):	$9,662
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.7
Simple Lifetime ROI	466%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$144,925
Internal Rate of Return (IRR)	37%
Net Present Value (NPV)	$89,715

ECM #4: Gymnasium Lighting Equipment and Controls Upgrade

Description:

The Gymnasium at Montville High School utilizes 250W metal halide fixtures for its lighting. Metal halide bulbs provide a reasonably efficient option for bay lighting however a few drawbacks that are common. Metal halide fixtures often have poor overall efficacy which limits the amount of light actually leaving the fixture. Also metal halide bulbs require a significant warm-up period and even longer cool down period eliminating the potential for occupancy sensors frequent switching. This symptom encourages the gymnasium lighting to be left on continuously during the day. Another drawback is the reduced lumen output (Lumen Maintenance) of the metal halide bulb over its life time. Average bulb output or "mean lumens," is approximately 25% less than the bulb's initial lumens for typical metal halide lamps. In addition the most rapid rate of light output decline is during the beginning of its life, approximately 15-20% light loss within the first 20% of its rated life. It is important to note that the light loss has no savings in energy used; therefore the overall light efficiency is continuously decreasing with age. The final drawback is the light quality or Color Rendering Index (CRI). Typical values for metal halide bulbs is 65, which is a measure of how close the light is to true "full spectrum" light produced by sunlight or incandescent lighting. Metal halide bulbs also show noticeable color shifting when the bulb is reaching the end of its life. Utilizing fluorescent fixtures in low and high bay spaces is a superior option over metal halide fixtures in all areas described above. Although metal halide fixtures provide light very efficiently at the start of the bulb life, the average efficiency over the life is below that of fluorescent fixtures.

This ECM includes replacement of each of the existing gymnasium high bay metal halide light fixtures with T5HO fixtures with reflective lenses. The retrofit for the metal halide fixtures includes a one for one fixture replacement. The fluorescent fixtures selected will provide equivalent light compared to the average light output of the existing metal halide fixtures. The bulb replacement cost for T-5 HO lamps compared to the existing metal halide lamps were found to be approximately equal and therefore not included in the savings calculations.

This ECM also includes installation of occupancy sensors for the proposed fluorescent gymnasium light fixtures. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives

Metal Halide Fixtures

From the **Smart Start Incentive Appendix**, the following incentives are warranted:
For replacement of HID (250-399W) with new T-5 or T-8 fixtures = $50/Fixture

$$\text{Smart Start ® Incentive} = (\#\text{ of Metal Halide Fixture Replaced} \times \$50)$$

$$\text{Smart Start ® Incentive} = (20 \times \$50) = \$1{,}000$$

Occupancy Sensors

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

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

$$\text{Smart Start ® Incentive} = (2 \times \$35) = \$70$$

There is no significant replacement or maintenance savings generated with this ECM.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,000
NJ Smart Start Equipment Incentive ($):	$1,070
Net Installation Cost ($):	$6,930
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,007
Total Yearly Savings ($/Yr):	$1,007
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.9
Simple Lifetime ROI	118%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$15,102
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$5,089

ECM #5: Install Unit Ventilators with Energy Recovery

Description:

The heating and air conditioning for the classrooms in the original section of the School are provided by Nesbitt unit ventilators, which are original to the building. The unit ventilators are over 30 years old and far beyond the end of expected useful service life, which is fifteen (15) years per ASHRAE.

The estimated total number of older unit ventilators in this facility is 39. The units are heating only and controlled with pneumatic controllers and actuators. It is recommended to replace older unit ventilators with modern unit ventilators with energy recovery wheels. The advantage of this setup is the utilization of the energy recovery system to recover the energy in the exhaust air in order to reduce the heating and cooling demand of the classrooms.

This ECM replaces existing 39 older unit ventilators with new unit ventilators with hot water heating coils and built-in energy recovery wheels. The basis for this ECM is Trane HUVC series unit ventilator with corresponding Energy Recovery ventilators. The ECM also includes attaching the unit ventilator controls to the Building Energy Management System to achieve superior scheduling and controls.

Energy Savings Calculations:

The energy savings calculations are based reduction of the outside air heating, reduction of the overheating and infiltration due to opening of the windows and temperature setback during nights and weekends.

Nominal recovery capacity of the proposed unit is calculated based on typical outside air percentage, heating degree days and design day temperature difference. Total energy recovery of each unit at heating modes is calculated using heating degree days:

$$\text{Heating Energy Recovered}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Recovery Rate}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}\left(\text{Day }^{\circ}\text{F}\right)\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(^{\circ}\text{F}\right)\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency }\left(\%\right)}$$

Amount of addition infiltration at each classroom due to open windows:

$$\text{Infiltration}\left(\text{BTU}/\text{Hr}\right)=\frac{\text{Ave Classroom Size (SF)}\times 10'\text{ Ceiling}\times\dfrac{\#\text{ Air Changes}}{\text{Hr}}}{\dfrac{60\text{ Minutes}}{\text{Hr}}}\times 1.08\times 65°\text{F}$$

$$\text{Infiltration Energy}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Infiltration}\left(\dfrac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}\left(\text{Day }°\text{F}\right)\times\#\left(\dfrac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(°\text{F}\right)\times\text{Fuel Heat Value}\left(\dfrac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency }(\%)}$$

Fan Energy Cost:

$$\text{Fan Energy, kWh}=\frac{\text{Fan Power (HP)}\times\dfrac{0.746\text{kW}}{\text{HP}}\times 0.8\text{ (Load Factor)}\times\text{Annual Hrs}}{0.9\text{ (Power Factor)}}$$

Results of the calculations can be found in the table below:

UNIT VENTILATOR CALCULATIONS			
ECM INPUTS	**EXISTING UNITS**	**PROPOSED UNITS**	**SAVINGS**
ECM INPUTS	Existing Unit Ventilators UVs	New UVs with ERVs	
Number of Units	39	39	-
Ave. Unit Flow Capacity (CFM)	1250	1250	
Outside Air %	30%	30%	
Outside Air Flow (CFM)	375	375	
Heating Design Day Temp. Diff (°F)	65	65	
Average Classroom Size (SF)	1000	1000	
Additional Air Changes per Hour*	2	0	
Infiltration (CFM)	333	0	
Windows Open Hours/Day	4	0	
Infiltration Energy Loss (MBH/Unit)	23.4	0	
Heating Energy Recovery, MBH/Unit	-	26.3	26.3
ERV Operation Hours / Day	-	12	-
Supply Fan Motor HP	1/3	1/4	0
Fan Annual Hours of Operation	1560	780	780
Heating Degree Days	4713	4713	-
Net Heating System Efficiency	70%	70%	-
Electric Cost ($/KWH)	$0.164	$0.164	0.164
Natural Gas Cost ($/Therm)	$1.08	$1.08	$1.08
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED UNITS**	**SAVINGS**
Fan Energy (kWh)	13,448	5,043	8,405
Heating Energy Infiltration (Therms)	2,269	0	2,269
Heating Energy Recovery (Therms)	0	-7,657	7,657
Fan Energy Cost ($)	$2,205	$827	$1,378
Infiltration Energy Cost ($)	$2,450	$0	$2,450
Heating Energy Recovered ($)	$0	-$8,269	$8,269
Total ($)	$4,656	-$7,442	$12,098
COMMENTS:	* Due to open windows and overheating		

Project cost, incentives and maintenance savings:

Total installed cost for 39 unit ventilators with hot water coils, energy recovery ventilators (ERV) and controls upgrade is $546,000.

The selected equipment does not qualify for any of the NJ Smart Start rebates.

There is no significant maintenance savings associated to this ECM.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$546,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$546,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$12,098
Total Yearly Savings ($/Yr):	$12,098
Estimated ECM Lifetime (Yr):	15
Simple Payback	45.1
Simple Lifetime ROI	-66.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$181,470
Internal Rate of Return (IRR)	-11%
Net Present Value (NPV)	($401,574.46)

ECM #6: RTU Upgrades

Description:

The majority of Montville High School is air conditioned by packaged rooftop units. The majority of the units at the school are in good to fair condition and are currently still within their useful ASHRAE service life, with the exception of the RTU which services the Library. The units currently installed are less efficient compared to modern equipment and can be replaced with new high efficiency units. New air conditioners provide higher full load and part load efficiencies due to advances in inverter motor technologies, heat exchangers and refrigerants.

This ECM includes one-for-one replacement of the older air conditioning units with new higher efficiency systems. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. A summary of the unit replacements for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS	**SERVICE FOR**	**NUMBER OF UNITS**	**COOLING CAPACITY, BTU/HR**	**TOTAL CAPACITY, TONS**	**REPLACE UNIT WITH**
RTU	Various	7	48,000	28	Carrier Weathermaster
RTU	Various	3	60,000	15	Carrier Weathermaster
RTU	RTU - 1/2	2	300,000	50	Carrier Weathermaster
RTU	Various	3	120,000	30	Carrier Weathermaster
RTU	Various	6	90,000	45	Carrier Weathermaster
RTU	RTU - 302/Library	2	24,000	4	Carrier Infinity
RTU	RTU - 24/25	2	36,000	6	Carrier Weathermaster
RTU	Various	4	150,000	50	Carrier Weathermaster
RTU	RTU - 23	1	180,000	15	Carrier Weathermaster
Total		**30**	**1,008,000**	**243**	

The manufacturers used as the basis for this calculation is Carrier. All units are one for one style replacements with matching capacity of the new units to the old units. The unit pricing and install cost were estimated based on current rates. The payback may change based on actual unit pricing and install costs if the ECM is implemented. Due to the payback over 15 years CE recommends that Montville BOE review the replacement of rooftop units as they reach the end of their service life in the coming years.

Energy Savings Calculations:

Cooling Energy Savings:

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

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

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

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

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNITS (S)EER**	**SPLIT UNITS (S)EER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
RTU	48,000	1,200	8.84 EER	12.5 EER	7	13,355	11.1
RTU	60,000	1,200	7.65 EER	12.45 EER	3	10,886	9.1
RTU	300,000	1,200	9.18 EER	12 EER	2	18,431	15.4
RTU	120,000	1,200	10.2 EER	12 EER	3	6,353	5.3
RTU	90,000	1,200	8.5 EER	12 EER	6	22,235	18.5
RTU	24,000	1,200	7.565 EER	12 EER	2	2,814	2.3
RTU	36,000	1,200	9.01 EER	13 EER	2	2,943	2.5
RTU	150,000	1,200	11.05 EER	12.2 EER	4	6,142	5.1
RTU	180,000	1,200	9.52 EER	12 EER	1	4,689	3.9
Total					**30**	**87,849**	**73.2**

Project Cost, Incentives and Maintenance Savings

From the NJ Smart Start® Program appendix, the replacement of split system AC units and unitary systems with high efficiency AC systems falls under the category "Unitary HVAC Split System" and warrants an incentive based on efficiency (EER/SEER). The program incentives are calculated as follows:

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

AC UNITS REBATE SUMMARY				
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/TON**	**PROPOSED CAPACITY TONS**	**TOTAL REBATE $**
≥20 to 30 tons	10.5 EER	$79	50	$3,950
≥ 11.25 to < 20 tons	11.5 EER	$79	65	$5,135
≥ 5.4 to < 11.25 tons	11.5 EER	$73	75	$5,475
5.4 tons or less Unitary AC and Split System	≥14 SEER	$92	53.0	$4,876
TOTAL			**243**	**$19,436**

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

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNITS (S)EER**	**SPLIT UNITS (S)EER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
RTU	48,000	1,200	8.84 EER	12.5 EER	7	13,355	11.1
RTU	60,000	1,200	7.65 EER	12.45 EER	3	10,886	9.1
RTU	300,000	1,200	9.18 EER	12 EER	2	18,431	15.4
RTU	120,000	1,200	10.2 EER	12 EER	3	6,353	5.3
RTU	90,000	1,200	8.5 EER	12 EER	6	22,235	18.5
RTU	24,000	1,200	7.565 EER	12 EER	2	2,814	2.3
RTU	36,000	1,200	9.01 EER	13 EER	2	2,943	2.5
RTU	150,000	1,200	11.05 EER	12.2 EER	4	6,142	5.1
RTU	180,000	1,200	9.52 EER	12 EER	1	4,689	3.9
Total					**30**	**87,849**	**73.2**

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

COST & SAVINGS SUMMARY							
ECM INPUTS	**UNIT COST**	**# OF UNITS**	**TOTAL COST**	**REBATES**	**NET COST**	**ENERGY SAVING**	**PAY BACK YEARS**
RTU	$11,000	7	$77,000	$2,576	$74,424	$2,217	33.6
RTU	$12,500	3	$37,500	$1,380	$36,120	$1,807	20.0
RTU	$26,000	2	$52,000	$3,950	$48,050	$3,060	15.7
RTU	$17,500	3	$52,500	$2,190	$50,310	$1,055	47.7
RTU	$16,250	6	$97,500	$3,285	$94,215	$3,691	25.5
RTU	$7,500	2	$15,000	$368	$14,632	$467	31.3
RTU	$9,250	2	$18,500	$552	$17,948	$489	36.7
RTU	$20,625	4	$82,500	$3,950	$78,550	$1,020	77.0
RTU	$21,000	1	$21,000	$1,185	$19,815	$778	25.5
Total	**$141,625**	**30**	**$453,500**	**$19,436**	**$434,064**	**$14,583**	**29.8**

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$453,500
NJ Smart Start Equipment Incentive ($):	$19,436
Net Installation Cost ($):	$434,064
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$14,583
Total Yearly Savings ($/Yr):	$14,583
Estimated ECM Lifetime (Yr):	15
Simple Payback	29.8
Simple Lifetime ROI	-49.6%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$218,743
Internal Rate of Return (IRR)	-8%
Net Present Value (NPV)	($259,974.63)

ECM #7: Install NEMA Premium® Efficiency Motors

Description:

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

The school has a number of motors that are candidates to be replaced with NEMA Premium® efficiency motors. The motors are located in the boiler room which serves the hot water loop and zone loops.

Boiler operating hours were estimated based on hours of operation obtained from the school. The pumps operate in pairs with one pump on standby; this reduces the overall operating hours of each pump individually by approximately 50%.

This energy conservation measure replaces the existing lower efficiency electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today. The energy savings and payback are subject to change based on the pool filtration usage during the year. An implementation summary of the motor is provided below.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
P - 1	Boiler Pump	10	2,000	87.0%	92.4%
P - 2	Boiler Pump	10	2,000	87.0%	92.4%
P - 5	Zone Pump	5	1,750	82.5%	90.2%
P - 6	Zone Pump	5	1,750	82.5%	90.2%
P - 7	Zone Pump	20	1,750	91.0%	93.0%
P - 8	Zone Pump	20	1,750	91.0%	93.0%

Energy Savings Calculations:

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

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

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

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

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

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	**MOTOR HP**	**LOAD FACTOR**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**POWER SAVINGS kW**	**ENERGY SAVINGS kWH**	**COST SAVINGS**
P - 1	10	90%	87.0%	92.4%	0.45	907	$151
P - 2	10	90%	87.0%	92.4%	0.45	907	$151
P - 5	5	90%	82.5%	90.2%	0.35	611	$101
P - 6	5	90%	82.5%	90.2%	0.35	611	$101
P - 7	20	90%	91.0%	93.0%	0.32	558	$93
P - 8	20	90%	91.0%	93.0%	0.32	558	$93
TOTAL					**2.2**	**4,153**	**$689**

Equipment Cost and Incentives

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

INCENTIVES	
HORSE POWER	**NJ SMART START INCENTIVE**
1	$45
1.5	$45
2	$54
3	$54
5	$54
7.5	$81
10	$90
15	$104
20	$113
25	$117
30	$135
40	$162

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

MOTOR REPLACEMENT SUMMARY						
EQMT ID	**MOTOR POWER HP**	**INSTALLED COST**	**SMART START INCENTIVE**	**NET COST**	**TOTAL SAVINGS**	**SIMPLE PAYBACK**
P - 1	10	$3,154	$90	$3,064	$151	20.4
P - 2	10	$3,154	$90	$3,064	$151	20.4
P - 5	5	$1,519	$90	$1,429	$101	14.1
P - 6	5	$1,519	$90	$1,429	$101	14.1
P - 7	20	$4,635	$90	$4,545	$93	49.0
P - 8	20	$4,635	$90	$4,545	$93	49.0
TOTAL		**$18,616**	**$540**	**$18,076**	**$689**	**26.2**

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$18,616
NJ Smart Start Equipment Incentive ($):	$540
Net Installation Cost ($):	$18,076
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$689
Total Yearly Savings ($/Yr):	$689
Estimated ECM Lifetime (Yr):	15
Simple Payback	26.2
Simple Lifetime ROI	-42.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$10,340
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	($9,847)

ECM #8: Demand Controlled Ventilation

Demand Controlled Ventilation (DCV) is a means to provide active, zone level control of ventilation for spaces within a facility. The basic premise behind DCV is monitoring indoor CO2 levels versus outdoor CO2 levels in order to provide proper ventilation to the spaces within the facility as well as saving costly dollars treating unconditioned ventilation air. Carbon dioxide ventilation control or demand controlled ventilation (DCV) allows for the measurement and control of outside air ventilation levels to a target cfm/person ventilation rate in the space (i.e., 15 cfm/person) based on the number of people in the space. It is a direct measure of ventilation effectiveness and is a method whereby buildings can regain active and automatic zone level ventilation control, without having to open windows. The fixed ventilation approach depends on a set-it-and-forget-it methodology that is completely unresponsive to changes in the way spaces are utilized/occupied or how equipment is maintained. A DCV system utilizes various control algorithms to maintain a base ventilation rate. The system monitors space CO2 levels and the algorithm automatically adjusts the outdoor and return air dampers to provide the quantity of outdoor air to maintain the required CO2 level in the space. System designs are normally designed for maximum occupancy and the ventilation rates are designed for this (maximum) occupancy. In areas where occupancy swings are prevalent there is ample opportunity to reduce outdoor air quantity to satisfy the needs of the actual number of occupants present. By installing the DCV controls, energy savings are realized by the reduced quantities of outdoor air that do not require heating and cooling energy from the steam and chilled water plants.

Packaged rooftop units serving offices, classrooms and activity rooms are standard air conditioning units with constant minimum outside air setup. When these units are on unoccupied mode, the outside air dampers shut. The outside air volume is typically based on the maximum occupancy of the space conditioned. When a given space is not fully occupied the outside air quantity delivered to the space is greater than the amount actually needed for adequate ventilation, which results in waste of heating or air conditioning energy.

This ECM includes the installation of CO_2 sensors integrated into a demand control ventilation system, for the units mentioned above. This system allows the air handling unit to respond to changes in occupancy and therefore reduce the amount of outside air that has to be conditioned. Outside air accounts for a large portion of the energy consumption in the HVAC system, especially in high occupancy spaces.

The components required for the demand control ventilation system installation include damper actuators, Variable Frequency Drives for larger units, CO2 sensors, wiring, Energy Management System equipment expansion and programming. Each occupied zone would require minimum one CO_2 sensor installed to monitor occupancy levels.

Often heating and air conditioning units switch to occupied mode several hours before the actual occupancy in order to provide pre-heating or pre-cooling of the space. Energy savings achieved through “Demand Control Ventilation” is calculated based on actual occupancy of the spaces and the hours the units are in occupied mode.

Energy Savings Calculations:

Following table summarizes the estimated occupancy characteristics of the spaces and the HVAC equipment at this school.

ENERGY SAVINGS	
ECM INPUTS	**DCV**
Average Full Occupancy Hours	9:00 AM - 3:00 PM
Full Occupancy Hours per Day	6
HVAC Eqp. On Occupied Mode	6:00 AM - 6:00 PM
Occupied Hours per day	12
HVAC occupied / spaces not occupied	6
Est. Conditioned outside air savings	50%

$$\text{Cooling Energy Usage} = \frac{\text{Cooling(Tons)} \times 12{,}000 \left(\frac{\text{Btu}}{\text{Ton hr}}\right) \times \text{Annual Full Load Cooling Hrs.}}{1000 \left(\frac{\text{Wh}}{\text{kWh}}\right) \times \text{EER}\left(\frac{\text{Btu}}{\text{Wh}}\right)}$$

$$\text{Energy Savings} = \text{Cooling Energy(kwh)} \times \text{Saving\%}$$

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

$$\text{Heating Energy (Therms)} = \frac{\text{Outside Air Heating Capacity} \left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD(Day °F)} \times 12 \left(\frac{\text{Hr.}}{\text{Day}}\right) \times (0.60)}{65(°\text{F}) \times \text{Fuel Heat Value} \left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency (\%)}}$$

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

Following is a list of HVAC equipment and corresponding spaces identified for Demand Controlled Ventilation.

IMPLEMENTATION SUMMARY							
INPUTS	**HVAC UNIT**	**Service**	**# of Units**	**# of CO2 SENSORS**	**Total Cooling Capaity, Tons**	**Outside Air Cooling, Tons**	**Outside Air Heating, MBH**
DCV-1	**RTU - 20**	Team Room	1	1	5	2.0	56
DCV-2	**RTU - 21**	Girls Coach's Office	1	1	5	2.0	56
DCV-3	**RTU - 23**	Wrestling Room	1	1	15	6.0	168
DCV-4	**RTU - 1/2**	Gym	2	2	50	20.0	562
DCV-5	**RTU - Chorus**	Chorus Room	1	1	10	4.0	112
DCV-6	**RTU - 13**	Drawing Room	1	1	8	3.0	84
DCV-7	**RTU - 12**	-	1	1	8	3.0	84
DCV-8	**RTU - 11**	Yearbook Room	1	1	8	3.0	84
DCV-9	**RTU - 10**	TV/Video Room	1	1	8	3.0	84
DCV-10	**RTU - 6/7/8/9**	Café	4	4	49	19.5	548
DCV-11	**RTU - 418**	Room 418	1	1	8	3.0	84
DCV-12	**RTU - 419**	Rooms 419/420/442	1	3	8	3.0	84
DCV-13	**RTU - 3**	Room 507	1	1	5	2.0	56
DCV-14	**RTU - 4**	-	1	1	8	3.0	84
DCV-15	**RTU - 2**	Room 505	1	1	10	4.0	112
Total			19	**21**	**201**	**81**	**2,261**

Assumptions: 400 CFM/Ton, 40% average fresh air, 65°F design day ΔT

Max outside air heating capacity = 1.08 x Fresh Air CFM x design day ΔT

Results of the energy savings calculations are summarized in the table below:

DEMAND CONTROLLED VENTILATION	
ECM INPUTS	**DCV**
Equipment	Rooftop Units
OA Cooling Capacity, Tons	81
Average Efficiency (EER)	9
Annual Full Load Cooling Hours	600
OA Heating Capacity, MBh	2261
Net Heating Efficiency (Gas)	75%
Heating Degree Days (65°F)	4713
Occupied Hours per day	8
Heating Energy Saving	50%
A/C Energy Savings	50%
Elec Cost ($/kWh)	$0.164
Natural Gas Cost ($/Therm)	$1.04
ENERGY SAVINGS	
ECM RESULTS	**DCV**
Cooling Energy Cnsmption, kWh	64,416
Heating Energy (Therms)	10,492
Cooling Energy Savings kWh	32,208
Heating Energy Savings (Therms)	5,246
Electric Energy Cost Savings ($)	$5,282
Total Gas Cost Savings ($)	$5,456
Total Cost Savings ($)	$10,738
COMMENTS:	HDD estimated based on Newark Liberty Airport OA: Outside Air

Cost and Incentives:

The components included to install for a demand control ventilation system include damper actuators (if not exist), Variable Frequency Drives (for larger AC units), CO2 sensors, wiring, Energy Management System equipment expansion and programming. Each occupied zone would require minimum one CO_2 sensor installed to monitor occupancy levels.

Estimated installed cost for demand controlled ventilation for the rooftop heating and air conditioning units is $108,000. Estimated cost includes CO2 sensors, control wiring, electrical wiring, control system equipment expansion and programming.

There are currently no Smart Start ® incentives available for a Demand Control Ventilation System.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$108,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$108,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$10,738
Total Yearly Savings ($/Yr):	$10,738
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.1
Simple Lifetime ROI	49.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$161,071
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	$20,190

ECM #9: Computer Monitor Replacement

Description:

The computers throughout the facility utilize a mixture of CRT computer monitors and LCD computer monitors. The CRT computer monitors within the offices and classrooms are outdated and have several disadvantages such as; significantly increased energy consumption, uses large amount of desk space, poor picture quality, distortions and flickering image, secular glare problems, high weight, and electromagnetic emissions. Many of these 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.

By choosing LCD monitors with an LED backlighting system the resulting energy consumption can be reduced even further. LED based LCD monitor's use less energy than conventional LCD monitor, and due to recent advancements have a comparable cost to conventional LCD monitors. For example a typical LCD with LED technology will use an estimated 2 watts when in sleep mode, and 20 watts while in operation (Based on 18.5 inch display).

Based on the site survey it was noted that there are 49 CRT monitors. Some of the monitors were left in screen saver mode, which 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 is based on averages for power usage of various computer monitors.

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

Energy Savings Calculations:

No. of CRT Monitors:	49
Operating Weeks per Yr:	42
Hrs per Week:	40 (8 hrs per day estimated average)

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

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

Installation cost of new monitors is estimated based on current pricing for an 18.5" 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 $120.

Installation Costs: # Monitors X Cost per Monitor
49 Monitors X $100 per Monitor
$4,900

COMPUTER MONITOR CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CRT Monitors	LCD Monitor	-
# of Computers	49	49	-
Monitor Power Cons. (W)	75	20	-
Operating Hrs per Week	40	40	-
Operating Weeks per Yr	42	42	-
Elec Cost ($/kWh)	0.164	0.164	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	6,174	1,646	4,528
Energy Cost ($)	$1,013	$270	$743
COMMENTS:	CRT Monitor consumption based on Dell CRT monitor M/N: CRT-E771MM. LCD Monitor based on Dell IN1930 LCD LED. Operating hours estimated.		

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$4,900
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$4,900
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$743
Total Yearly Savings ($/Yr):	$743
Estimated ECM Lifetime (Yr):	10
Simple Payback	6.6
Simple Lifetime ROI	51.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$7,425
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	$1,434

ECM #10: Set Computers to Automatic Stand-by or Hibernate Modes

Description:

During the survey, it was noticed that the majority of the computers were left at ON position with the monitors at Screen Saver or OFF positions. According to interviews with some of the personnel, the computers require significant amount of time to boot up therefore they are typically left ON.

Many personal computers (PC) came equipped with automatic Stand-by or Hibernate (power down) features. Normally computers boot up from Stand-by or Hibernate modes much faster than powering up from Shut Down position.

Based on an independent study by the U.S. Department of Energy, Energy star® rated computers use approximately 70% less power during Stand-by Mode. It is recommended to set up the PCs at this facility to switch into Stand-by Mode after a short period of inactivity and Hibernate mode after a long period of inactivity.

This ECM includes configuring the computers in the classrooms and the library such that they automatically:

- Stand-by after 15 minutes of inactivity
- Hibernate after 60 minutes of inactivity

The inactivity times above can be adjusted based on experience or preference. Even though this ECM can be implemented easily in house, the calculations assume an independent computer technician performing the task at a typical market rate.

Energy Savings Calculations:

No. of CRT Monitors:	49
Operating Weeks per Yr:	42
Estimated percentage of computers left ON over night:	75%

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

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

The cost of configuring the computers to automatically sleep or hibernate is based on 10 minutes per computer per technician at an hourly rate indicated below.

Implementation Costs: = # Computers X Configuration Time X Cost per Hour

= 49 Monitors X 10 Minutes/Computer X $100 per Hour
= $408

AUTOMATIC SLEEP OR HIBERNATE MODES FOR COMPUTERS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Manual Operation	Auto Power Save	-
# of Computers	49	49	-
% Computers left ON	75%	75%	-
Power when left ON (Watt)	50	50	-
Power at Stand-by (Watt)	5	5	-
Power at Hibernate (Watt)	4	4	-
Power when OFF (Watt)	0	0	-
Operating Weeks per Yr	42	42	-
Operating Hours per Week	168	168	-
Hours/Wk Computers ON	120	20	-
Hours/Wk at Sleep Mode	0	20	-
Hours/Wk at Hibernate Mode	0	80	-
Hours/Wk at Power Down	48	48	-
Elec Cost ($/kWh)	0.164	0.164	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	9,261	1,698	7,563
Energy Cost ($)	$1,519	$278	$1,240
COMMENTS:	Calculation assumes computers currently run throughout work week and get shut down over the weekend.		

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$408
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$408
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,240
Total Yearly Savings ($/Yr):	$1,240
Estimated ECM Lifetime (Yr):	10
Simple Payback	0.3
Simple Lifetime ROI	2937.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$12,404
Internal Rate of Return (IRR)	304%
Net Present Value (NPV)	$10,172

ECM #11: DDC Controls Upgrade

Description:

Majority of the Montville High School HVAC systems are controlled primarily through the use of pneumatic control systems. CE recommends expanding the DDC system to control remaining HVAC systems in the school including the air handling units, unit ventilators, wall thermostats, air conditioning units, rooftop units, and boilers. In addition the existing control systems will be unified under one system allowing easier operation for building facility management personnel.

This ECM includes expansion of the existing Building Automation system to include control of the majority of the HVAC equipment in the facility. The system will include new temperature sensors and new local thermostats with limited over-ride capability, a front end computer and main controller. The system will also include central controls for lighting. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the building may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. 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 referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 5% of the electricity and 10% for the gas utility in this building.

The basis for the DDC system expansion is the Automated Logic Energy Management System or similar.

Energy Savings Calculations:

Since some of the key utility consumption and cost information was not available, estimated values are used for the unit cost of natural gas, total electricity usage and unit cost of electricity.

Energy savings for each utility is calculated with the equation below.

Energy Savings (Utility) = Current Energy Consumption × Estimated Savings, %

Following table summarizes energy savings for this facility via implementation of an Energy Management System:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Controls w/ Local Thermostats	DDC Controls	
Existing Nat Gas Usage (Therms)	119,642	-	
Existing Electricity Usage (kWh)	2,517,882	-	
Energy Savings, Nat. Gas	-	10%	
Energy Savings, Electricity	-	5%	
Gas Cost ($/Therm)	*$1.04*	$1.04	
Electricity Cost ($/kWh)	*$0.166*	$0.166	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	119,642	107,678	11,964
Electricity Usage (kWh)	2,517,882	2,391,988	125,894
Natural Gas Cost ($)	$124,428	$111,985	$12,443
Electricity Cost ($)	$417,968	$397,070	$20,898
Energy Cost ($)	$542,396	$509,055	$33,341
COMMENTS:			

Demand savings due to implementation of this ECM is minimal.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $1.00 to $2.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = $305,000

Currently, there are no prequalified NJ SmartSmart Incentives for installation of the DDC system.

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$305,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$305,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$33,341
Total Yearly Savings ($/Yr):	$33,341
Estimated ECM Lifetime (Yr):	15
Simple Payback	9.1
Simple Lifetime ROI	64.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$500,118
Internal Rate of Return (IRR)	7%
Net Present Value (NPV)	$93,025

ECM #12: Vending Miser Controls

Description:

Montville High School currently utilizes vending machines in select areas within the building. Vending machines are located within cafeterias and some corridors. The installation of the Vending Miser system will help reduce the operating hours of vending machines.

Cold beverage machines regularly operate inefficiently trying to maintain a constant cool temperature within the machine and snack machines with no cooling usually have lights that operate 24/7. The VendingMiser® system incorporates innovative energy-saving technology into a small plug-and-play device that in conjunction with a passive infrared sensor regulate the operation of the cold beverage and snack machines based on occupancy and room temperature. This ECM approximates the installation of three of these control systems for the cold beverage machines and two for the un-cooled snack machines.

Energy Savings Calculations:

See **Vending Miser Appendix** for calculation methods and analysis.

Energy Savings Summary:

ECM #12 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$695
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$695
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$963
Total Yearly Savings ($/Yr):	$963
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.7
Simple Lifetime ROI	1978.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$14,442
Internal Rate of Return (IRR)	139%
Net Present Value (NPV)	$10,799.00

ECM #13: Water Efficiency & Conservation

Description:

The facility utilizes standard plumbing fixtures. The typical water closet and urinal water consumption only meet the minimum federally required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the replacement of the existing sink faucets, water closets and urinals within the bathrooms the facility. The estimated usage of the plumbing fixtures is based on the total population of the facility.

The proposed retrofit includes installation of auto flow sink faucets, low flow aerators, low flow flushometer style water closets that utilize 1.28 gallons per flush and ultra-low flushometer style urinals that utilize 1/8 gallons per flush. For the basis of this calculation the LEED rating system was used to estimate the occupancy usage for students within the school. When water consumption information was not available, the GPF values were estimated for the existing fixtures.

Energy Savings Calculations:

Urinals and Toilets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Flush}}{\text{Person per Day}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Flush}}\right)$$

Faucets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Use}}{\text{Person per Day}}\right) \times \text{Use Time}\left(\frac{\text{Sec}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Water Cost} = \frac{\text{Water Consumption (Gallons)} \times \text{Ave Cost}\left(\frac{\$}{1000\,\text{Gal}}\right)}{1000(\text{Gal})}$$

$$\text{Gas Cost (Therms)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.34\,\text{BTU}}{\text{Gal}} \times \frac{\text{Therm}}{100{,}000\,\text{BTU}}$$

WATER CONSERVATION CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Fixtures	Low Flow / Auto Flow Fixtures	-
Total Number of Students	1,340	1,340	-
% Male to Female	50%	50%	-
Estimated % Floor Area Served by Older Bathrooms	100%	100%	-
Occupied Days Per Year	195	195	-
Lavatory Uses per Day per Person	3	3	-
Sink flow time per use, sec	15	12	-
Sink Aerator Flow, GPM	1.5	0.5	-
WC Uses per Day per Person	2.0	2.0	-
Urinal Uses per Day per Person	1.0	1.0	-
Total Urinal Flushes Per Day	670	670	-
Total WC Flushes Per Day	1,340	1,340	-
Urinal Gallons Per Flush (GPF)	1.0	0.125	0.875
WC Gallons Per Flush (GPF)	1.6	1.28	0.32
**** Water Cost ($/1000 Gal)**	$8.00	$8.00	-
Gas Cost ($/Therm)	$1.04	$1.04	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Water Consumption, Urinal and WC (Gal)	548,730	350,795	197,935
Water Consumption, Faucets (Gal)	293,963	78,390	215,573
Total Water Consumption, (Gal)	842,693	429,185	413,507
Water Cost ($)	$6,742	$3,433	$3,308
Gas Consumption (Therms)	1,226	327	899
Gas Cost ($/Year)	$1,275	$340	$935
Total Savings ($/Year)	-	-	$4,243
COMMENTS:	*Savings are based on LEED Reference Guide for Green Building Design and Construction - 2009 Edition for WC and Urinal water usage. ** Cost of Water estimated.		

The cost for installation and materials of water closets, low flow urinals and new auto flow sink faucets throughout the facility is estimated to be $116,500.

There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #13 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$115,600
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$115,600
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,243
Total Yearly Savings ($/Yr):	$4,243
Estimated ECM Lifetime (Yr):	15
Simple Payback	27.2
Simple Lifetime ROI	-44.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$63,645
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($64,947)

ECM #14: Boiler Systems Upgrade – Condensing Boilers

Description:

Space heating for the original sections of Montville High School is provided by heating hot water loop. The source of hot water for this equipment is two hot water boilers located in the boiler room.

The input capacity of each boiler is 12,544 MBH. The boilers were installed with the original construction and are 42 years old, which brings them significantly past their ASHRAE service life. The units are still in service put are in poor condition and should be replaced with newer high efficiency units. This ECM provides insight into the energy efficiency benefit of condensing boiler technology compared to standard cast iron and firetube boilers.

Standard (non-condensing) boilers provide lower than nominal efficiency compared to condensing boilers. Standard boilers suffer further efficiency losses at part load operating conditions mainly due to limitations in the reduction of the flue gas temperature. Current average combustion efficiency of each boiler is estimated to be 70% due to standard non-condensing boiler technology, limited turn down ratio, cycling losses and outdated design and controls. A new condensing boiler could substantially improve the operating efficiency of the heating system of the building. Condensing boiler's peak efficiency tops out at 99% depending on return water temperature.

This ECM is based on the replacement of both hot water boilers with five (5) Aerco Benchmark 3.0 modular condensing boilers. Normally, one boiler is able to satisfy the facility's heating load. The proposed system will allow for N +2 redundancies.

The annual average operating efficiency of the proposed boiler set is expected to be 90%, which gives the heating system a 20% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature. The owner is recommended to retain a professional engineer to confirm equipment sizing and finalize design.

BOILER REPLACEMENT SUMMARY		
EXISTING UNIT	**LOCATION**	**PROPOSED UNITS**
(2) Firetube Boilers	Boiler Room	(6) Aerco Benchmark 3.0

First, domestic hot water usage is estimated and subtracted from the total usage in order to estimate the net natural gas usage for space heating. Additional gas usage by the other boiler room was also estimated then subtracted from total gas usage.

Current total hot water usage can be found in the table below:

ANNUAL GAS USAGE				
MONTH	TOTAL USAGE THERMS	DOMESTIC HW USAGE	HEATING ONLY	COST
Jul-10	241	241	0	$0
Aug-10	409	321	66	$69
Sep-10	4,076	321	2,816	$2,929
Oct-10	11,085	321	8,073	$8,396
Nov-10	20,659	321	15,254	$15,864
Dec-10	29,362	321	21,781	$22,652
Jan-11	31,388	321	23,300	$24,232
Feb-11	11,482	321	8,371	$8,706
Mar-11	9,726	321	7,054	$7,336
Apr-11	579	321	194	$201
May-11	306	306	0	$0
Jun-11	329	321	6	$6
TOTAL	**119,642**	**3,757**	**86,914**	**$90,390**

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

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

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

Energy savings calculations are summarized in the table below:

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	(2) Existing Hot Water Boiler	(6) New Condensing Boilers	-
Boiler Input Capacity (MBH)	32,614	18,000	-
Boiler Output Capacity (MBH)	25,088	16,800	-
Existing Nat Gas (Therms)	86,914	-	-
Boiler Efficiency (%)	70%	90%	20%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	-
Building Heating Energy Usage (MMBTUs)	6,084	6,084	-
Ave. Gas Cost ($/Therm)	1.04	1.04	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	86,914	67,600	19,314
Energy Cost ($)	$90,390	$70,304	$20,087
COMMENTS:			

Project Cost, Incentives and Maintenance Savings

Estimated cost for removing the existing boilers and installing (6) Aerco Benchmark 3.0 condensing boilers plus labor is estimated to be $772,500.

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

GAS FIRED BOILER REBATE SUMMARY					
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/MBH**	**PROPOSED CAPACITY, MBH**	**NUMBER OF UNITS**	**TOTAL REBATE, $**
≥ 300 MBH - 1500 MBH	84% AFUE for Hot Water boilers	$1.75	0	0	$0
>1500 - ≤ 4000 MBH	84% AFUE for Hot Water boilers	$1	3,000	6	$18,000
> 4000 MBH	84% AFUE for Hot Water boilers	$1	0	0	$0
TOTAL					**$18,000**

Estimated maintenance savings associated with this ECM is minimal.

Energy Savings Summary:

ECM #14 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$772,500
NJ Smart Start Equipment Incentive ($):	$18,000
Net Installation Cost ($):	$754,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$20,087
Total Yearly Savings ($/Yr):	$20,087
Estimated ECM Lifetime (Yr):	30
Simple Payback	38
Simple Lifetime ROI	-20%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$602,602
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($360,791)

REM #1: 580 KW Solar System

Description:

Montville High School has available roof and parking space that could accommodate a significant amount of solar generation. Based on the available area a 580 kilowatt solar array could be installed, assuming the existing roof structure is capable of supporting an array. The array will produce approximately 420 kW power, which will result in 670,738 kilowatt-hours annually and reduce the overall electric usage of the facility by 26%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period. This model has been adjusted based on current SREC market values as of December 2011.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
System Size (KW_{DC}):	580.45
Electric Generation (KWH/Yr):	670,738
Installation Cost ($):	$3,592,794
SREC Revenue ($/Yr):	$137,057
Energy Savings ($/Yr):	$111,343
Total Yearly Savings ($/Yr):	$248,400
ECM Analysis Period (Yr):	15
Simple Payback (Yrs):	14.5
Analysis Period Electric Savings ($):	$2,070,850
Analysis Period SREC Revenue ($):	$1,985,441
Net Present Value (NPV)	($1,079,378)

V. 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. Turn off computers when not in use. Ensure computers are not running in screen saver mode which saves the monitor screen not energy.

F. Ensure outside air dampers are functioning properly and only open during occupied mode.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Montville High School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)		
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	General Lighting Equipment Upgrade	$385	$0	$20	$365	$464	$0	$464	15	$6,965	$0	1808.3%	0.8	127.22%	$5,178.44
ECM #2	Lighting Upgrade – LED Lights for Auditorium	$6,325	$6,325	$2,200	$10,450	$3,467	$0	$3,467	15	$52,002	$0	397.6%	3.0	32.70%	$30,936.09
ECM #3	Lighting Controls - Upgrade	$28,950	$0	$3,325	$25,625	$9,662	$0	$9,662	15	$144,925	$0	465.6%	2.7	37.38%	$89,715.08
ECM #4	Gymnasium Lighting Equipment and Controls Upgrade	$8,000	$0	$1,070	$6,930	$1,007	$0	$1,007	15	$15,102	$0	117.9%	6.9	11.80%	$5,089.25
ECM #5	Unit Ventilator with Energy Recovery	$351,000	$195,000	$0	$546,000	$12,098	$0	$12,098	15	$181,470	$0	-66.8%	45.1	-11.40%	($401,574.46)
ECM #6	RTU Upgrades	$226,750	$226,750	$19,436	$434,064	$14,583	$0	$14,583	15	$218,743	$0	-49.6%	29.8	-7.55%	($259,974.63)
ECM #7	NEMA Premium Efficiency Motors	$9,308	$9,308	$540	$18,076	$689	$0	$689	15	$10,340	$0	-42.8%	26.2	-6.29%	($9,846.78)
ECM #8	Demand Controlled Ventilation	$54,000	$54,000	$0	$108,000	$10,738	$0	$10,738	15	$161,071	$0	49.1%	10.1	5.47%	$20,189.97
ECM #9	CRT Monitor Upgrades	$5,880	$0	$0	$5,880	$743	$0	$743	10	$7,425	$0	26.3%	7.9	4.48%	$453.90
ECM #10	Automatic Computer Stand-by / Hibernate	$0	$408	$0	$408	$1,240	$0	$1,240	10	$12,404	$0	2937.6%	0.3	303.76%	$10,172.16
ECM #11	DDC Controls Upgrade	$305,000	$0	$0	$305,000	$33,341	$0	$33,341	15	$500,118	$0	64.0%	9.1	6.93%	$93,024.95
ECM #12	Vending Miser Controls	$695	$0	$0	$695	$963	$0	$963	15	$14,442	$0	1978.0%	0.7	138.53%	$10,799.00
ECM #13	Water Efficiency	$57,800	$57,800	$0	$115,600	$4,243	$0	$4,243	15	$63,645	$0	-44.9%	27.2	-6.68%	($64,947.34)
ECM #14	Boiler Upgrade	$309,000	$463,500	$18,000	$754,500	$20,087	$0	$20,087	30	$602,602	$0	-20.1%	37.6	-1.39%	($360,791.16)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	580 KW Solar System	$3,592,794	$0	$0	$3,592,794	$111,343	$137,057	$248,400	15	$3,725,998	$2,055,860	3.7%	14.5	0.46%	($627,412.95)

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

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-2 lamps) $30 per fixture (3-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Premium Motors

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Montville High School

Building ID: 2957246
For 12-month Period Ending: June 30, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: January 12, 2012

Facility
Montville High School
100 Horseneck Road
Montville, NJ 07045

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

Year Built: 1954
Gross Floor Area (ft²): 213,000

Energy Performance Rating[2] (1-100) 30

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	8,591,013
Natural Gas (kBtu)[4]	11,964,200
Total Energy (kBtu)	20,555,213

Energy Intensity[4]

Site (kBtu/ft²/yr)	97
Source (kBtu/ft²/yr)	194

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	1,853

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

National Median Comparison

National Median Site EUI	81
National Median Source EUI	162
% Difference from National Median Source EUI	19%
Building Type	K-12 School

Stamp of Certifying Professional

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

Meets Industry Standards[5] **for Indoor Environmental Conditions:**

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

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) 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	Montville High School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	100 Horseneck Road, Montville, NJ 07045	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 a hospital (general medical and surgical)) nor can they be submitted as representing only a portion of a building		☐
Montville High School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	213,000 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.		☐
Open Weekends?	Yes	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	300	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	2	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	50 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	Yes	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Light Co [FirstEnergy Corp]

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
06/01/2011	06/30/2011	211,143.00
05/01/2011	05/31/2011	208,535.00
04/01/2011	04/30/2011	219,589.00
03/01/2011	03/31/2011	233,760.00
02/01/2011	02/28/2011	132,376.00
01/01/2011	01/31/2011	218,876.00
12/01/2010	12/31/2010	262,685.00
11/01/2010	11/30/2010	223,026.00
10/01/2010	10/31/2010	203,615.00
09/01/2010	09/30/2010	228,632.00
08/01/2010	08/31/2010	189,442.00
07/01/2010	07/31/2010	186,203.00
Electric Consumption (kWh (thousand Watt-hours))		**2,517,882.00**
Electric Consumption (kBtu (thousand Btu))		**8,591,013.38**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**8,591,013.38**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
06/01/2011	06/30/2011	329.00
05/01/2011	05/31/2011	306.00
04/01/2011	04/30/2011	579.00
03/01/2011	03/31/2011	9,726.00
02/01/2011	02/28/2011	11,482.00
01/01/2011	01/31/2011	31,388.00
12/01/2010	12/31/2010	29,362.00
11/01/2010	11/30/2010	20,659.00
10/01/2010	10/31/2010	11,085.00
09/01/2010	09/30/2010	4,076.00

08/01/2010	08/31/2010	409.00
07/01/2010	07/31/2010	241.00
Gas Consumption (therms)		**119,642.00**
Gas Consumption (kBtu (thousand Btu))		**11,964,200.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**11,964,200.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same 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.

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
Montville High School
100 Horseneck Road
Montville, NJ 07045

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

General Information

Montville High School	
Gross Floor Area Excluding Parking: (ft^2)	213,000
Year Built	1954
For 12-month Evaluation Period Ending Date:	June 30, 2011

Facility Space Use Summary

Montville High School	
Space Type	K-12 School
Gross Floor Area(ft^2)	213,000
Open Weekends?	Yes
Number of PCs	300
Number of walk-in refrigeration/freezer units	2
Presence of cooking facilities	Yes
Percent Cooled	50
Percent Heated	100
Months[o]	N/A
High School?	Yes
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 06/30/2011)	**Baseline** (Ending Date 06/30/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	30	30	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	97	97	63	N/A	81
Source (kBtu/ft^2)	194	194	127	N/A	162
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					
$MtCO_2e$/year	1,853	1,853	1,213	N/A	1,551
$kgCO_2e/ft^2$/year	9	9	6	N/A	8

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Median column presents energy performance data your building would have if your building had a median rating of 50.

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

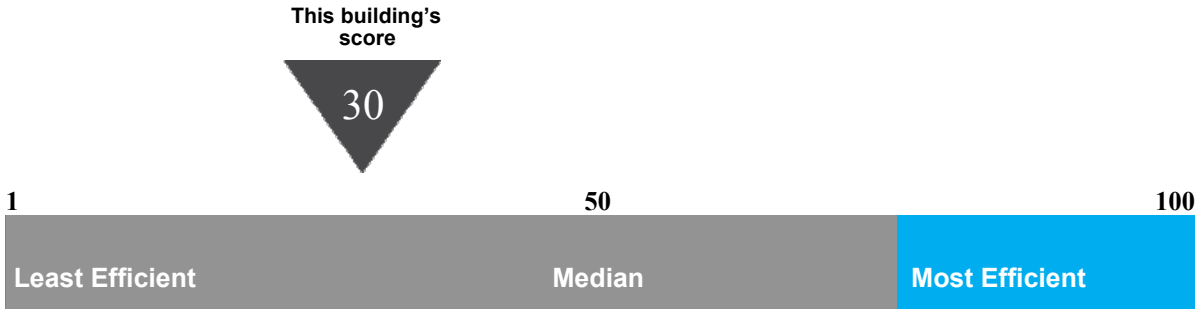
Statement of Energy Performance

2011

Montville High School
100 Horseneck Road
Montville, NJ 07045

Portfolio Manager Building ID: 2957246

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 194 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending June 2011

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 01/12/2012

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

Unit Ventilators

Tag	UV	UV	UV
Unit Type	Vertical Cabinet	Vertical Cabinet	Horizontal Floor Mount
Qty	20 (Est)	20 (Est)	39 (Est)
Location	New Section Classrooms/Offices	New Section Classrooms/Offices	Original Section
Manufacturer	Airedale	Airedale	Nesbitt
Model #	CM5X	CMX-2	-
Serial #	Varies	Varies	-
Flow (CFM)	2000	800	1200 (Est)
Cooling Capacity (Tons)	5	2	N/A
Estimated Cooling Efficiency (EER)	9.0 EER	9.0 EER	N/A
Heating Type	Hot Water Coil	Hot Water Coil	Hot Water Coil
Heating Input (MBH)	101 MBH @ 3 GPM	75 MBH @ 3 GPM	-
Approx Age	9	9	30
Ashrae Service Life	15	15	15
Remaining Life	6	6	(15)
Comments	R22 1/3 HP Fan	R22 1 HP Fan	Poor condition

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	SS - 1	SS - 2	SS - 3
Unit Type	Split System	Split System	Split System
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Auditorium	Auditorium	Main Office
Manufacturer	Carrier	Carrier	Carrier
Model #	38AKS044	38AKS034	50TM016
Serial #	1795F45066	2095F48903	3203F47239
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	40 (Est)	28 (Est)	15
Cooling Efficiency (SEER/EER)	10.5	10.7	9.7
Approx Age	9	9	8
ASHRAE Service Life	15	15	15
Remaining Life	6	6	7
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	SS - 4	SS - 5	RTU - 19
Unit Type	Split System	Split System	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Tech Room	-	Team Room
Manufacturer	-	-	Lennox
Model #	-	-	LCA048HN3G
Serial #	-	-	5602L07527
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	5 (est)	5 (est)	4
Cooling Efficiency (SEER/EER)	9.0 (est)	8.0 (est)	10.4
Approx Age	15 (est)	20 (est)	9
ASHRAE Service Life	15	15	15
Remaining Life	0	(5)	6
Comments	*No Label	* Does not run often, poor condition	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 20	RTU - 21	RTU - 22
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Team Room	Girls Coach's Office	Girls Coach's Office
Manufacturer	Lennox	Lennox	Lennox
Model #	LCA060HN1G	LCA060HN1G	LCA048HN3G
Serial #	5602L07673	5602L07671	5602L07528
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	5	5	4
Cooling Efficiency (SEER/EER)	10.3	10.3	10.4
Approx Age	9	9	9
ASHRAE Service Life	15	15	15
Remaining Life	6	6	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 14	RTU - 15	RTU - 16
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Physical Education Office	Weight Room	Weight Room
Manufacturer	Lennox	Lennox	Lennox
Model #	LCA048HN3G	LCA048HN3G	LCA048HN3G
Serial #	5602L07525	5602L07533	5602L07532
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	4	4	4
Cooling Efficiency (SEER/EER)	10.4	10.4	10.4
Approx Age	9	9	9
ASHRAE Service Life	15	15	15
Remaining Life	6	6	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 17	RTU - 18	RTU - 23
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	-	Room 103	Wrestling Room
Manufacturer	Lennox	Lennox	Lennox
Model #	LCA048HN3G	LCA048HN3G	LCA180HN1G
Serial #	5602L07535	5602L07534	5602L07106
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	4	4	15
Cooling Efficiency (SEER/EER)	10.4	10.4	11.2
Approx Age	9	9	9
ASHRAE Service Life	15	15	15
Remaining Life	6	6	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 1/2	RTU - Chorus	RTU - 13
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	2	1	1
Location	Roof	Roof	Roof
Area Served	Gym	Chorus Room	Drawing Room
Manufacturer	Lennox	Trane	Lennox
Model #	RPS025CLW	TC0103B40ADA	LCA090HN1G
Serial #	FB0U030100449	J30144213D	5602L07424
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	25	10	7.5
Cooling Efficiency (SEER/EER)	10.8	12	10
Approx Age	8	9	9
ASHRAE Service Life	15	15	15
Remaining Life	7	6	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 12	RTU - 11	RTU - 10
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	-	Yearbook Room	TV/Video Room
Manufacturer	Lennox	Lennox	Lennox
Model #	LCA090HN1G	LCA090HN1G	LCA090HN1G
Serial #	5602L07425	5602L07750	5602L07426
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	7.5	7.5	7.5
Cooling Efficiency (SEER/EER)	10	10	10
Approx Age	9	9	9
ASHRAE Service Life	15	15	15
Remaining Life	6	6	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 6/7/8/9	RTU - 24/25	SS
Unit Type	Rooftop Unit	Rooftop Unit	Split System
Qty	4	2	1
Location	Roof	Roof	Roof
Area Served	Café	Guidance Rooms	Library
Manufacturer	Lennox	Lennox	Carrier
Model #	LCC156HN1G	LCA036HN1G	33AK024
Serial #	Varies	5602L07621	Z982291
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	12.2	3	24
Cooling Efficiency (SEER/EER)	13	10.6	8.9
Approx Age	9	9	22
ASHRAE Service Life	15	15	15
Remaining Life	6	6	(7)
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 409	RTU - 23	RTU - 302
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Room 409	Room 413	Room 320
Manufacturer	Carrier	-	Lennox
Model #	50TFF008	-	CHA16-024-1P
Serial #	3201G32156	-	5602M01041
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	7.5	7.5 (est)	2
Cooling Efficiency (SEER/EER)	9.8	9.0 (est)	10.2
Approx Age	10	15 (est)	9
ASHRAE Service Life	15	15	15
Remaining Life	5	0	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 418	RTU - 419	RTU - 600
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Room 418	Rooms 419/420/442	Hallways (600 Level)
Manufacturer	Carrier	Carrier	Lennox
Model #	Weathermaker I	50TM-008-A-601	LCA120HN1G
Serial #	-	3803G50858	5602L07331
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	5.0 (est)	7.5	10
Cooling Efficiency (SEER/EER)	9.0 (est)	9.8	9.7
Approx Age	15 (est)	10	9
ASHRAE Service Life	15	15	15
Remaining Life	0	5	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 3	RTU - 4	RTU - 2
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Room 507	-	Room 505
Manufacturer	Lennox	Lennox	Lennox
Model #	LCA048HN3G	LCA048HN3G	LCA048HN3G
Serial #	5602L07529	5602L07530	5602L07526
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	4	4	4
Cooling Efficiency (SEER/EER)	10.4	10.4	10.4
Approx Age	9	9	9
ASHRAE Service Life	15	15	15
Remaining Life	6	6	6
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - 1	RTU - 5	SS
Unit Type	Rooftop Unit	Rooftop Unit	Ductless Split
Qty	1	1	1
Location	Roof	Roof	Ground
Area Served	Room 506	Hallways (500 Level)	-
Manufacturer	Lennox	Lennox	Mitsubishi
Model #	LCA048HN3G	LCA120HN1G	-
Serial #	5602L07531	5602L07330	-
Cooling Type	R22, DX	R22, DX	R410a DX
Cooling Capacity (Tons)	4	10	2 (Est)
Cooling Efficiency (SEER/EER)	10.4	10	18
Approx Age	9	9	5
ASHRAE Service Life	15	15	15
Remaining Life	6	6	10
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

AC Units

Tag	RTU - Band Room	RTU	SS
Unit Type	Rooftop Unit	Rooftop Unit	Ductless Split
Qty	1	1	2
Location	Roof	Roof	Roof
Area Served	Band Room	-	-
Manufacturer	Trane	-	Fujitsu
Model #	TC0103B40ADA	DAPB-F036AB	AOU30CLX
Serial #	-	(S)NELM042232	Den 011624
Cooling Type	R22, DX	R22, DX	R410a DX
Cooling Capacity (Tons)	10	3	2.5
Cooling Efficiency (SEER/EER)	12	12	15 (Est)
Approx Age	9	9	2
ASHRAE Service Life	15	15	15
Remaining Life	6	6	13
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

Air Handling Units

Tag	HV-1	AC-1	AHU
Unit Type	Split Air Handling Unit	Split Air Handling Unit	Split Air Handling Unit
Qty	1	1	1
Location	Penthouse MER	Penthouse MER	Auditorium MER
Area Served	Hallways Ventilation	Library	Auditorium
Manufacturer	-	-	Carrier
Model #	-	-	-
Serial #	-	-	-
Cooling Type	N/A	DX	DX
Cooling Capacity (Tons)	N/A	24 (Est)	60 (Est)
Cooling Efficiency (SEER/EER)	N/A	9 EER (Est)	9 EER (Est)
Supply Fan Motor HP	7.5	5	20 (Est)
Return Fan Motor HP	N/A	N/A	7.5
CFM	-	9000 (Est)	20,000 (Est)
Heating Type	Hot Water	Hot Water	Hot Water
Heating Input (MBH)	-	-	-
Fuel	N/A	N/A	N/A
Approx Age	30	30	5
ASHRAE Service Life	15	15	15
Remaining Life	(15)	(15)	10
Comments		DX cooling with a Split AC Unit	DX cooling with a Split AC Unit

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

Air Handling Units

Tag	AHU		
Unit Type	Split Air Handling Unit		
Qty	1		
Location	Gym MER		
Area Served	Main Gymnasium		
Manufacturer	-		
Model #	-		
Serial #	-		
Cooling Type	N/A		
Cooling Capacity (Tons)	-		
Cooling Efficiency (SEER/EER)	-		
Supply Fan Motor HP	30		
Return Fan Motor HP	N/A		
CFM	30,000 (Est)		
Heating Type	Hot Water		
Heating Input (MBH)	-		
Fuel	N/A		
Approx Age	30		
ASHRAE Service Life	15		
Remaining Life	(15)		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

Boilers

Tag	Boiler - 1	Boiler - 2	Boiler - 3/4/5/6
Unit Type	Firetube Boiler	Firetube Boiler	Condensing Boiler
Qty	1	1	4
Location	Original Boiler Room	Original Boiler Room	Addition Boiler Room
Area Served	Original Building Heating Hot Water Loop	Original Building Heating Hot Water Loop	Addition Heating Hot Water Loop
Manufacturer	Cleaver Brooks	Cleaver Brooks	Aerco
Model #	CB786-300	CB786-300	Benchmark 2.0
Serial #	L-47345	L-47344	Varies
Input Capacity (Btu/Hr)	-	-	-
Rated Output Capacity (Btu/Hr)	12,554 MBH	12,554 MBH	2,000 MBH
Approx. Efficiency %	70% (est)	70% (est)	95.0%
Fuel	Natural Gas	Natural Gas	Natural Gas
Approx Age	42	42	7
ASHRAE Service Life	25	25	25
Remaining Life	(17)	(17)	18
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

Domestic Water Heaters

Tag			
Unit Type	Hot Water Boiler	Hot Water Retainer Tank	
Qty	1	2	
Location	Boiler Room	Boiler Room	
Area Served	Domestic Hot Water Heating System	Domestic Hot Water Heating System	
Manufacturer	Lochinvar	Lochinvar	
Model #	Powerfin PFN1002PM	RGA0318	
Serial #	B10H00224337	K0701-123468	
Size (Gallons)	-	300	
Input Capacity (MBH/KW)	1000	0	
Recovery (Gal/Hr)	1030	0	
Efficiency %	86%	0.00%	
Fuel	Natural Gas	0	
Approx Age	3	4	
ASHRAE Service Life	15	15	
Remaining Life	12	11	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

Pumps

Tag	P - 1/2	P - 3/4	P - 5/6
Unit Type	Base Mounted	Base Mounted	Base Mounted
Qty	2	2	2
Location	Original Boiler Room	Original Boiler Room	Original Boiler Room
Area Served	Boiler Pump	Zone Pump	Zone Pump
Manufacturer	-	Aurora	-
Model #	FD2087879	06-1333697	-
Serial #	120067	-	-
Horse Power	10	15	5
Flow	-	391 GPM @ 80ft	-
Motor Info	Marathon Electric	Dayton	Reliance
Electrical Power	230/460	230/460	230/460
RPM	3470	1770	1740
Motor Efficiency %	87% (est)	93%	82.5%
Approx Age	15 (est)	10	20
ASHRAE Service Life	20	20	20
Remaining Life	5	10	0
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Montville High School

Pumps

Tag	P - 7/8		
Unit Type	Base Mounted		
Qty	2		
Location	Addition Boiler Room		
Area Served	Boiler Pump		
Manufacturer	Taco		
Model #	-		
Serial #	-		
Horse Power	20		
Flow	-		
Motor Info	Baldor		
Electrical Power	230/460		
RPM	1760		
Motor Efficiency %	91%		
Approx Age	12		
ASHRAE Service Life	20		
Remaining Life	8		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

Investment Grade Lighting Audit

CEG Job #: 9C11044

Project: Montville Twp BOE — **Montville High School** — **KWH COST:** $0.164

100 Horseneck Rd

Montville, NJ

Bldg. Sq. Ft. 213,000

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.21	Classroom 112	2600	24	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	2.57	6,676.8	$1,093.69	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Classroom 113	2600	12	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	1.28	3,338.4	$546.85	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Classroom 111	2600	21	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	2.25	5,842.2	$956.98	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.31	Classroom 110	2600	4	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.25	644.8	$105.62	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Classroom 107	2600	21	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	2.25	5,842.2	$956.98	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.31	Classroom 107 Closet	1000	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.12	124.0	$20.31	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Classroom 105	2600	30	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	3.21	8,346.0	$1,367.12	30	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Classroom 105 Office	2600	1	1	Recessed Down Light, 90w R40 Lamp	90	0.09	234.0	$38.33	1	1	26w CFL Lamp	26	0.03	67.6	$11.07	$20.00	$20.00	0.06	166.4	$27.26	0.73
221.31	Classroom 105 Storage	1000	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.12	124.0	$20.31	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 103	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Men's Toilet Room	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.19	483.6	$79.22	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 101	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.11	Catwalk	1000	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	33	0.07	66.0	$10.81	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 100	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 101	2600	24	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.06	5,366.4	$879.04	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
558	Auditorium	2600	110	1	Recessed Down Light, 90w PAR38 Flood Lamp	90	9.90	25,740.0	$4,216.34	110	1	16w LED PAR38 Dimmable Flood Lamp	16	1.76	4576	$749.57	$115.00	$12,650.00	8.14	21164	$3,466.77	3.65
221.34	Stage	2600	18	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	1.04	2,714.4	$444.63	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
327.23	AUX GYM	2600	20	2	2x4 4 Lamp, 54w T5, Pendant Mnt. Fixture	220	4.40	11,440.0	$1,873.93	20	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.21	Locker Room Corridor	4000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.26	1,032.0	$169.05	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
745	GYM	2600	20	1	250w Pulse Start MH HiBay w/Prismatic Lens	291	5.82	15,132.0	$2,478.70	20	4	2x4, 4 Lamp, 54w T5HO, Elect. Ballast, Lo Bay	231	4.62	12012	$1,967.63	$370.00	$7,400.00	1.20	3120	$511.07	14.48
242.212	GYM	2600	10	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	1.04	2,704.0	$442.93	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	GYM	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.23	603.2	$98.81	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Room 051	2600	9	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.77	2,012.4	$329.64	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Men's Toilet Room	2600	1	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.09	223.6	$36.63	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Women's Toilet Room	2600	1	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.09	223.6	$36.63	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Girl's Locker Room	2600	26	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.61	4,191.2	$686.54	26	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
610	Girl's Locker Room - Storage	1000	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	120.0	$19.66	1	2	13w CFL Lamps	26	0.03	26	$4.26	$25.00	$25.00	0.09	94	$15.40	1.62
211.11	Girl's Locker Room - Toilet	2600	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	33	0.07	171.6	$28.11	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.11	Athletic Director	2600	6	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.62	1,622.4	$265.76	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.11	Trainers Office	2600	8	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.83	2,163.2	$354.34	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Team Room	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.69	1,788.8	$293.01	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Corridor Boy's Locker Room	4000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.26	1,032.0	$169.05	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Boy's Locker Room	2600	29	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.80	4,674.8	$765.76	29	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Room 021	2600	6	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.37	967.2	$158.43	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Room 023	2600	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	322.4	$52.81	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Coaches' Office	2600	4	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.43	1,112.8	$182.28	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
200	Coaches' Office - Toilet	2600	1	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.03	88.4	$14.48	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Coache's Office	2600	2	1	Recessed Down Light, 90w R40 Lamp	90	0.18	468.0	$76.66	2	1	26w CFL Lamp	26	0.05	135.2	$22.15	$20.00	$40.00	0.13	332.8	$54.51	0.73
221.14	Coache's Office - Locker	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.06	150.8	$24.70	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
321.37	Wrestling Room	2600	10	8	8 Lamp, 28w T5, Pendant Mnt., Fixture	58	0.58	1,508.0	$247.02	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	Wrestling Room Storage Room	1000	5	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	107	0.54	535.0	$87.64	5	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Wrestling Room Corridor	4000	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.09	344.0	$56.35	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	GYM Main Corridor	4000	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	3,440.0	$563.49	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Men's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	967.2	$158.43	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Men's Toilet Room	2600	2	1	Recessed Down Light, 90w R40 Lamp	90	0.18	468.0	$76.66	2	1	26w CFL Lamp	26	0.05	135.2	$22.15	$20.00	$40.00	0.13	332.8	$54.51	0.73
221.21	Women's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	967.2	$158.43	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Women's Toilet Room	2600	2	1	Recessed Down Light, 90w R40 Lamp	90	0.18	468.0	$76.66	2	1	26w CFL Lamp	26	0.05	135.2	$22.15	$20.00	$40.00	0.13	332.8	$54.51	0.73
211.22	Main Corridor Around Main Office	4000	15	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, cove lighting	30	0.45	1,800.0	$294.85	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Main Corridor Around Main Office	4000	78	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	4.52	18,096.0	$2,964.22	78	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
30	Main Corridor Around Main Office	4000	74	2	Recessed Down Light, (1) 26w PL Lamp	26	1.92	7,696.0	$1,260.64	74	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.22	Classroom 104	2600	16	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.93	2,412.8	$395.23	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 106	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$366.27	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 108	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Café	2600	40	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	3.44	8,944.0	$1,465.07	40	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.34	Café	2600	24	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.72	1,872.0	$306.64	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Kitchen	2600	21	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.81	4,695.6	$769.16	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Kitchen Dishwasher	2600	2	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.07	176.8	$28.96	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
284.25	Falculty Room	2600	4	8	4x4, 8 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., White Diffuser	214	0.86	2,225.6	$364.56	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Corridor 100	4000	35	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	2.17	8,680.0	$1,421.83	35	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor 100	4000	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.50	1,984.0	$324.99	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.22	Main Office	2600	25	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	1.45	3,770.0	$617.55	25	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
30	Main Office	2600	10	2	Recessed Down Light, (1) 26w PL Lamp	26	0.26	676.0	$110.73	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
710	Exterior	4000	3	1	100w HPS Wallpack	125	0.38	1,500.0	$245.71	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
610	Exterior	4000	4	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.48	1,920.0	$314.51	4	2	13w CFL Lamps	26	0.10	416	$68.14	$25.00	$100.00	0.38	1504	$246.36	0.41
730	Exterior	4000	6	1	150w MH Flood	125	0.75	3,000.0	$491.42	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
731	Exterior Parking Lights	4000	28	1	150w MH Pole Mnt., "Shoebox"	125	3.50	14,000.0	$2,293.27	28	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Boiler Room	2600	10	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.58	1,508.0	$247.02	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Electrical Room	1000	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	232.0	$38.00	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Custodial Supervisor	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	603.2	$98.81	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 419	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 417	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 416	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 415	2600	15	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.29	3,354.0	$549.40	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
267.21	Stairwell 10,4	4000	7	6	4x4, 6 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	172	1.20	4,816.0	$788.89	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.44	Custodial Closet	1000	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Wall MNt., No Lens	32	0.03	32.0	$5.24	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 413	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.33	Classroom 614	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.50	6,489.6	$1,063.03	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Prep Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.26	670.8	$109.88	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 612	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.33	Classroom 611	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.50	6,489.6	$1,063.03	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.45	Stairwell 7,6	4000	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., Indirect	58	0.23	928.0	$152.01	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
3520	Stairwell 7,6	4000	2	1	Ceiling Mount White Globe, (2) 26w CFL Lamp	125	0.25	1,000.0	$163.81	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 610	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 608	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 607	2600	20	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.72	4,472.0	$732.54	20	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 604	2600	20	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.72	4,472.0	$732.54	20	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.14	Electrical Closet	1000	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	33	0.03	33.0	$5.41	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Prep Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.26	670.8	$109.88	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.33	Classroom 603	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.50	6,489.6	$1,063.03	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 602	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Prep Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.26	670.8	$109.88	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.333	Classroom 600	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.50	6,489.6	$1,063.03	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	600 Corridor	4000	36	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	3.10	12,384.0	$2,028.56	36	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
30	600 Corridor	4000	12	2	Recessed Down Light, (1) 26w PL Lamp	26	0.31	1,248.0	$204.43	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 618	2600	7	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.60	1,565.2	$256.39	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Men's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	322.4	$52.81	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Women's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	322.4	$52.81	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
1	Center Stairwell	4000	8	1	22w Circuline Fluor.	25	0.20	800.0	$131.04	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	615 Resource	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.95	2,459.6	$402.90	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 412	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Room 403	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.52	1,341.6	$219.76	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 411	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.21	Classroom 410	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 409	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.69	1,788.8	$293.01	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 408	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 407	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$366.27	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 405	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$366.27	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 403	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$366.27	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 402	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2,236.0	$366.27	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
100	Display Case	4000	2	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.08	336.0	$55.04	2	2	Reballast & Relamp; 17w T8 Elec. Ballast	33	0.07	264	$43.24	$60.00	$120.00	0.02	72	$11.79	10.17
232.21	Classroom 401	2600	18	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.55	4,024.8	$659.28	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Men's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	967.2	$158.43	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Women's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	967.2	$158.43	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
267.21	Stairwell	4000	6	6	4x4, 6 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	172	1.03	4,128.0	$676.19	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Custodian 439	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.35	904.8	$148.21	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 420	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Office 442	2600	4	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.34	894.4	$146.51	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 421	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 422	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	400 Corridor	4000	58	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	4.99	19,952.0	$3,268.24	58	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Office 433	2600	4	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.34	894.4	$146.51	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 404	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Room 414A	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.21	Classroom 414	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.52	1,341.6	$219.76	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Room 418A	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.69	1,788.8	$293.01	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 418	2600	20	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.72	4,472.0	$732.54	20	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Room 414C	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.52	1,341.6	$219.76	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Faculy Lounge	2600	8	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.50	1,289.6	$211.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	317 Spec. Services	2600	32	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.75	7,155.2	$1,172.06	32	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 314	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 313	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 312	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 311	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 310	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Room 309	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.95	2,459.6	$402.90	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 307	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 305	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 303	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 302	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	1,934.4	$316.86	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 301	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	1,934.4	$316.86	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Men's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	967.2	$158.43	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Women's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	967.2	$158.43	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.34	Electrical Closet 342	1000	0	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.00	0.0	$0.00	0	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Resource Center	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	1,934.4	$316.86	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Classroom 304	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	1,934.4	$316.86	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 306	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	1,934.4	$316.86	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 308	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	1,934.4	$316.86	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Room 341	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.50	1,289.6	$211.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Summer Program	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	1,934.4	$316.86	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 319	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.50	1,289.6	$211.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 500	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 501	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 502	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 503	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 504	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.03	2,683.2	$439.52	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Room 518	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.52	1,341.6	$219.76	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 585	2600	15	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.29	3,354.0	$549.40	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Men's Toilet Room	2600	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.19	483.6	$79.22	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Women's Toilet Room	2600	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.19	483.6	$79.22	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 507	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 508	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.38	3,577.6	$586.03	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Classroom 513	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.52	1,341.6	$219.76	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.33	Classroom 509	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.50	6,489.6	$1,063.03	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.33	Classroom 511	2600	28	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.91	7,571.2	$1,240.20	28	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.34	Boiler Room	1000	15	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.45	450.0	$73.71	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.21	500 Corridor	4000	30	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.58	10,320.0	$1,690.47	30	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
237.21	Room 320	2600	13	3	2x2, 3 Lamp, 31w T8 Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	92	1.20	3,109.6	$509.37	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Media Center	2600	63	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	3.91	10,155.6	$1,663.54	63	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Library Classroom	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.50	1,289.6	$211.24	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Room 214	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$98.81	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Room 213	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$98.81	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Room 212	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$98.81	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Room 217	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.17	452.4	$74.11	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Ms. Massi's Office	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$98.81	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Nurse's Office	2600	8	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.46	1,206.4	$197.61	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Room 205	2600	8	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.46	1,206.4	$197.61	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Secretary to Principal	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$98.81	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		2,281	464				528,704	$86,604	2,281	15			6.8	17,767	$2,910		$20,435	10.3	27,119	$4,442	4.60

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

CEG Job #:
Project: Montville Twp BOE
Address: 100 Horseneck Rd
Montville, NJ
Building SF: 213,000

Montville High School

KWH COST: $0.164

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.21	Classroom 112	2600	24	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	2.568	6676.8	1093.6939	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	2.05	20%	5341.44	$874.96	$300.00	$300.00	0	1335.36	$218.74	1.37
242.21	Classroom 113	2600	12	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	1.284	3338.4	546.84695	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	1.03	20%	2670.72	$437.48	$300.00	$300.00	0	667.68	$109.37	2.74
242.21	Classroom 111	2600	21	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	2.247	5842.2	956.98217	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	1.80	20%	4673.76	$765.59	$300.00	$300.00	0	1168.44	$191.40	1.57
221.31	Classroom 110	2600	4	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.248	644.8	105.62153	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.20	20%	515.84	$84.50	$300.00	$300.00	0	128.96	$21.12	14.20
242.21	Classroom 107	2600	21	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	2.247	5842.2	956.98217	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	1.80	20%	4673.76	$765.59	$300.00	$300.00	0	1168.44	$191.40	1.57
221.31	Classroom 107 Closet	1000	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.124	124	20.311833	2	0	no change	62	0.12	0%	124	$20.31	$0.00	$0.00	0	0	$0.00	0.00
242.21	Classroom 105	2600	30	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	3.21	8346	1367.1174	30	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	2.57	20%	6676.8	$1,093.69	$300.00	$300.00	0	1669.2	$273.42	1.10
31	Classroom 105 Office	2600	1	1	Recessed Down Light, 90w R40 Lamp	90	0.09	234	38.330394	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	90	0.07	20%	187.2	$30.66	$150.00	$150.00	0	46.8	$7.67	19.57
221.31	Classroom 105 Storage	1000	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.124	124	20.311833	2	0	no change	62	0.12	0%	124	$20.31	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 103	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
221.21	Men's Toilet Room	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.186	483.6	79.216148	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.15	20%	386.88	$63.37	$150.00	$150.00	0	96.72	$15.84	9.47
232.21	Classroom 101	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
211.11	Catwalk	1000	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	33	0.066	66	10.811137	2	0	no change	33	0.07	0%	66	$10.81	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 100	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 101	2600	24	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.064	5366.4	879.0437	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.65	20%	4293.12	$703.23	$300.00	$300.00	0	1073.28	$175.81	1.71

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
558	Auditorium	2600	110	1	Recessed Down Light, 90w PAR38 Flood Lamp	90	9.9	25740	4216.3433	110	0	no change	90	9.90	0%	25740	$4,216.34	$0.00	$0.00	0	0	$0.00	0.00
221.34	Stage	2600	18	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	1.044	2714.4	444.63257	18	0	no change	58	1.04	0%	2714.4	$444.63	$0.00	$0.00	0	0	$0.00	0.00
327.23	AUX GYM	2600	20	2	2x4 4 Lamp, 54w T5, Pendant Mnt. Fixture	220	4.4	11440	1873.9304	20	0	no change	220	4.40	0%	11440	$1,873.93	$0.00	$0.00	0	0	$0.00	0.00
232.21	Locker Room Corridor	4000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.258	1032	169.04687	3	0	no change	86	0.26	0%	1032	$169.05	$0.00	$0.00	0	0	$0.00	0.00
745	GYM	2600	20	1	250w Pulse Start MH HiBay w/Prismatic Lens	291	5.82	15132	2478.6988	20	2	Dual Technology Occupancy Sensor - Remote Mnt.	291	4.66	20%	12105.6	$1,982.96	$300.00	$600.00	0	3026.4	$495.74	1.21
242.212	GYM	2600	10	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	1.04	2704	442.929	10	0	no change	104	1.04	0%	2704	$442.93	$0.00	$0.00	0	0	$0.00	0.00
221.14	GYM	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.232	603.2	98.807238	4	0	no change	58	0.23	0%	603.2	$98.81	$0.00	$0.00	0	0	$0.00	0.00
232.21	Room 051	2600	9	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.774	2012.4	329.64139	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.62	20%	1609.92	$263.71	$300.00	$300.00	0	402.48	$65.93	4.55
232.21	Men's Toilet Room	2600	1	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.086	223.6	36.626821	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.07	20%	178.88	$29.30	$150.00	$150.00	0	44.72	$7.33	20.48
232.21	Women's Toilet Room	2600	1	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.086	223.6	36.626821	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.07	20%	178.88	$29.30	$150.00	$150.00	0	44.72	$7.33	20.48
221.11	Girl's Locker Room	2600	26	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.612	4191.2	686.53995	26	0	no change	62	1.61	0%	4191.2	$686.54	$0.00	$0.00	0	0	$0.00	0.00
610	Girl's Locker Room - Storage	1000	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	120	19.656612	1	0	no change	120	0.12	0%	120	$19.66	$0.00	$0.00	0	0	$0.00	0.00
211.11	Girl's Locker Room - Toilet	2600	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	33	0.066	171.6	28.108956	2	0	no change	33	0.07	0%	171.6	$28.11	$0.00	$0.00	0	0	$0.00	0.00
241.11	Athletic Director	2600	6	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.624	1622.4	265.7574	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.50	20%	1297.92	$212.61	$150.00	$150.00	0	324.48	$53.15	2.82
241.11	Trainers Office	2600	8	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.832	2163.2	354.3432	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.67	20%	1730.56	$283.47	$150.00	$150.00	0	432.64	$70.87	2.12
232.21	Team Room	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.688	1788.8	293.01457	8	0	no change	86	0.69	0%	1788.8	$293.01	$0.00	$0.00	0	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.21	Corridor Boy's Locker Room	4000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.258	1032	169.04687	3	0	no change	86	0.26	0%	1032	$169.05	$0.00	$0.00	0	0	$0.00	0.00
221.11	Boy's Locker Room	2600	29	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.798	4674.8	765.75609	29	0	no change	62	1.80	0%	4674.8	$765.76	$0.00	$0.00	0	0	$0.00	0.00
221.11	Room 021	2600	6	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.372	967.2	158.4323	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.30	20%	773.76	$126.75	$150.00	$150.00	0	193.44	$31.69	4.73
221.11	Room 023	2600	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	322.4	52.810765	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$42.25	$150.00	$150.00	0	64.48	$10.56	14.20
242.21	Coaches' Office	2600	4	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.428	1112.8	182.28232	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.34	20%	890.24	$145.83	$150.00	$150.00	0	222.56	$36.46	4.11
200	Coaches' Office - Toilet	2600	1	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.034	88.4	14.480371	1	0	no change	34	0.03	0%	88.4	$14.48	$0.00	$0.00	0	0	$0.00	0.00
31	Coache's Office	2600	2	1	Recessed Down Light, 90w R40 Lamp	90	0.18	468	76.660788	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	90	0.14	20%	374.4	$61.33	$150.00	$150.00	0	93.6	$15.33	9.78
221.14	Coache's Office - Locker	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.058	150.8	24.701809	1	0	no change	58	0.06	0%	150.8	$24.70	$0.00	$0.00	0	0	$0.00	0.00
321.37	Wrestling Room	2600	10	8	8 Lamp, 28w T5, Pendant Mnt., Fixture	58	0.58	1508	247.01809	10	0	no change	58	0.58	0%	1508	$247.02	$0.00	$0.00	0	0	$0.00	0.00
221.14	Wrestling Room Storage Room	1000	5	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	107	0.535	535	87.63573	5	0	no change	107	0.54	0%	535	$87.64	$0.00	$0.00	0	0	$0.00	0.00
242.21	Wrestling Room Corridor	4000	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.086	344	56.348955	1	0	no change	86	0.09	0%	344	$56.35	$0.00	$0.00	0	0	$0.00	0.00
232.21	GYM Main Corridor	4000	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	3440	563.48955	10	0	no change	86	0.86	0%	3440	$563.49	$0.00	$0.00	0	0	$0.00	0.00
221.21	Men's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	967.2	158.4323	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.30	20%	773.76	$126.75	$150.00	$150.00	0	193.44	$31.69	4.73
31	Men's Toilet Room	2600	2	1	Recessed Down Light, 90w R40 Lamp	90	0.18	468	76.660788	2	0	no change	90	0.18	0%	468	$76.66	$0.00	$0.00	0	0	$0.00	0.00
221.21	Women's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	967.2	158.4323	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.30	20%	773.76	$126.75	$150.00	$150.00	0	193.44	$31.69	4.73
31	Women's Toilet Room	2600	2	1	Recessed Down Light, 90w R40 Lamp	90	0.18	468	76.660788	2	0	no change	90	0.18	0%	468	$76.66	$0.00	$0.00	0	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
211.22	Main Corridor Around Main Office	4000	15	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, cove lighting	30	0.45	1800	294.84918	15	0	no change	30	0.45	0%	1800	$294.85	$0.00	$0.00	0	0	$0.00	0.00
227.22	Main Corridor Around Main Office	4000	78	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	4.524	18096	2964.2171	78	0	no change	58	4.52	0%	18096	$2,964.22	$0.00	$0.00	0	0	$0.00	0.00
30	Main Corridor Around Main Office	4000	74	2	Recessed Down Light, (1) 26w PL Lamp	26	1.924	7696	1260.6441	74	0	no change	26	1.92	0%	7696	$1,260.64	$0.00	$0.00	0	0	$0.00	0.00
222.22	Classroom 104	2600	16	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.928	2412.8	395.22895	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.74	20%	1930.24	$316.18	$300.00	$300.00	0	482.56	$79.05	3.80
232.21	Classroom 106	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	366.26821	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$293.01	$300.00	$300.00	0	447.2	$73.25	4.10
232.21	Classroom 108	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Café	2600	40	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	3.44	8944	1465.0728	40	0	no change	86	3.44	0%	8944	$1,465.07	$0.00	$0.00	0	0	$0.00	0.00
211.34	Café	2600	24	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.72	1872	306.64315	24	0	no change	30	0.72	0%	1872	$306.64	$0.00	$0.00	0	0	$0.00	0.00
232.21	Kitchen	2600	21	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.806	4695.6	769.16324	21	0	no change	86	1.81	0%	4695.6	$769.16	$0.00	$0.00	0	0	$0.00	0.00
227.211	Kitchen Dishwasher	2600	2	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.068	176.8	28.960742	2	0	no change	34	0.07	0%	176.8	$28.96	$0.00	$0.00	0	0	$0.00	0.00
284.25	Falculty Room	2600	4	8	4x4, 8 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., White Diffuser	214	0.856	2225.6	364.56464	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	214	0.68	20%	1780.48	$291.65	$150.00	$150.00	0	445.12	$72.91	2.06
221.21	Corridor 100	4000	35	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	2.17	8680	1421.8283	35	0	no change	62	2.17	0%	8680	$1,421.83	$0.00	$0.00	0	0	$0.00	0.00
222.21	Corridor 100	4000	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.496	1984	324.98932	8	0	no change	62	0.50	0%	1984	$324.99	$0.00	$0.00	0	0	$0.00	0.00
227.22	Main Office	2600	25	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	1.45	3770	617.54524	25	0	no change	58	1.45	0%	3770	$617.55	$0.00	$0.00	0	0	$0.00	0.00
30	Main Office	2600	10	2	Recessed Down Light, (1) 26w PL Lamp	26	0.26	676	110.73225	10	0	no change	26	0.26	0%	676	$110.73	$0.00	$0.00	0	0	$0.00	0.00
710	Exterior	4000	3	1	100w HPS Wallpack	125	0.375	1500	245.70765	3	0	no change	125	0.38	0%	1500	$245.71	$0.00	$0.00	0	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
610	Exterior	4000	4	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.48	1920	314.5058	4	0	no change	120	0.48	0%	1920	$314.51	$0.00	$0.00	0	0	$0.00	0.00
730	Exterior	4000	6	1	150w MH Flood	125	0.75	3000	491.41531	6	0	no change	125	0.75	0%	3000	$491.42	$0.00	$0.00	0	0	$0.00	0.00
731	Exterior Parking Lights	4000	28	1	150w MH Pole Mnt., "Shoebox"	125	3.5	14000	2293.2714	28	0	no change	125	3.50	0%	14000	$2,293.27	$0.00	$0.00	0	0	$0.00	0.00
221.34	Boiler Room	2600	10	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.58	1508	247.01809	10	0	no change	58	0.58	0%	1508	$247.02	$0.00	$0.00	0	0	$0.00	0.00
221.34	Electrical Room	1000	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	232	38.002784	4	0	no change	58	0.23	0%	232	$38.00	$0.00	$0.00	0	0	$0.00	0.00
221.34	Custodial Supervisor	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	603.2	98.807238	4	0	no change	58	0.23	0%	603.2	$98.81	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 419	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 417	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 416	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 415	2600	15	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.29	3354	549.40231	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.03	20%	2683.2	$439.52	$300.00	$300.00	0	670.8	$109.88	2.73
267.21	Stairwell 10,4	4000	7	6	4x4, 6 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	172	1.204	4816	788.88537	7	0	no change	172	1.20	0%	4816	$788.89	$0.00	$0.00	0	0	$0.00	0.00
211.44	Custodial Closet	1000	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Wall MNt., No Lens	32	0.032	32	5.2417633	1	0	no change	32	0.03	0%	32	$5.24	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 413	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
241.33	Classroom 614	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.496	6489.6	1063.0296	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	2.00	20%	5191.68	$850.42	$300.00	$300.00	0	1297.92	$212.61	1.41
232.21	Prep Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.258	670.8	109.88046	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.21	20%	536.64	$87.90	$150.00	$150.00	0	134.16	$21.98	6.83
232.21	Classroom 612	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
241.33	Classroom 611	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.496	6489.6	1063.0296	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	2.00	20%	5191.68	$850.42	$300.00	$300.00	0	1297.92	$212.61	1.41
221.45	Stairwell 7,6	4000	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., Indirect	58	0.232	928	152.01114	4	0	no change	58	0.23	0%	928	$152.01	$0.00	$0.00	0	0	$0.00	0.00
3520	Stairwell 7,6	4000	2	1	Ceiling Mount White Globe, (2) 26w CFL Lamp	125	0.25	1000	163.8051	2	0	no change	125	0.25	0%	1000	$163.81	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 610	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 608	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 607	2600	20	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.72	4472	732.53642	20	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.38	20%	3577.6	$586.03	$300.00	$300.00	0	894.4	$146.51	2.05
232.21	Classroom 604	2600	20	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.72	4472	732.53642	20	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.38	20%	3577.6	$586.03	$300.00	$300.00	0	894.4	$146.51	2.05
211.14	Electrical Closet	1000	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	33	0.033	33	5.4055684	1	0	no change	33	0.03	0%	33	$5.41	$0.00	$0.00	0	0	$0.00	0.00
232.21	Prep Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.258	670.8	109.88046	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.21	20%	536.64	$87.90	$150.00	$150.00	0	134.16	$21.98	6.83
241.33	Classroom 603	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.496	6489.6	1063.0296	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	2.00	20%	5191.68	$850.42	$300.00	$300.00	0	1297.92	$212.61	1.41
232.21	Classroom 602	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Prep Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.258	670.8	109.88046	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.21	20%	536.64	$87.90	$150.00	$150.00	0	134.16	$21.98	6.83
241.333	Classroom 600	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.496	6489.6	1063.0296	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	2.00	20%	5191.68	$850.42	$300.00	$300.00	0	1297.92	$212.61	1.41
232.21	600 Corridor	4000	36	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	3.096	12384	2028.5624	36	0	no change	86	3.10	0%	12384	$2,028.56	$0.00	$0.00	0	0	$0.00	0.00
30	600 Corridor	4000	12	2	Recessed Down Light, (1) 26w PL Lamp	26	0.312	1248	204.42877	12	0	no change	26	0.31	0%	1248	$204.43	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 618	2600	7	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.602	1565.2	256.38775	7	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.48	20%	1252.16	$205.11	$300.00	$300.00	0	313.04	$51.28	5.85

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Men's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	322.4	52.810765	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$42.25	$150.00	$150.00	0	64.48	$10.56	14.20
222.21	Women's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	322.4	52.810765	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$42.25	$150.00	$150.00	0	64.48	$10.56	14.20
1	Center Stairwell	4000	8	1	22w Circuline Fluor.	25	0.2	800	131.04408	8	0	no change	25	0.20	0%	800	$131.04	$0.00	$0.00	0	0	$0.00	0.00
232.21	615 Resource	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.946	2459.6	402.89503	11	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.76	20%	1967.68	$322.32	$300.00	$300.00	0	491.92	$80.58	3.72
232.21	Classroom 412	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Room 403	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.516	1341.6	219.76093	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.41	20%	1073.28	$175.81	$150.00	$150.00	0	268.32	$43.95	3.41
232.21	Classroom 411	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 410	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 409	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.688	1788.8	293.01457	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.55	20%	1431.04	$234.41	$300.00	$300.00	0	357.76	$58.60	5.12
232.21	Classroom 408	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 407	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	366.26821	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$293.01	$300.00	$300.00	0	447.2	$73.25	4.10
232.21	Classroom 405	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	366.26821	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$293.01	$300.00	$300.00	0	447.2	$73.25	4.10
232.21	Classroom 403	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	366.26821	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$293.01	$300.00	$300.00	0	447.2	$73.25	4.10
232.21	Classroom 402	2600	10	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.86	2236	366.26821	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.69	20%	1788.8	$293.01	$300.00	$300.00	0	447.2	$73.25	4.10
100	Display Case	4000	2	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.084	336	55.038515	2	0	no change	42	0.08	0%	336	$55.04	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 401	2600	18	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.548	4024.8	659.28278	18	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.24	20%	3219.84	$527.43	$300.00	$300.00	0	804.96	$131.86	2.28

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.21	Men's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	967.2	158.4323	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.30	20%	773.76	$126.75	$150.00	$150.00	0	193.44	$31.69	4.73
221.21	Women's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	967.2	158.4323	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.30	20%	773.76	$126.75	$150.00	$150.00	0	193.44	$31.69	4.73
267.21	Stairwell	4000	6	6	4x4, 6 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	172	1.032	4128	676.18746	6	0	no change	172	1.03	0%	4128	$676.19	$0.00	$0.00	0	0	$0.00	0.00
221.34	Custodian 439	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.348	904.8	148.21086	6	0	no change	58	0.35	0%	904.8	$148.21	$0.00	$0.00	0	0	$0.00	0.00
232.21	Classroom 420	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Office 442	2600	4	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.344	894.4	146.50728	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.28	20%	715.52	$117.21	$150.00	$150.00	0	178.88	$29.30	5.12
232.21	Classroom 421	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 422	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	400 Corridor	4000	58	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	4.988	19952	3268.2394	58	0	no change	86	4.99	0%	19952	$3,268.24	$0.00	$0.00	0	0	$0.00	0.00
232.21	Office 433	2600	4	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.344	894.4	146.50728	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.28	20%	715.52	$117.21	$150.00	$150.00	0	178.88	$29.30	5.12
232.21	Classroom 404	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Room 414A	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	1.10	20%	2862.08	$468.82	$150.00	$150.00	0	715.52	$117.21	1.28
232.21	Classroom 414	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.516	1341.6	219.76093	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.41	20%	1073.28	$175.81	$300.00	$300.00	0	268.32	$43.95	6.83
232.21	Room 418A	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.688	1788.8	293.01457	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.55	20%	1431.04	$234.41	$150.00	$150.00	0	357.76	$58.60	2.56
232.21	Classroom 418	2600	20	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.72	4472	732.53642	20	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.38	20%	3577.6	$586.03	$300.00	$300.00	0	894.4	$146.51	2.05
232.21	Room 414C	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.516	1341.6	219.76093	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.41	20%	1073.28	$175.81	$150.00	$150.00	0	268.32	$43.95	3.41

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.11	Faculy Lounge	2600	8	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.496	1289.6	211.24306	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.40	20%	1031.68	$168.99	$150.00	$150.00	0	257.92	$42.25	3.55
232.21	317 Spec. Services	2600	32	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.752	7155.2	1172.0583	32	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	2.20	20%	5724.16	$937.65	$300.00	$300.00	0	1431.04	$234.41	1.28
232.21	Classroom 314	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 313	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 312	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 311	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 310	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Room 309	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.946	2459.6	402.89503	11	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.76	20%	1967.68	$322.32	$150.00	$150.00	0	491.92	$80.58	1.86
232.21	Classroom 307	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 305	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 303	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
222.21	Classroom 302	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	1934.4	316.86459	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1547.52	$253.49	$300.00	$300.00	0	386.88	$63.37	4.73
222.21	Classroom 301	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	1934.4	316.86459	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1547.52	$253.49	$300.00	$300.00	0	386.88	$63.37	4.73
221.21	Men's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	967.2	158.4323	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.30	20%	773.76	$126.75	$150.00	$150.00	0	193.44	$31.69	4.73
221.21	Women's Toilet Room	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	967.2	158.4323	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.30	20%	773.76	$126.75	$150.00	$150.00	0	193.44	$31.69	4.73
211.34	Electrical Closet 342	1000	0	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0	0	0	0	0	no change	30	0.00	0%	0	$0.00	$0.00	$0.00	0	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Resource Center	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	1934.4	316.86459	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1547.52	$253.49	$300.00	$300.00	0	386.88	$63.37	4.73
222.21	Classroom 304	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	1934.4	316.86459	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1547.52	$253.49	$300.00	$300.00	0	386.88	$63.37	4.73
222.21	Classroom 306	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	1934.4	316.86459	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1547.52	$253.49	$300.00	$300.00	0	386.88	$63.37	4.73
222.21	Classroom 308	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	1934.4	316.86459	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1547.52	$253.49	$300.00	$300.00	0	386.88	$63.37	4.73
222.21	Room 341	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.496	1289.6	211.24306	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.40	20%	1031.68	$168.99	$150.00	$150.00	0	257.92	$42.25	3.55
222.21	Summer Program	2600	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	1934.4	316.86459	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1547.52	$253.49	$300.00	$300.00	0	386.88	$63.37	4.73
222.21	Classroom 319	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.496	1289.6	211.24306	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.40	20%	1031.68	$168.99	$300.00	$300.00	0	257.92	$42.25	7.10
232.21	Classroom 500	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 501	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 502	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 503	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Classroom 504	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.032	2683.2	439.52185	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$351.62	$300.00	$300.00	0	536.64	$87.90	3.41
232.21	Room 518	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.516	1341.6	219.76093	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.41	20%	1073.28	$175.81	$150.00	$150.00	0	268.32	$43.95	3.41
232.21	Classroom 585	2600	15	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.29	3354	549.40231	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.03	20%	2683.2	$439.52	$300.00	$300.00	0	670.8	$109.88	2.73
222.21	Men's Toilet Room	2600	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.186	483.6	79.216148	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.15	20%	386.88	$63.37	$150.00	$150.00	0	96.72	$15.84	9.47
222.21	Women's Toilet Room	2600	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.186	483.6	79.216148	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.15	20%	386.88	$63.37	$150.00	$150.00	0	96.72	$15.84	9.47

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.21	Classroom 507	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 508	2600	16	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	1.376	3577.6	586.02914	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.10	20%	2862.08	$468.82	$300.00	$300.00	0	715.52	$117.21	2.56
232.21	Classroom 513	2600	6	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.516	1341.6	219.76093	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.41	20%	1073.28	$175.81	$300.00	$300.00	0	268.32	$43.95	6.83
241.33	Classroom 509	2600	24	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.496	6489.6	1063.0296	24	0	no change	104	2.50	0%	6489.6	$1,063.03	$0.00	$0.00	0	0	$0.00	0.00
241.33	Classroom 511	2600	28	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	2.912	7571.2	1240.2012	28	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	2.33	20%	6056.96	$992.16	$300.00	$300.00	0	1514.24	$248.04	1.21
211.34	Boiler Room	1000	15	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.45	450	73.712296	15	0	no change	30	0.45	0%	450	$73.71	$0.00	$0.00	0	0	$0.00	0.00
232.21	500 Corridor	4000	30	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.58	10320	1690.4687	30	0	no change	86	2.58	0%	10320	$1,690.47	$0.00	$0.00	0	0	$0.00	0.00
237.21	Room 320	2600	13	3	2x2, 3 Lamp, 31w T8 Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	92	1.196	3109.6	509.36835	13	1	Dual Technology Occupancy Sensor - Switch Mnt.	92	0.96	20%	2487.68	$407.49	$150.00	$150.00	0	621.92	$101.87	1.47
222.21	Media Center	2600	63	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	3.906	10155.6	1663.5391	63	0	no change	62	3.91	0%	10155.6	$1,663.54	$0.00	$0.00	0	0	$0.00	0.00
222.21	Library Classroom	2600	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.496	1289.6	211.24306	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.40	20%	1031.68	$168.99	$300.00	$300.00	0	257.92	$42.25	7.10
227.22	Room 214	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	98.807238	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.19	20%	482.56	$79.05	$150.00	$150.00	0	120.64	$19.76	7.59
227.22	Room 213	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	98.807238	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.19	20%	482.56	$79.05	$150.00	$150.00	0	120.64	$19.76	7.59
227.22	Room 212	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	98.807238	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.19	20%	482.56	$79.05	$150.00	$150.00	0	120.64	$19.76	7.59
227.22	Room 217	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.174	452.4	74.105428	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.14	20%	361.92	$59.28	$150.00	$150.00	0	90.48	$14.82	10.12
227.22	Ms. Massi's Office	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	98.807238	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.19	20%	482.56	$79.05	$150.00	$150.00	0	120.64	$19.76	7.59
227.22	Nurse's Office	2600	8	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.464	1206.4	197.61448	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.37	20%	965.12	$158.09	$150.00	$150.00	0	241.28	$39.52	3.80

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.22	Room 205	2600	8	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.464	1206.4	197.61448	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.37	20%	965.12	$158.09	$150.00	$150.00	0	241.28	$39.52	3.80
227.22	Secretary to Principal	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	98.807238	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.19	20%	482.56	$79.05	$150.00	$150.00	0	120.64	$19.76	7.59
	Totals		2,281	464			188.2	528,703.6	$86,604	2,281	120			164.3		466,694.6	$76,446.96		$29,550	0	62,009	$10,157	2.91

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Montville High School	55,000	SHARP NU-U235F2	2470	17.5	43,326	580.45	670,738	420.2	103,493	13.40

Proposed PV Layout

Notes:

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

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	580.5 kW
DC to AC Derate Factor:	0.810
AC Rating:	470.2 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.0 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.39	34826	5223.90
2	3.17	42220	6333.00
3	4.07	59090	8863.50
4	4.83	65467	9820.05
5	5.70	77889	11683.35
6	5.94	76111	11416.65
7	5.77	75519	11327.85
8	5.38	69947	10492.05
9	4.65	60181	9027.15
10	3.61	49539	7430.85
11	2.35	31598	4739.70
12	2.01	28351	4252.65
Year	4.16	670738	100610.70

Project Name: **Montville BOE**
Location: **Montville High School**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$3,592,794
Annual kWh Production	670,738
Annual Energy Cost Reduction	$111,343
Average Annual SREC Revenue	$137,057

Simple Payback: **14.46** Years

Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.166**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.204

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$0	0	0	0	$0	0	0	0	0
1	$0	670,738	$111,343	$0	$201,221	$211,422	$152,394	($51,253)	($51,253)
2	$0	667,384	$114,683	$0	$200,215	$202,023	$161,794	($48,918)	($100,171)
3	$0	664,047	$118,123	$0	$166,012	$192,044	$171,773	($79,681)	($179,852)
4	$0	660,727	$121,667	$0	$165,182	$181,449	$182,367	($76,968)	($256,820)
5	$0	657,424	$125,317	$6,771	$131,485	$170,201	$193,615	($113,786)	($370,606)
6	$0	654,136	$129,076	$6,738	$130,827	$158,259	$205,557	($110,650)	($481,257)
7	$0	650,866	$132,949	$6,704	$130,173	$145,581	$218,236	($107,398)	($588,655)
8	$0	647,611	$136,937	$6,670	$129,522	$132,121	$231,696	($104,027)	($692,683)
9	$0	644,373	$141,045	$6,637	$128,875	$117,830	$245,986	($100,534)	($793,216)
10	$0	641,151	$145,277	$6,604	$128,230	$102,658	$261,158	($96,913)	($890,130)
11	$0	637,946	$149,635	$6,571	$95,692	$86,551	$277,266	($125,060)	($1,015,190)
12	$0	634,756	$154,124	$6,538	$95,213	$69,449	$294,367	($121,017)	($1,136,207)
13	$0	631,582	$158,748	$6,505	$94,737	$51,294	$312,523	($116,837)	($1,253,044)
14	$0	628,424	$163,510	$6,473	$94,264	$32,018	$331,799	($112,515)	($1,365,559)
15	$0	625,282	$168,416	$6,440	$93,792	$11,553	$352,263	($108,049)	($1,473,608)
	Totals:	9,716,449	$2,070,850	$72,652	$1,985,441	$1,864,453	$3,592,794	($1,473,608)	($10,648,251)

Net Present Value (NPV) **($1,079,378)**

Cold Drink and Snack Vending Machine Energy Conservation Project

Energy Analysis Prepared For:

Your company name here
Questions? Call 877-766-5412
www.VendingMiserStore.com

Input Variables	
Energy Costs ($0.000 per kwh)	$0.166
Facility Occupied Hours per Week	80
Number of Cold Drink Vending Machines	3
Number of Uncooled Snack Machines	2
Power Requirements of Cold Drink Machine (avg watts)	427
Power Requirements of Snack Machine (avg watts)	100
VendingMiser Sale Price (for cold drink machines)	$179.00
OfficeMiser Sale Price (for snack machines)	$79.00

Savings Analysis

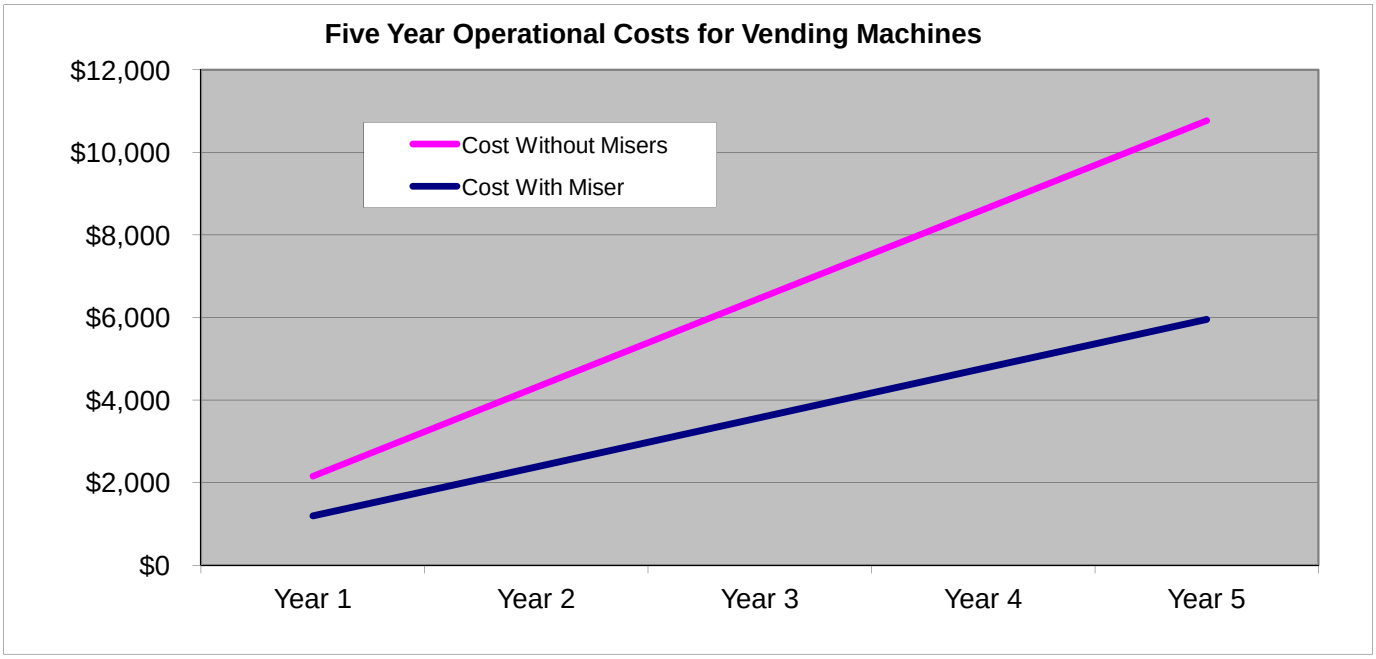
	Before	After	
Cold Drink Machines	$1,864.05	$1,053.16	Cost of Operation
	11,229	6,344	kWh
		44%	% Energy Savings
Snack Machines	$290.04	$138.11	Cost of Operation
	1,747	832	kWh
		52%	% Energy Savings

Project Summary

Present kWh	Projected kWh	kWh Savings per Year
12,976	7,176	5,800

Present Cost	Projected Costs	Annual Savings	Per Cent Savings	Total Project Cost	Break Even (Months)
$2,154.09	$1,191.28	$962.81	45%	$695.00	8.7

Five Year Savings on 5 Machines = $4,814.07
Five Year Return on Investment = 593%



MONTVILLE TOWNSHIP
BOARD OF EDUCATION

ROBERT R. LAZAR MIDDLE SCHOOL

123 CHANGEBRIDGE ROAD
MONTVILLE, NJ 0704

FACILITY ENERGY REPORT

TABLE OF CONTENTS

I. HISTORIC ENERGY CONSUMPTION/COST 2

II. FACILITY DESCRIPTION 7

III. MAJOR EQUIPMENT LIST 10

IV. ENERGY CONSERVATION MEASURES 11

V. ADDITIONAL RECOMMENDATIONS 52

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start® Program Incentives

Appendix C – Portfolio Manager "Statement of Energy Performance"

Appendix D – Major Equipment List

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

I. HISTORIC ENERGY CONSUMPTION/COST

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.

Electric Utility Provider:	Jersey Central Power and Light (JCP&L)
Electric Utility Rate Structure:	General Service Secondary Three-Phase
Third Party Supplier:	None

Natural Gas Utility Provider:	New Jersey Natural Gas
Utility Rate Structure:	General Service Large (GSL)
Third Party Supplier:	Amerada HESS

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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

Description	Average
Electricity	18.1¢ / kWh
Natural Gas	$1.18 / Therm

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY			
Utility Provider:	Jersey Central Power & Light		
Rate:	GSS / GSS / GSS / GSS Secondary 3 Phase		
Meter No:	A87364167 / A87364132 / G28030907 / G16650082		
Account #	-		
Third Party Utility Provider:	N/A		
TPS Meter / Acct No:	N/A		
MONTH OF USE	**CONSUMPTION KWH**	**DEMAND KW**	**TOTAL BILL**
Aug-10	78,965	268.0	$14,056
Sep-10	82,691	338.0	$15,249
Oct-10	92,043	304.0	$15,835
Nov-10	88,130	265.0	$15,028
Dec-10	91,689	257.0	$15,360
Jan-11	98,595	255.0	$16,311
Feb-11	72,028	258.0	$12,469
Mar-11	87,344	255.0	$13,906
Apr-11	82,841	276.0	$13,249
May-11	67,948	273.0	$11,228
Jun-11	35,061	337.0	$18,280
Jul-11	90,515	255.0	$14,083
Totals	**967,850**	**338.0 Max**	**$175,054**
	AVERAGE DEMAND	**278.4 KW average**	
	AVERAGE RATE	**$0.181 $/kWh**	

Figure 1
Electricity Usage Profile
Lazar Middle School
August - 10 through July - 11

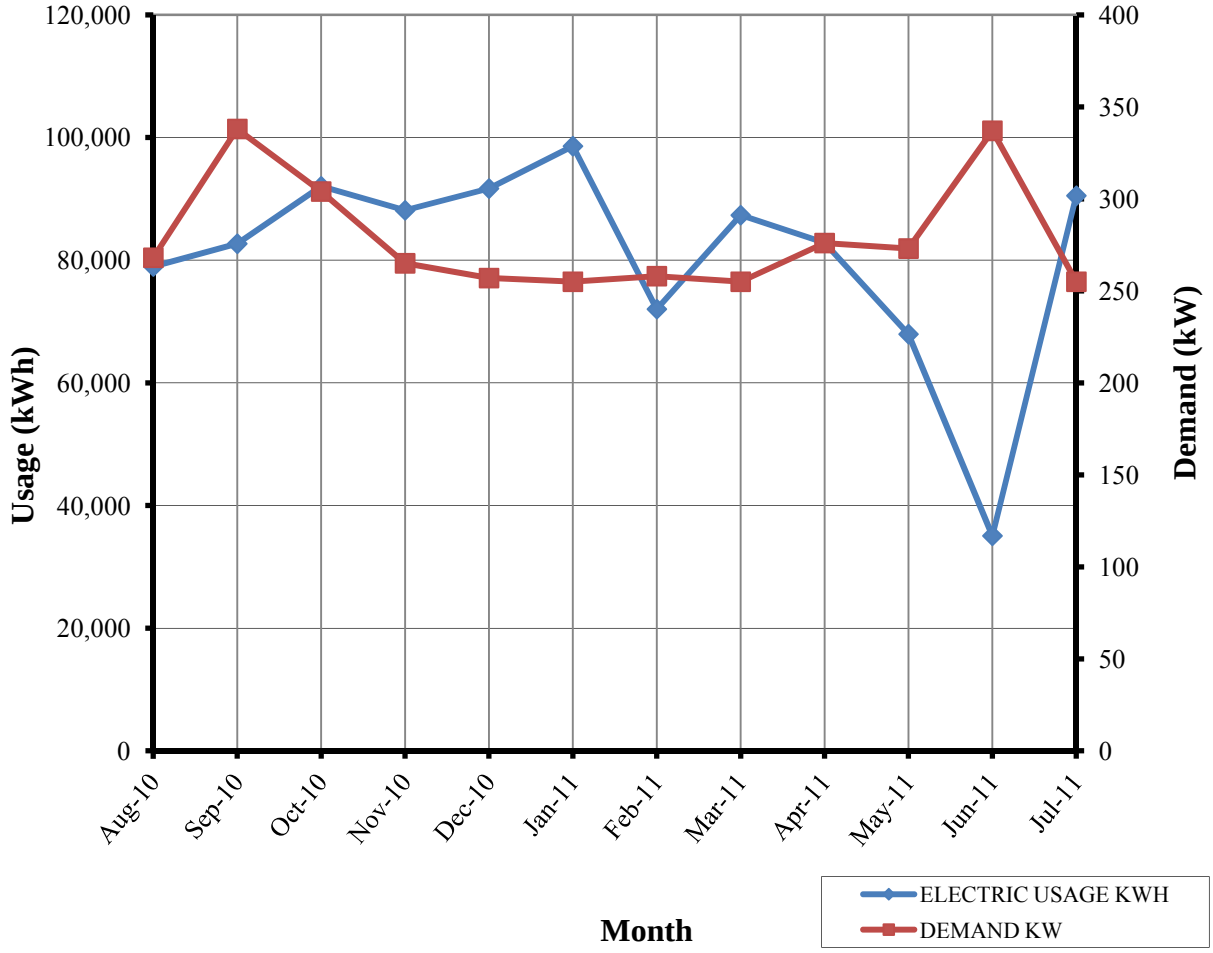
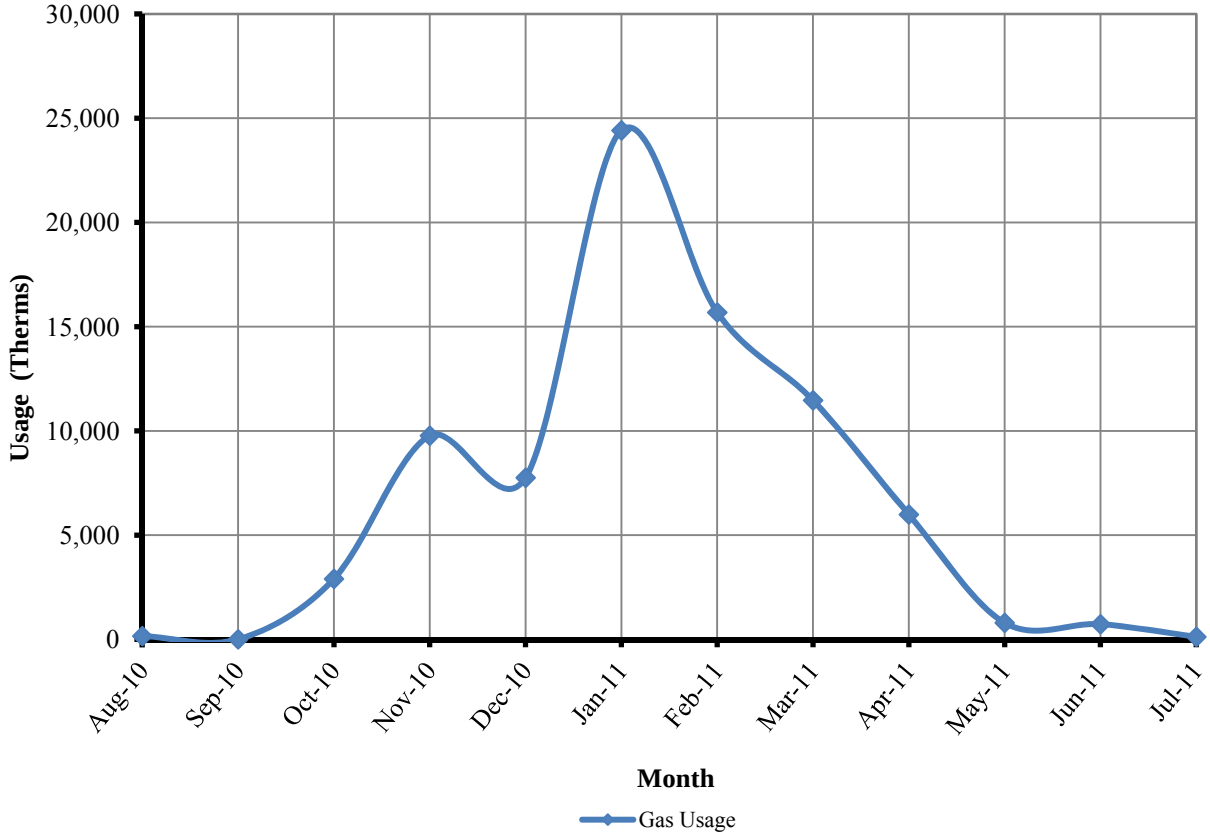


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: NJ Natural Gas		
Rate: GSL / GSS		
Meter No: 00851435 / 00629315		
Point of Delivery ID: 04-1219-2155-1Y / 04-1219-4465-11		
Third Party Utility Provider: Amerada Hess		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Aug-10	161.00	$1,017.60
Sep-10	6.00	$1,076.00
Oct-10	2,904.00	$3,954.00
Nov-10	9,772.00	$10,990.00
Dec-10	7,755.00	$9,072.00
Jan-11	24,414.00	$26,290.00
Feb-11	15,685.00	$17,255.00
Mar-11	11,468.00	$12,902.00
Apr-11	5,992.00	$7,255.00
May-11	798.00	$1,870.00
Jun-11	730.00	$1,088.00
Jul-11	125.00	$1,165.00
TOTALS	**79,810.00**	**$93,934.60**
AVERAGE RATE:	**$1.18**	**$/THERM**

Figure 2
Natural Gas Usage Profile
Lazar Middle School
August - 10 through July - 11



II. FACILITY DESCRIPTION

The 114,000 SF Middle School is a single story facility comprised of classrooms, media center, cafeteria, kitchen, gymnasium, administration office, restrooms, boiler rooms, and storage closets. The School was built in 1950 with several renovations in the 1970s and a major addition in 2000. The addition consists primarily of classrooms and science laboratories for the 8th grade.

Building Profile

The school hours are between 8:30 AM and 3:40 PM on the weekdays. The teachers start arriving several hours before the classes. The school remains open till 6:00 PM in the evening for after school activities. The gymnasium, cafeteria and library are used after hours for sports and other events during the weekdays and weekends.

The student enrollment at the Montville Middle School is approximately 960. Estimated total number of staff is 125.

Building Envelope

The facility exterior consists of block construction with brick façade. Insulation within the original building is estimated to consist of an air space. The roof consists of a flat built up style roof with an estimated 1 inch rigid insulation below the tar and light gravel covering. Majority of the HVAC equipment is installed on the roof.

Windows throughout the facility consists of double pane windows with aluminum frames. The windows are in good condition.

HVAC Systems

Heating is provided by two central hot water heating systems. The original building boiler room provides heat for the majority of the school's heating equipments with the exception of the 8th grade wing, which was added in 2000. The new boiler plant services the 8th grade wing terminal and rooftop equipments.

The original boiler plant is comprised of two boilers in two adjacent boiler rooms. First boiler is an H.B. Smith cast iron boiler with an input capacity of 4,718 MBH. The boiler was installed in 1990 and appears to be in fair condition. The H.B. Smith boiler is fitted with a constant speed PowerFlame burner. The second boiler is a Cleaver Brooks CB Series boiler installed in 1982 with an input capacity of 5,230 MBH. The CB boiler is fitted with an original CB burner with ¼ turn down ratio. These boilers provide heating hot water to baseboards, unit ventilators, heating and ventilation units and packaged rooftop heating and air conditioning units throughout the school. The boilers utilize a total of eight (8) constant speed end suction pumps serving four (4) heating zones. The pumps are driven with 1.5, 2, 3 and 5 Horse power standard efficiency motors. The end suction pumps are in good to fair condition. Some of the motors driving the pumps are old and inefficient compared to current motor efficiency standards.

The newer boiler room is comprised of two (2) condensing boilers made by Aerco. Each boiler has an input capacity of 2,000 MBH. The boiler water is circulated through the building by two

end suction constant speed pumps driven by 7.5 HP standard efficiency motors. The new boilers and equipment within the new boiler plant were installed in 2000 and they are in excellent condition.

Terminal heating equipment consists of unit ventilators made by Nesbitt in combination with hydronic baseboard heat. These units serve the classrooms throughout the original section of the school. The unit ventilators in the original portion appear to be in poor condition. The unit ventilators are controlled by the building pneumatic system. Majority of the unit ventilator controls are not functioning correctly due to leaks in the system or failure of the control valves and dampers resulting in lack of temperature control. As a result of these issues, nearly all the classrooms as well as the other spaces with original unit ventilators have windows open in the winter to maintain comfortable temperatures. It is strongly recommended to correct the temperature control issues in these spaces in order to reduce tremendous amount of energy wasted throughout the heating season.

The newer classrooms in the 8th grade section utilize unit ventilators made by Trane. Each classroom has a dedicated unit ventilator with hot water heating coils and direct expansion cooling coils. The unit ventilators are coupled with 3.5 ton Trane split condensing units. Heat is provided by hot water heating coils fed from the new boiler plant. New Trane units are in good condition and appear to be maintained well.

In addition to the unit ventilators, several spaces utilize packaged rooftop heating and air conditioning units. The packaged units provide heat and air conditioning for various spaces such as; main office, cafeteria, guidance room, gymnasium, library, computer lab, teacher's room and assistant principal's room. In addition, the classrooms #60-65 are conditioned with two (2) Trane packaged rooftop units. The majority of the packaged rooftop units are constant volume units made by Trane. The units range from new and excellent condition to old and poor condition. The units are equipped with supply fans with standard efficiency motors. The majority of the units over 5 ton capacity have built-in 100% outside air economizer functionality.

The make-up air for the kitchen and the science lab is provided with two (2) make up air units made by Reznor. The make-up air units are equipped with heating coils only.

Kitchen and Cafeteria

The Lazar Middle School houses a full service kitchen and cafeteria. The kitchen prepares full meals for the students of the School. The kitchen operates between the hours of 5:30AM and 2:30 PM.

The kitchen houses one (1) walk-in refrigerator and several free standing commercial refrigerators and freezers. The walk-in units and the condensing units are in good condition. The school has two (2) refrigerated wending machines, which operate year round.

Exhaust System

The air is exhausted from the classrooms, hallways and corridors via dedicated exhaust fans located on the roof. The toilet rooms have dedicated roof exhausters as well. The kitchen

includes a 4' x 14' commercial exhaust hood, which provides exhaust for cooking equipment. A separate exhaust hood is interlocked with the dishwasher. The main kitchen hood is manually controlled with a wall switch.

HVAC System Controls

The HVAC systems in this facility are controlled via a variety of control systems and equipment. The new section (8th grade classrooms) unit ventilators, the split condensers and the boilers are controlled via a DDC Building Management System (BMS) made by Honeywell. The BMS provides control over the equipment and consists of scheduling, temperature sensors, equipment start stop controls, supply water temperature reset etc. Each classroom is equipped with a thermostat with limited override capability. The digital control system appears to be providing adequate control for conditioning of the building and occupant comfort. The BMS currently does not have optimal start/stop controls.

The rooftop air conditioning units serving the newly fitted out rooms #60-65 are controlled via a separate Building Management System made by TAC. The TAC system is accessed through a control panel in one of the utility closets within this section of the building.

The rooftop air conditioning units serving the Media Center, rooms 138-139, 14 and 19 are controlled via digital programmable thermostats.

The unit ventilators in the original building as well as the older heating and ventilation units serving the gym and the cafeteria are controlled via the original pneumatic control system. The old and outdated pneumatic controllers and actuators for the unit ventilators are deteriorated therefore do not function properly. The lack of proper controls results in severe overheating of the spaces. It was noticed that almost all the classroom windows were open during the energy audit. It is strongly recommended to upgrade the old and outdated pneumatic controls to a state of the art DDC control system to restore comfort conditions in the classrooms and increase energy efficiency.

Domestic Hot Water

Domestic hot water for the facility is provided with two (2) 65 gallon, 360 MBH hot water heaters. The hot water heaters are made by Rheem and appear to be in good condition. The domestic hot water is distributed throughout the facility with a small circulator. The hot water heater, piping, and insulation are in good condition.

Lighting

Typical lighting throughout the building is fluorescent tube fixtures with 800 series T8 lamps and electronic ballasts. There are a number of fixtures with older T12 lamps and magnetic ballasts. Several spaces use incandescent lamps in recessed or pendant fixtures and can be easily upgraded. The gymnasium uses 250W metal halide lamps with electronic ballasts. A space by space breakdown of the lighting throughout the facility is provided in the **Investment Grade Lighting Appendix**.

III. 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.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 3
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Equipment Upgrade	$14,720	$2,980	4.9	204%
ECM #2	Lighting Controls Upgrade	$22,665	$7,350	3.1	386%
ECM #3	Gymnasium Lighting Equipment and Controls	$9,490	$1,557	6	146%
ECM #4	Automatic Computer Stand-by / Hibernate	$458	$1,537	0.3	3252%
ECM #5	Unit Ventilator with Energy Recovery	$350,000	$12,704	28	-46%
ECM #6	Install High Efficiency Condensing Boilers	$377,250	$14,794	25	18%
ECM #7	Nema Premium Efficiency Motors	$9,890	$359	28	-46%
ECM #8	AC Unit Upgrades	$344,222	$11,747	29	-49%
ECM #9	CRT Monitor Upgrades	$5,500	$920	6.0	151%
ECM #10	Domestic Hot Water Heating System Upgrade	$25,802	$1,841	14	7%
ECM #11	Central DDC Control System Upgrade	$200,000	$16,333	12	22.5%
ECM #12	Water Efficiency	$95,134	$3,537	27	-44%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	301 KW Solar System	$1,844,044	$133,939	13.8	9.0%

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

Table 4
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Equipment Upgrade	6.2	15,812	-
ECM #2	Lighting Controls Upgrade	-	40,606	-
ECM #3	Gymnasium Lighting Equipment and Controls	1.7	8,605	-
ECM #4	Automatic Computer Stand-by / Hibernate	-	8,489	-
ECM #5	Unit Ventilator with Energy Recovery	-	7,327	9,642
ECM #6	Install High Efficiency Condensing Boilers	-	-	12,538
ECM #7	Nema Premium Efficiency Motors	1.1	2,160	-
ECM #8	AC Unit Upgrades	81	64,899	-
ECM #9	CRT Monitor Upgrades	-	5,082	-
ECM #10	Domestic Hot Water Heating System Upgrade	-	-	1,560
ECM #11	Central DDC Control System Upgrade	-	48,393	7,981
ECM #12	Water Efficiency	-	-	728
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	301 KW Solar System	243	347,589	-

Table 5
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Equipment Upgrade	$2,980	$16,740	$2,020	$14,720	4.9
Lighting Controls Upgrade	$7,350	$25,200	$2,535	$22,665	3.1
Gymnasium Lighting Equipment and Controls	$1,557	$10,960	$1,470	$9,490	6.1
Automatic Computer Stand-by / Hibernate	$1,537	$458	$0	$458	0.3
~~Unit Ventilator with Energy Recovery~~	~~$12,704~~	~~$350,000~~	~~$0~~	~~$350,000~~	~~27.6~~
~~Install High Efficiency Condensing Boilers~~	~~$14,794~~	~~$386,250~~	~~$9,000~~	~~$377,250~~	~~25.5~~
Nema Premium Efficiency Motors	$359	$10,250	$360	$9,890	27.6
~~AC Unit Upgrades~~	~~$11,747~~	~~$360,858~~	~~$16,636~~	~~$344,222~~	~~29.3~~
CRT Monitor Upgrades	$920	$5,500	$0	$5,500	6.0
Domestic Hot Water Heating System Upgrade	$1,841	$27,000	$1,198	$25,802	14.0
Central DDC Control System Upgrade	$16,333	$200,000	$0	$200,000	12.2
~~Water Efficiency~~	~~$3,537~~	~~$95,134~~	~~$0~~	~~$95,134~~	~~26.9~~
Design / Construction Extras (15%)	$0	$41,012	$0	$41,012	
Total Project	**$32,876**	**$337,120**	**$7,583**	**$329,537**	**10.0**

ECMs with strikethrough font are not included in total

Design / Construction Extras is shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Lighting Equipment Upgrade

Description:

Typical lighting throughout the building is fluorescent tube fixtures with 800 series T8 lamps and electronic ballasts. There are a number of older and outdated fixtures with T12 lamps and magnetic ballasts. It is recommended to replace all of the T12 fixtures in these areas with higher efficiency fluorescent T8 fixtures with electronic ballasts.

This ECM includes re-lamping of the existing fluorescent fixtures with 800 series 28W T8 lamps. The new, energy efficient fixtures with supersaver T8 lamps will provide adequate lighting and will save on electrical costs due to better performance of the lamp and ballasts. This ECM also includes maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need approximately 33% less lamps replaced per year for each one for one fixture replaced.

The ECM also includes replacement of any incandescent lamps with compact fluorescent lamps. 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 energy usage of an incandescent lamp compared to a compact fluorescent lamp 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:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

Rebates and Incentives:

NJ Smart Start® Program Incentives are calculated using the **Smart Start® Incentive Appendix** as follows:

Retrofit of T12 fixtures to T5 or T8 with electric ballasts	$10 per fixture (1-4 lamp retrofits)

$$\text{Smart Start® Incentive} = (\#\ \text{of fixtures} \times \$10) = 202 \times \$10 = \$2020$$

Replacement and Maintenance Savings:

Replacement and Maintenance Savings are calculated as follows:

Savings = (Reduction in lamps replaced/year) x (Replacement $/lamp + Labor $/lamp)

Savings = 16.81 x ($2/lamp + $5/lamp) = 118

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$16,740
NJ Smart Start Equipment Incentive ($):	$2,020
Net Installation Cost ($):	$14,720
Maintenance Savings ($/Yr):	$118
Energy Savings ($/Yr):	$2,862
Total Yearly Savings ($/Yr):	$2,980
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.9
Simple Lifetime ROI	203.6%
Simple Lifetime Maintenance Savings	$1,765
Simple Lifetime Savings	$44,694
Internal Rate of Return (IRR)	19%
Net Present Value (NPV)	$20,850

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

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

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

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

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

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

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

Energy Savings Calculations:

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

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

Total number of rooms to be retrofitted is 97. Remote mounted sensors are to be used in 66 rooms and switch mounted sensors are to be used in 31 rooms. The total cost to install sensors is $24,600.

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

Occupancy Sensor Switch Mounted = $20 per sensor
Occupancy Sensor Remote Mounted = $35 per sensor

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$25,200
NJ Smart Start Equipment Incentive ($):	$2,535
Net Installation Cost ($):	$22,665
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$7,350
Total Yearly Savings ($/Yr):	$7,350
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.1
Simple Lifetime ROI	386%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$110,245
Internal Rate of Return (IRR)	32%
Net Present Value (NPV)	$65,075

ECM #3: Gymnasium Lighting Equipment and Controls Upgrade

Description:

The Gymnasium at Lazar Middle School utilizes 250W metal halide fixtures for its lighting. Metal halide bulbs provide a reasonably efficient option for bay lighting however a few drawbacks that are common. Metal halide fixtures often have poor overall efficacy which limits the amount of light actually leaving the fixture. Also metal halide bulbs require a significant warm-up period and even longer cool down period eliminating the potential for occupancy sensors frequent switching. This symptom encourages the gymnasium lighting to be left on continuously during the day. Another drawback is the reduced lumen output (Lumen Maintenance) of the metal halide bulb over its life time. Average bulb output or "mean lumens," is approximately 25% less than the bulb's initial lumens for typical metal halide lamps. In addition the most rapid rate of light output decline is during the beginning of its life, approximately 15-20% light loss within the first 20% of its rated life. It is important to note that the light loss has no savings in energy used; therefore the overall light efficiency is continuously decreasing with age. The final drawback is the light quality or Color Rendering Index (CRI). Typical values for metal halide bulbs is 65, which is a measure of how close the light is to true "full spectrum" light produced by sunlight or incandescent lighting. Metal halide bulbs also show noticeable color shifting when the bulb is reaching the end of its life. Utilizing fluorescent fixtures in low and high bay spaces is a superior option over metal halide fixtures in all areas described above. Although metal halide fixtures provide light very efficiently at the start of the bulb life, the average efficiency over the life is below that of fluorescent fixtures.

This ECM includes replacement of each of the existing gymnasium high bay metal halide light fixtures with T5HO fixtures with reflective lenses. The retrofit for the metal halide fixtures includes a one for one fixture replacement. The fluorescent fixtures selected will provide equivalent light compared to the average light output of the existing metal halide fixtures. The bulb replacement cost for T-5 HO lamps compared to the existing metal halide lamps were found to be approximately equal and therefore not included in the savings calculations.

This ECM also includes installation of occupancy sensors for the proposed fluorescent gymnasium light fixtures. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives

Metal Halide Fixtures

From the **Smart Start Incentive Appendix**, the following incentives are warranted:
For replacement of HID (250-399W) with new T-5 or T-8 fixtures = $50/Fixture

$$\text{Smart Start ® Incentive} = (\#\text{ of Metal Halide Fixture Replaced} \times \$50)$$

$$\text{Smart Start ® Incentive} = (28 \times \$50) = \$1{,}400$$

Occupancy Sensors

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

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

$$\text{Smart Start ® Incentive} = (2 \times \$35) = \$70$$

There is no significant replacement or maintenance savings generated with this ECM.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,960
NJ Smart Start Equipment Incentive ($):	$1,470
Net Installation Cost ($):	$9,490
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,557
Total Yearly Savings ($/Yr):	$1,557
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.1
Simple Lifetime ROI	146%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$23,362
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$9,103

ECM #4: Set Computers to Automatic Stand-by or Hibernate Modes

Description:

During the survey, it was noticed that the majority of the computers were left at ON position with the monitors at Screen Saver or OFF positions. According to interviews with some of the personnel, the computers require significant amount of time to boot up therefore they are typically left ON.

Many personal computers (PC) came equipped with automatic Stand-by or Hibernate (power down) features. Normally computers boot up from Stand-by or Hibernate modes much faster than powering up from Shut Down position.

Based on an independent study by the U.S. Department of Energy, Energy star® rated computers use approximately 70% less power during Stand-by Mode. It is recommended to set up the PCs at this facility to switch into Stand-by Mode after a short period of inactivity and Hibernate mode after a long period of inactivity.

This ECM includes configuring the computers in the classrooms and the library such that they automatically:

- Stand-by after 15 minutes of inactivity
- Hibernate after 60 minutes of inactivity

The inactivity times above can be adjusted based on experience or preference. Even though this ECM can be implemented easily in house, the calculations assume an independent computer technician performing the task at a typical market rate.

Energy Savings Calculations:

No. of CRT Monitors:	55
Operating Weeks per Yr:	42
Estimated percentage of computers left ON over night:	75%

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

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

The cost of configuring the computers to automatically sleep or hibernate is based on 10 minutes per computer per technician at an hourly rate indicated below.

Implementation Costs: = # Computers X Configuration Time X Cost per Hour
= 55 Monitors X 10 Minutes/Computer X $100 per Hour

= $458

AUTOMATIC SLEEP OR HIBERNATE MODES FOR COMPUTERS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Manual Operation	Auto Power Save	-
# of Computers	55	55	-
% Computers left ON	75%	75%	-
Power when left ON (Watt)	50	50	-
Power at Stand-by (Watt)	5	5	-
Power at Hibernate (Watt)	4	4	-
Power when OFF (Watt)	0	0	-
Operating Weeks per Yr	42	42	-
Operating Hours per Week	168	168	-
Hours/Wk Computers ON	120	20	-
Hours/Wk at Sleep Mode	0	20	-
Hours/Wk at Hibernate Mode	0	80	-
Hours/Wk at Power Down	48	48	-
Elec Cost ($/kWh)	0.181	0.181	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	10,395	1,906	8,489
Energy Cost ($)	$1,881	$345	$1,537
COMMENTS:	Calculation assumes computers currently run throughout work week and get shut down over the weekend.		

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$458
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$458
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,537
Total Yearly Savings ($/Yr):	$1,537
Estimated ECM Lifetime (Yr):	10
Simple Payback	0.3
Simple Lifetime ROI	3252.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$15,366
Internal Rate of Return (IRR)	335%
Net Present Value (NPV)	$12,648.79

ECM #5: Install Unit Ventilators with Energy Recovery

Description:

The heating and air conditioning for the classrooms in the original section of the School are provided by Nesbitt unit ventilators, which are original to the building. The unit ventilators are over 30 years old and far beyond the end of expected useful service life, which is fifteen (15) years per ASHRAE.

The estimated total number of older unit ventilators in this facility is 34. The units are heating only and controlled with pneumatic controllers and actuators. It is recommended to replace older unit ventilators with modern unit ventilators with energy recovery wheels. The advantage of this setup is the utilization of the energy recovery system to recover the energy in the exhaust air in order to reduce the heating and cooling demand of the classrooms.

This ECM replaces existing older unit ventilators with new unit ventilators with hot water heating coils and built-in energy recovery wheels. The basis for this ECM is Trane HUVC series unit ventilator with corresponding Energy Recovery ventilators. The ECM also includes attaching the unit ventilator controls to the Building Energy Management System to achieve superior scheduling and controls.

Energy Savings Calculations:

The energy savings calculations are based reduction of the outside air heating, reduction of the overheating and infiltration due to opening of the windows and temperature setback during nights and weekends.

Nominal recovery capacity of the proposed unit is calculated based on typical outside air percentage, heating degree days and design day temperature difference. Total energy recovery of each unit at heating modes is calculated using heating degree days:

$$\text{Heating Energy Recovered}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Recovery Rate}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}\left(\text{Day }^{\circ}\text{F}\right)\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(^{\circ}\text{F}\right)\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\left(\%\right)}$$

Amount of addition infiltration at each classroom due to open windows:

$$\text{Infiltration}\left(\text{BTU/Hr}\right)=\frac{\text{Ave Classroom Size (SF)}\times 10'\text{ Ceiling}\times\frac{\text{\# Air Changes}}{\text{Hr}}}{\frac{\text{60 Minutes}}{\text{Hr}}}\times 1.08\times 65°\text{F}$$

$$\text{Infiltration Energy}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Infiltration}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}\left(\text{Day }°\text{F}\right)\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(°\text{F}\right)\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency }\left(\%\right)}$$

Fan Energy Cost:

$$\text{Fan Energy, kWh}=\frac{\text{Fan Power (HP)}\times\frac{0.746\text{kW}}{\text{HP}}\times 0.8\text{ (Load Factor)}\times\text{Annual Hrs}}{0.9\text{ (Power Factor)}}$$

Results of the calculations can be found in the table below:

UNIT VENTILATOR CALCULATIONS			
ECM INPUTS	**EXISTING UNITS**	**PROPOSED UNITS**	**SAVINGS**
ECM INPUTS	Existing Unit Ventilators UVs	New UVs with ERVs	
Number of Units	34	34	-
Ave. Unit Flow Capacity (CFM)	1250	1250	
Outside Air %	30%	30%	
Outside Air Flow (CFM)	375	375	
Heating Design Day Temp. Diff (°F)	65	65	
Average Classroom Size (SF)	1000	1000	
Additional Air Changes per Hour*	2	0	
Infiltration (CFM)	333	0	
Windows Open Hours/Day	6	0	
Infiltration Energy Loss (MBH/Unit)	23.4	0	
Heating Energy Recovery, MBH/Unit	-	26.3	26.3
ERV Operation Hours / Day	-	12	-
Supply Fan Motor HP	1/3	1/4	0
Fan Annual Hours of Operation	1560	780	780
Heating Degree Days	4713	4713	-
Net Heating System Efficiency	70%	70%	-
Electric Cost ($/KWH)	$0.181	$0.181	0.181
Natural Gas Cost ($/Therm)	$1.18	$1.18	$1.18
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED UNITS**	**SAVINGS**
Fan Energy (kWh)	11,724	4,396	7,327
Heating Energy Infiltration (Therms)	2,967	0	2,967
Heating Energy Recovery (Therms)	0	-6,675	6,675
Fan Energy Cost ($)	$2,122	$796	$1,326
Infiltration Energy Cost ($)	$3,501	$0	$3,501
Heating Energy Recovered ($)	$0	-$7,877	$7,877
Total ($)	$5,623	-$7,081	$12,704
COMMENTS:	* Due to open windows and overheating		

Project cost, incentives and maintenance savings:

Total installed cost for 34 unit ventilators with hot water coils, energy recovery ventilators (ERV) and controls upgrade is $480,000

The selected equipment does not qualify for any of the NJ Smart Start rebates.

There is no significant maintenance savings associated to this ECM.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$480,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$480,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$12,704
Total Yearly Savings ($/Yr):	$12,704
Estimated ECM Lifetime (Yr):	15
Simple Payback	37.8
Simple Lifetime ROI	-60.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$190,557
Internal Rate of Return (IRR)	-10%
Net Present Value (NPV)	($328,342.82)

ECM #6: Boiler Systems Upgrade – Condensing Boilers

Description:

Space heating for the original sections of Lazar Middle School is provided by heating hot water loop. The source of hot water for this equipment is two hot water boilers located in the boiler room.

The output capacity of each boiler is 3,563 and 5,230 MBH. The boilers were installed with the original construction and are 39 years old, which brings them past their ASHRAE service life. The units are still in service put are in poor condition and should be replaced with newer high efficiency units. This ECM provides insight into the energy efficiency benefit of condensing boiler technology compared to standard cast iron and firetube boilers.

Standard (non-condensing) boilers provide lower than nominal efficiency compared to condensing boilers. Standard boilers suffer further efficiency losses at part load operating conditions mainly due to limitations in the reduction of the flue gas temperature. Current average combustion efficiency of each boiler is estimated to be 70% due to standard non-condensing boiler technology, limited turn down ratio, cycling losses and outdated design and controls. A new condensing boiler could substantially improve the operating efficiency of the heating system of the building. Condensing boiler's peak efficiency tops out at 99% depending on return water temperature.

This ECM is based on the replacement of the existing hot water boilers with three (3) Aerco Benchmark 3.0 condensing boilers. The annual average operating efficiency of the proposed boiler set is expected to be 90%, which gives the heating system a 20% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature. The owner is recommended to retain a professional engineer to confirm equipment sizing and finalize design.

BOILER REPLACEMENT SUMMARY		
EXISTING UNIT	**LOCATION**	**PROPOSED UNITS**
(2) Firetube Boilers	Boiler Room	(3) Aerco Benchmark 3.0

First, domestic hot water usage is estimated and subtracted from the total usage in order to estimate the net natural gas usage for space heating. Additional gas usage by the other boiler room was also estimated then subtracted from total gas usage.

Current total hot water usage can be found in the table below:

ANNUAL GAS USAGE				
MONTH	TOTAL USAGE THERMS	DOMESTIC HW USAGE	HEATING ONLY	COST
Aug-10	161	161	0	$0
Sep-10	6	6	0	$0
Oct-10	2,904	364	1,880	$2,218
Nov-10	9,772	364	6,962	$8,215
Dec-10	7,755	364	5,469	$6,454
Jan-11	24,414	364	17,797	$21,000
Feb-11	15,685	364	11,338	$13,378
Mar-11	11,468	364	8,217	$9,696
Apr-11	5,992	364	4,165	$4,914
May-11	798	364	321	$379
Jun-11	730	364	271	$320
Jul-11	125	125	0	$0
TOTAL	**79,810**	**3,568**	**56,419**	**$66,575**

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

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

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

Energy savings calculations are summarized in the table below:

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	(2) Existing Hot Water Boiler	(4) New Condensing Boilers	-
Boiler Input Capacity (MBH)	11,431	12,000	-
Boiler Output Capacity (MBH)	8,793	10,800	-
Existing Nat Gas (Therms)	56,419	-	-
Boiler Efficiency (%)	70%	90%	20%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	-
Building Heating Energy Usage (MMBTUs)	3,949	3,949	-
Ave. Gas Cost ($/Therm)	1.18	1.18	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	56,419	43,882	12,538
Energy Cost ($)	$66,575	$51,780	$14,794
COMMENTS:			

Project Cost, Incentives and Maintenance Savings

Estimated cost for removing the existing boilers and installing three (3) Aerco Benchmark 3.0 condensing boilers plus labor is estimated to be $386,250.

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

GAS FIRED BOILER REBATE SUMMARY					
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/MBH**	**PROPOSED CAPACITY, MBH**	**NUMBER OF UNITS**	**TOTAL REBATE, $**
≥ 300 MBH - 1500 MBH	84% AFUE for Hot Water boilers	$1.75	0	0	$0
>1500 - ≤ 4000 MBH	84% AFUE for Hot Water boilers	$1	3,000	3	$9,000
> 4000 MBH	84% AFUE for Hot Water boilers	$1	0	0	$0
TOTAL					**$9,000**

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

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$386,250
NJ Smart Start Equipment Incentive ($):	$9,000
Net Installation Cost ($):	$377,250
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$14,794
Total Yearly Savings ($/Yr):	$14,794
Estimated ECM Lifetime (Yr):	30
Simple Payback	25.5
Simple Lifetime ROI	17.6%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$443,830
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($87,274.47)

ECM #7: Install NEMA Premium® Efficiency Motors

Description:

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

The school has a number of motors that are candidates to be replaced with NEMA Premium® efficiency motors. The motors are located in the boiler room which serves the hot water loop and zone loops.

Boiler operating hours were estimated based on hours of operation obtained from the school. The pumps operate in pairs with one pump on standby; this reduces the overall operating hours of each pump individually by approximately 50%.

This energy conservation measure replaces the existing lower efficiency electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today. The energy savings and payback are subject to change based on the pool filtration usage during the year. An implementation summary of the motor is provided below.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
P - 1	Boiler Pump	10	2,000	88.0%	92.4%
P - 2	Boiler Pump	10	2,000	88.0%	92.4%
P - 9	Zone Pump	7.5	1,750	88.5%	91.7%
P - 10	Zone Pump	7.5	1,750	88.5%	91.7%

Energy Savings Calculations:

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

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

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

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

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

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	**MOTOR HP**	**LOAD FACTOR**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**POWER SAVINGS kW**	**ENERGY SAVINGS kWH**	**COST SAVINGS**
P - 1	10	90%	88.0%	92.4%	0.36	731	$121
P - 2	10	90%	88.0%	92.4%	0.36	731	$121
P - 9	7.5	90%	88.5%	91.7%	0.20	349	$58
P - 10	7.5	90%	88.5%	91.7%	0.20	349	$58
TOTAL					**1.1**	**2,160**	**$359**

Equipment Cost and Incentives

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

INCENTIVES	
HORSE POWER	**NJ SMART START INCENTIVE**
5	$54
7.5	$81
10	$90
15	$104
20	$113
25	$117
30	$135
40	$162

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

MOTOR REPLACEMENT SUMMARY						
EQMT ID	MOTOR POWER HP	INSTALLED COST	SMART START INCENTIVE	NET COST	TOTAL SAVINGS	SIMPLE PAYBACK
P - 1	10	$3,154	$90	$3,064	$121	25.3
P - 2	10	$3,154	$90	$3,064	$121	25.3
P - 9	7.5	$1,971	$90	$1,881	$58	32.4
P - 10	7.5	$1,971	$90	$1,881	$58	32.4
TOTAL		**$10,250**	**$360**	**$9,890**	**$359**	**27.6**

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,250
NJ Smart Start Equipment Incentive ($):	$360
Net Installation Cost ($):	$9,890
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$359
Total Yearly Savings ($/Yr):	$359
Estimated ECM Lifetime (Yr):	15
Simple Payback	27.6
Simple Lifetime ROI	-45.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,378
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($5,610.12)

ECM #8: AC Unit Upgrades

Description:

The majority of Lazar Middle School is air conditioned by packaged rooftop units. The majority of the units at the school are in good to fair condition and are currently still within their useful ASHRAE service life. The units currently installed are less efficient compared to modern equipment and can be replaced with new high efficiency units. New air conditioners provide higher full load and part load efficiencies due to advances in inverter motor technologies, heat exchangers and refrigerants.

This ECM includes one-for-one replacement of the older air conditioning units with new higher efficiency systems. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. A summary of the unit replacements for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY				
SERVICE FOR	**NUMBER OF UNITS**	**COOLING CAPACITY, BTU/HR**	**TOTAL CAPACITY, TONS**	**REPLACE UNIT WITH**
RTU - 1	1	216,000	18	Carrier Weathermaster Series
RTU - 2	1	120,000	10	Carrier Weathermaster Series
RTU - 3	1	150,000	12.5	Carrier Weathermaster Series
RTU - 4	1	300,000	25	Carrier Weathermaster Series
RTU - 5	1	48,000	4	Carrier Infinity Series
RTU - 7	1	180,000	15	Carrier Weathermaster Series
RTU - 8	1	90,000	7.5	Carrier Weathermaster Series
RTU - 9/10	2	90,000	15	Carrier Weathermaster Series
SS - 1	23	42,000	81	Carrier Infinity Series
SS - 2	1	18,000	1.5	Carrier Infinity Series
SS - 3	1	18,000	1.5	Carrier Infinity Series
SS - 4	2	24,000	4.0	Carrier Infinity Series
SS - 5	2	18,000	3.0	Carrier Infinity Series
Total	**38**	**1,314,000**	**197.5**	

The manufacturers used as the basis for this calculation is Carrier. All units are one for one style replacements with matching capacity of the new units to the old units. The unit pricing and

install cost were estimated based on current rates. The payback may change based on actual unit pricing and install costs if the ECM is implemented. Due to the payback over 15 years CE recommends that Montville BOE review the replacement of rooftop and split system units as they reach the end of their service life in the coming years.

Energy Savings Calculations:

Cooling Energy Savings:

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

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

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

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

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNITS (S)EER**	**UNITS (S)EER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
RTU - 1	216,000	800	9.35 EER	12 EER	1	4,081	5.1
RTU - 2	120,000	800	8.245 EER	11.4 EER	1	3,222	4.0
RTU - 3	150,000	800	8.33 EER	12 EER	1	4,406	5.5
RTU - 4	300,000	800	8.67 EER	11.2 EER	1	6,253	7.8
RTU - 5	48,000	800	8.33 EER	14.3 EER	1	1,925	2.4
RTU - 7	180,000	800	8.415 EER	12 EER	1	5,112	6.4
RTU - 8	90,000	800	8.245 EER	11.4 EER	1	2,417	3.0
RTU - 9/10	90,000	800	8.84 EER	11.4 EER	2	3,658	4.6
SS - 1	42,000	800	9.18 EER	14 EER	23	28,983	36.2
SS - 2	18,000	800	8 EER	14.5 EER	1	1,125	1.4
SS - 3	18,000	800	10 EER	14.5 EER	1	701	0.9
SS - 4	24,000	800	10 EER	14.3 EER	2	1,832	2.3
SS - 5	18,000	800	10.5 EER	14.1 EER	2	1,184	1.5
Total					**38**	**64,899**	**81.1**

Project Cost, Incentives and Maintenance Savings

From the NJ Smart Start® Program appendix, the replacement of split system AC units and unitary systems with high efficiency AC systems falls under the category "Unitary HVAC Split System" and warrants an incentive based on efficiency (EER/SEER). The program incentives are calculated as follows:

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

AC UNITS REBATE SUMMARY				
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/TON**	**PROPOSED CAPACITY TONS**	**TOTAL REBATE $**
≥20 to 30 tons	10.5 EER	$79	25	$1,975
≥ 11.25 to < 20 tons	11.5 EER	$79	45.5	$3,595
≥ 5.4 to < 11.25 tons	11.5 EER	$73	32.5	$2,373
5.4 tons or less Unitary AC and Split System	≥14 SEER	$92	94.5	$8,694
TOTAL			**197.5**	**$16,636**

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**
RTU	$21,000	1	$21,000	$1,422	$19,578	$739	26.5
RTU	$17,500	1	$17,500	$730	$16,770	$583	28.8
RTU	$20,625	1	$20,625	$988	$19,638	$797	24.6
RTU	$26,000	1	$26,000	$1,975	$24,025	$1,132	21.2
RTU	$11,000	1	$11,000	$368	$10,632	$348	30.5
RTU	$21,000	1	$21,000	$1,185	$19,815	$925	21.4
RTU	$16,250	1	$16,250	$548	$15,703	$437	35.9
RTU	$16,250	2	$32,500	$1,095	$31,405	$662	47.4
SS	$7,250	23	$166,750	$7,406	$159,344	$5,246	30.4
SS	$4,058	1	$4,058	$138	$3,920	$204	19.3
SS	$4,058	1	$4,058	$138	$3,920	$127	30.9
SS	$6,000	2	$12,000	$368	$11,632	$332	35.1
SS	$4,058	2	$8,117	$276	$7,841	$214	36.6
Total	**$175,050**	**38**	**$360,858**	**$16,636**	**$344,222**	**$11,747**	**29.3**

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

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$360,858
NJ Smart Start Equipment Incentive ($):	$16,636
Net Installation Cost ($):	$344,222
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$11,747
Total Yearly Savings ($/Yr):	$11,747
Estimated ECM Lifetime (Yr):	15
Simple Payback	29.3
Simple Lifetime ROI	-48.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$176,205
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($203,987.08)

ECM #9: Computer Monitor Replacement

Description:

The computers throughout the facility utilize a mixture of CRT computer monitors and LCD computer monitors. The CRT computer monitors within the offices and classrooms are outdated and have several disadvantages such as; significantly increased energy consumption, uses large amount of desk space, poor picture quality, distortions and flickering image, secular glare problems, high weight, and electromagnetic emissions. Many of these 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.

By choosing LCD monitors with an LED backlighting system the resulting energy consumption can be reduced even further. LED based LCD monitor's use less energy than conventional LCD monitor, and due to recent advancements have a comparable cost to conventional LCD monitors. For example a typical LCD with LED technology will use an estimated 2 watts when in sleep mode, and 20 watts while in operation (Based on 18.5 inch display).

Based on the site survey it was noted that there are 55 CRT monitors. Some of the monitors were left in screen saver mode, which 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 is based on averages for power usage of various computer monitors.

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

Energy Savings Calculations:

No. of CRT Monitors:	55
Operating Weeks per Yr:	42
Hrs per Week:	40 (8 hrs per day estimated average)

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

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

Installation cost of new monitors is estimated based on current pricing for an 18.5" 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 $120.

Installation Costs: # Monitors X Cost per Monitor
55 Monitors X $100 per Monitor
$5,500

COMPUTER MONITOR CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CRT Monitors	LCD Monitor	-
# of Computers	55	55	-
Monitor Power Cons. (W)	75	20	-
Operating Hrs per Week	40	40	-
Operating Weeks per Yr	42	42	-
Elec Cost ($/kWh)	0.181	0.181	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	6,930	1,848	5,082
Energy Cost ($)	$1,254	$334	$920
COMMENTS:	CRT Monitor consumption based on Dell CRT monitor M/N: CRT-E771MM. LCD Monitor based on Dell IN1930 LCD LED. Operating hours estimated.		

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$5,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$920
Total Yearly Savings ($/Yr):	$920
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.0
Simple Lifetime ROI	150.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$13,798
Internal Rate of Return (IRR)	15%
Net Present Value (NPV)	$5,481.01

ECM #10: High Efficiency Gas Fired Hot Water Heaters

Description:

The Lazar Middle School has three (3) existing gas-fired hot water heating systems. One of the systems consists of a split hot water boiler and a hot water retainer tank made by Lochinvar. The other system consists of two tank type Rheem hot water heaters. The heaters are at the end of their useful service life and could be replaced with much more efficient hot water heating systems. This ECM will replace the existing two systems and install two separate hot water heaters. Basis for the replacement is as follows. It is recommended to retain a plumbing professional to confirm equipment sizing before pursuing with this ECM.

HOT WATER HEATER REPLACEMENT	
EXISTING	**RECOMMENDED**
Two (2) Rheem 65 Gallon, 360 MBH Hot Water Heaters	One (1) 130 Gallon - 399,900 BTU AO Smith Cyclone Xi BTH-400A
One (1) Lochinvar Model N/A 269 MBH Output	One (1) 100 Gallon - 250,000 BTU AO Smith Cyclone Xi BTH-250A

Energy Savings Calculations:

Calculations are estimated base on Domestic Hot Water Energy Usage for Educational buildings is 5.2 kBtu / SF / year.

$$DHW\ \ Heat\ Usage = Energy\ Density\left(\frac{kBtu\ yr}{SF}\right)\times Building\ \ Square\ Footage\ \ (SF)$$

$$DHW\,Total\,Usage = \frac{Dom\ HW\ \ Heat\ Cons.(Btu)}{Heating\ \ Eff.(\%)\times Fuel\ \ Heat\,Value\left(\frac{BTU}{Fuel\,Unit}\right)}$$

$$Energy\,Cost = Heating\ \ Fuel\,Usage(Fuel\,Units)\times Ave\ Fuel\ Cost\left(\frac{\$}{Fuel\,Unit}\right)$$

CONDENSING DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Hot Water Heater	Bradford White High Efficiency	
Building Type	Education	Education	
Building Square-foot	114,000	114,000	
Domestic Water Usage, kBtu	592,800	592,800	
DHW Heating Fuel Type	Gas	Gas	
Ave. Heating Efficiency	76%	95%	19%
Total Usage (kBTU)	780,000	624,000	156,000
Nat Gas Cost ($/Therm)	$1.18	$1.18	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	7,800	6,240	1,560
Energy Cost ($)	$9,204	$7,363	$1,841
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Cost, Rebates and Incentives:

The total installed cost for the replacement of gas fired hot water heaters with gas piping is estimated to be **$29,000.**

From the NJ Smart Start® Program appendix, the hot water heater installation falls under the category "Gas Water Heating" and warrants an incentive as follows:

NJ Smart Start ®Incentives:

$2/MBH x Unit Capacity, MBH (Water Heaters > 50 Gallons, up to 300 MBH)
$1.75/MBH x Unit Capacity, MBH (Water Heaters > 50 Gallons, up to 1500 MBH)

250 MBH x $2/MBH = $500
399 MBH x $1.75/MBH = $698

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$27,000
NJ Smart Start Equipment Incentive ($):	$1,198
Net Installation Cost ($):	$25,802
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,841
Total Yearly Savings ($/Yr):	$1,841
Estimated ECM Lifetime (Yr):	15
Simple Payback	14.0
Simple Lifetime ROI	7.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$27,612
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($3,826.40)

ECM #11: Central DDC Control System Upgrade

Description:

Majority of the Lazar Middle School HVAC systems are controlled primarily through the use of pneumatic control systems. CE recommends expanding the DDC system to control remaining HVAC systems in the school including the air handling units, unit ventilators, wall thermostats, air conditioning units, rooftop units, and boilers. In addition the existing control systems will be unified under one system allowing easier operation for building facility management personnel.

This ECM includes expansion of the existing Building Automation system to include control of the majority of the HVAC equipment in the facility. The system will include new temperature sensors and new local thermostats with limited over-ride capability, a front end computer and main controller. The system will also include central controls for lighting. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the building may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. 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 referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 5% of the electricity and 10% for the gas utility in this building.

The basis for the DDC system expansion is the Automated Logic Energy Management System or similar.

Energy Savings Calculations:

Since some of the key utility consumption and cost information was not available, estimated values are used for the unit cost of natural gas, total electricity usage and unit cost of electricity.

Energy savings for each utility is calculated with the equation below.

Energy Savings (Utility) = Current Energy Consumption × Estimated Savings, %

Following table summarizes energy savings for this facility via implementation of an Energy Management System:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Controls w/ Local Thermostats	DDC Controls	
Existing Nat Gas Usage (Therms)	79,810	-	
Existing Electricity Usage (kWh)	967,850	-	
Energy Savings, Nat. Gas	-	10%	
Energy Savings, Electricity	-	5%	
Gas Cost ($/Therm)	*$1.04*	$1.04	
Electricity Cost ($/kWh)	*$0.166*	$0.166	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	79,810	71,829	7,981
Electricity Usage (kWh)	967,850	919,458	48,393
Natural Gas Cost ($)	$83,002	$74,702	$8,300
Electricity Cost ($)	$160,663	$152,630	$8,033
Energy Cost ($)	$243,666	$227,332	$16,333
COMMENTS:			

Demand savings due to implementation of this ECM is minimal.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $1.00 to $2.00 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = $200,000

Currently, there are no prequalified NJ SmartSmart Incentives for installation of the DDC system.

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$200,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$200,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$16,333
Total Yearly Savings ($/Yr):	$16,333
Estimated ECM Lifetime (Yr):	15
Simple Payback	12.2
Simple Lifetime ROI	22.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$245,001
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	($5,012.99)

ECM #12: Water Efficiency & Conservation

Description:

The facility utilizes standard plumbing fixtures. The typical water closet and urinal water consumption only meet the minimum federally required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the replacement of the existing sink faucets, water closets and urinals within the bathrooms the facility. The estimated usage of the plumbing fixtures is based on the total population of the facility.

The proposed retrofit includes installation of auto flow sink faucets, low flow aerators, low flow flushometer style water closets that utilize 1.28 gallons per flush and ultra-low flushometer style urinals that utilize 1/8 gallons per flush. For the basis of this calculation the LEED rating system was used to estimate the occupancy usage for students within the school. When water consumption information was not available, the GPF values were estimated for the existing fixtures.

Energy Savings Calculations:

Urinals and Toilets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Flush}}{\text{Person per Day}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Flush}}\right)$$

Faucets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Use}}{\text{Person per Day}}\right) \times \text{Use Time}\left(\frac{\text{Sec}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Water Cost} = \frac{\text{Water Consumption (Gallons)} \times \text{Ave Cost}\left(\frac{\$}{1000\,\text{Gal}}\right)}{1000(\text{Gal})}$$

$$\text{Gas Cost (Therms)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.34\,\text{BTU}}{\text{Gal}} \times \frac{\text{Therm}}{100{,}000\,\text{BTU}}$$

WATER CONSERVATION CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Fixtures	Low Flow / Auto Flow Fixtures	-
Total Number of Students	1,085	1,085	-
% Male to Female	50%	50%	-
Estimated % Floor Area Served by Older Bathrooms	100%	100%	-
Occupied Days Per Year	195	195	-
Lavatory Uses per Day per Person	3	3	-
Sink flow time per use, sec	15	12	-
Sink Aerator Flow, GPM	1.5	0.5	-
WC Uses per Day per Person	2.0	2.0	-
Urinal Uses per Day per Person	1.0	1.0	-
Total Urinal Flushes Per Day	543	543	-
Total WC Flushes Per Day	1,085	1,085	-
Urinal Gallons Per Flush (GPF)	1.0	0.125	0.875
WC Gallons Per Flush (GPF)	1.6	1.28	0.32
**** Water Cost ($/1000 Gal)**	$8.00	$8.00	-
Gas Cost ($/Therm)	$1.18	$1.18	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Water Consumption, Urinal and WC (Gal)	444,308	284,039	160,268
Water Consumption, Faucets (Gal)	238,022	63,473	174,549
Total Water Consumption, (Gal)	682,329	347,512	334,817
Water Cost ($)	$5,459	$2,780	$2,679
Gas Consumption (Therms)	993	265	728
Gas Cost ($/Year)	$1,171	$312	$859
Total Savings ($/Year)	-	-	$3,537
COMMENTS:	*Savings are based on LEED Reference Guide for Green Building Design and Construction - 2009 Edition for WC and Urinal water usage. ** Cost of Water estimated.		

The cost for installation and materials of water closets, low flow urinals and new auto flow sink faucets throughout the facility is estimated to be $95,134.

There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #12 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$95,134
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$95,134
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,537
Total Yearly Savings ($/Yr):	$3,537
Estimated ECM Lifetime (Yr):	15
Simple Payback	26.9
Simple Lifetime ROI	-44.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$53,055
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($52,909.52)

REM #1: 301 KW Solar System

Description:

Lazar Middle School has available roof and parking space that could accommodate a significant amount of solar generation. Based on the available area a 300 kilowatt solar array could be installed, assuming the existing roof structure is capable of supporting an array. The array will peak at 243 kW AC power. This will result in approximately 347,000 kilowatt-hours of annual electricity generation, which will reduce the overall electric usage of the facility by 35%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period. This model has been adjusted based on current SREC market values as of December 2011.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
System Size (KW_{DC}):	301
Electric Generation (KWH/Yr):	347,589
Installation Cost ($):	$1,844,044
SREC Revenue ($/Yr):	$71,026
Energy Savings ($/Yr):	$62,914
Total Yearly Savings ($/Yr):	$133,939
ECM Analysis Period (Yr):	15
Simple Payback (Yrs):	13.8
Analysis Period Electric Savings ($):	$1,170,125
Analysis Period SREC Revenue ($):	$1,028,893
Net Present Value (NPV)	($467,482.86)

V. 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.

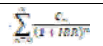
E. Turn off computers when not in use. Ensure computers are not running in screen saver mode which saves the monitor screen not energy.

F. Ensure outside air dampers are functioning properly and only open during occupied mode.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Lazar Middle School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)		
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Equipment Upgrade	$16,740	$0	$2,020	$14,720	$2,862	$118	$2,980	15	$44,694	$1,765	203.6%	4.9	18.69%	$20,850.19
ECM #2	Lighting Controls Upgrade	$25,200	$0	$2,535	$22,665	$7,350	$0	$7,350	15	$110,245	$0	386.4%	3.1	31.92%	$65,074.64
ECM #3	Gymnasium Lighting Equipment and Controls Upgrade	$10,960	$0	$1,470	$9,490	$1,557	$0	$1,557	15	$23,362	$0	146.2%	6.1	14.16%	$9,103.31
ECM #4	Automatic Computer Stand-by / Hibernate	$458	$0	$0	$458	$1,537	$0	$1,537	10	$15,366	$0	3252.5%	0.3	335.25%	$12,648.79
ECM #5	Unit Ventilator with Energy Recovery	$225,000	$125,000	$0	$350,000	$12,704	$0	$12,704	15	$190,557	$0	-45.6%	27.6	-6.79%	($198,342.82)
ECM #6	Install High Efficiency Condensing Boilers	$154,500	$231,750	$9,000	$377,250	$14,794	$0	$14,794	30	$443,830	$0	17.6%	25.5	1.08%	($87,274.47)
ECM #7	Nema Premium Efficiency Motors	$4,100	$6,150	$360	$9,890	$359	$0	$359	15	$5,378	$0	-45.6%	27.6	-6.80%	($5,610.12)
ECM #8	AC Unit Upgrades	$180,429	$180,429	$16,636	$344,222	$11,747	$0	$11,747	15	$176,202	$0	-48.8%	29.3	-7.40%	($203,990.00)
ECM #9	CRT Monitor Upgrades	$5,500	$0	$0	$5,500	$920	$0	$920	15	$13,798	$0	150.9%	6.0	14.54%	$5,481.01
ECM #10	Domestic Hot Water Heating System Upgrade	$27,000	$0	$1,198	$25,802	$1,841	$0	$1,841	15	$27,612	$0	7.0%	14.0	0.86%	($3,826.40)
ECM #11	Central DDC Control System Upgrade	$200,000	$0	$0	$200,000	$16,333	$0	$16,333	15	$245,001	$0	22.5%	12.2	2.65%	($5,012.99)
ECM #12	Water Efficiency	$47,567	$47,567	$0	$95,134	$3,537	$0	$3,537	15	$53,055	$0	-44.2%	26.9	-6.55%	($52,909.52)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	301 KW Solar System	$1,844,044	$0	$0	$1,844,044	$62,914	$71,026	$133,939	15	$2,009,090	$1,065,385	9.0%	13.8	1.09%	($245,085.53)

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

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-2 lamps) $30 per fixture (3-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Premium Motors

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Lazar Middle School

Building ID: 2957251
For 12-month Period Ending: July 31, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: January 12, 2012

Facility
Lazar Middle School
123 Changebridge Road
Montville, NJ 07045

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

Year Built: 1954
Gross Floor Area (ft²): 114,000

Energy Performance Rating[2] (1-100) 25

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	3,302,304
Natural Gas (kBtu)[4]	7,981,000
Total Energy (kBtu)	11,283,304

Energy Intensity[4]

Site (kBtu/ft²/yr)	99
Source (kBtu/ft²/yr)	170

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	892

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

National Median Comparison

National Median Site EUI	79
National Median Source EUI	136
% Difference from National Median Source EUI	25%
Building Type	K-12 School

Stamp of Certifying Professional

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

Meets Industry Standards[5] **for Indoor Environmental Conditions:**

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

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) 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	Lazar Middle School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	123 Changebridge Road, Montville, NJ 07045	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 a hospital (general medical and surgical)) nor can they be submitted as representing only a portion of a building		☐
Lazar Middle School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	114,000 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.		☐
Open Weekends?	Yes	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	100	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	1	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	60 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Light Co [FirstEnergy Corp]

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2011	07/31/2011	90,515.00
06/01/2011	06/30/2011	35,061.00
05/01/2011	05/31/2011	67,948.00
04/01/2011	04/30/2011	82,841.00
03/01/2011	03/31/2011	87,344.00
02/01/2011	02/28/2011	72,028.00
01/01/2011	01/31/2011	98,595.00
12/01/2010	12/31/2010	91,689.00
11/01/2010	11/30/2010	88,130.00
10/01/2010	10/31/2010	92,043.00
09/01/2010	09/30/2010	82,691.00
08/01/2010	08/31/2010	78,965.00
Electric Consumption (kWh (thousand Watt-hours))		**967,850.00**
Electric Consumption (kBtu (thousand Btu))		**3,302,304.20**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**3,302,304.20**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
07/01/2011	07/31/2011	125.00
06/01/2011	06/30/2011	730.00
05/01/2011	05/31/2011	798.00
04/01/2011	04/30/2011	5,992.00
03/01/2011	03/31/2011	11,468.00
02/01/2011	02/28/2011	15,685.00
01/01/2011	01/31/2011	24,414.00
12/01/2010	12/31/2010	7,755.00
11/01/2010	11/30/2010	9,772.00
10/01/2010	10/31/2010	2,904.00

09/01/2010	09/30/2010	6.00
08/01/2010	08/31/2010	161.00
Gas Consumption (therms)		**79,810.00**
Gas Consumption (kBtu (thousand Btu))		**7,981,000.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**7,981,000.00**
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.

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
Lazar Middle School
123 Changebridge Road
Montville, NJ 07045

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

General Information

Lazar Middle School	
Gross Floor Area Excluding Parking: (ft^2)	114,000
Year Built	1954
For 12-month Evaluation Period Ending Date:	July 31, 2011

Facility Space Use Summary

Lazar Middle School	
Space Type	K-12 School
Gross Floor Area(ft^2)	114,000
Open Weekends?	Yes
Number of PCs	100
Number of walk-in refrigeration/freezer units	1
Presence of cooking facilities	Yes
Percent Cooled	60
Percent Heated	100
Months[o]	N/A
High School?	No
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2011)	**Baseline** (Ending Date 07/31/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	25	25	75	N/A	50
Energy Intensity					
Site ($kBtu/ft^2$)	99	99	62	N/A	79
Source ($kBtu/ft^2$)	170	170	106	N/A	136
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					
$MtCO_2e$/year	892	892	557	N/A	713
$kgCO_2e/ft^2$/year	8	8	5	N/A	6

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Median column presents energy performance data your building would have if your building had a median rating of 50.

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

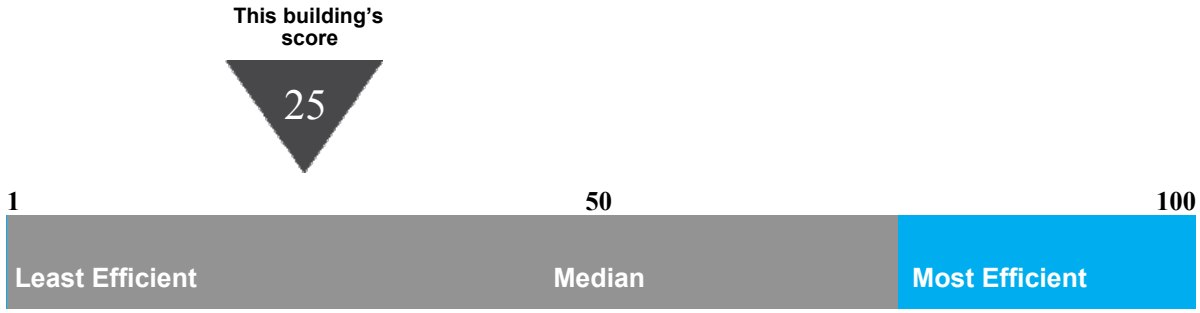
Statement of Energy Performance

2011

Lazar Middle School
123 Changebridge Road
Montville, NJ 07045

Portfolio Manager Building ID: 2957251

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 170 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2011

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 01/12/2012

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

Unit Ventilators

Tag	UV	UV	
Unit Type	Horizontal Floor Mount	Horizontal Floor Mount	
Qty	34 (Est)	23	
Location	Original Section	New Section	
Manufacturer	Nesbitt	Trane	
Model #	-	VUVB15011	
Serial #	-	W99H40268	
Flow (CFM)	1200 (Est)	1500	
Cooling Capacity (Tons)	N/A	3.5	
Estimated Cooling Efficiency (EER)	N/A	10	
Heating Type	Hot Water Coil	Hot Water Coil	
Heating Input (MBH)	-	-	
Approx Age	30	12	
Ashrae Service Life	15	15	
Remaining Life	(15)	3	
Comments	Poor condition	Good condition	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

AC Units

Tag	RTU - 1	SS	SS - 2
Unit Type	Rooftop Unit	Split System	Split System
Qty	1	23	1
Location	Roof	Roof	Roof
Area Served	-	Classrooms and Offices	-
Manufacturer	Trane	Trane	Inter-City Product Corp
Model #	TCD211C30AAB	TTP042C100A4	AD018GD
Serial #	P18102535D	Varies	L932617192
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	18.0	3.5	1.5
Cooling Efficiency (SEER/EER)	11.0 EER	10.8 EER	8.0 EER (est)
Approx Age	12	12	18
ASHRAE Service Life	15	15	15
Remaining Life	3	3	(3)
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

AC Units

Tag	SS - 3	RTU - 9/10	RTU - 8
Unit Type	Split System	Rooftop Air Handling Unit	Rooftop Unit
Qty	1	2	1
Location	Ground	Roof	Roof
Area Served	Office	-	-
Manufacturer	Trane	Trane	Trane
Model #	-	TTA090A300CC	TC0091030CBC
Serial #	-	P3512G9AH	P29104790
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	3.5 (est)	7.5	7.5
Cooling Efficiency (SEER/EER)	10.0 EER (est)	10.4 EER	9.7 EER
Approx Age	5 (est)	12	12
ASHRAE Service Life	15	15	15
Remaining Life	10	3	3
Comments		Coupled with Trane Split Condensing Units	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

AC Units

Tag	RTU - 5	SS - 4	RTU - 7
Unit Type	Rooftop Unit	Split System	Rooftop Unit
Qty	1	4	1
Location	Roof	Roof	Roof
Area Served	-	-	-
Manufacturer	Trane	Airedale	Trane
Model #	TCD049C30CBD	SCC24DFA0A0AA0A	TCD181C30CAA
Serial #	P30102571D	Varies	P29102227D
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	4.0	2.0	15.0
Cooling Efficiency (SEER/EER)	9.8 EER	10.0 EER (est)	9.9 EER
Approx Age	12	12	12
ASHRAE Service Life	15	15	15
Remaining Life	3	3	3
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

AC Units

Tag	RTU - 2	SS - 5	RTU - 3
Unit Type	Rooftop Unit	Split System	Rooftop Unit
Qty	1	2	1
Location	Roof	Roof	Roof
Area Served	-	-	-
Manufacturer	Trane	Mitsubishi Electric	Trane
Model #	TCD121C30AAA	PU18EK	TCD151C30AAA
Serial #	R45102325D	-	R45102330D
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	10.0	1.5	12.5
Cooling Efficiency (SEER/EER)	9.7 EER	10.5 EER (est)	9.8 EER
Approx Age	11	16	11
ASHRAE Service Life	15	15	15
Remaining Life	4	(1)	4
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

AC Units

Tag	RTU - 4	MUA	
Unit Type	Rooftop Unit	Rooftop Makeup Air Unit	
Qty	1	1	
Location	Roof	Roof	
Area Served	-	Science Lab	
Manufacturer	Trane	Reznor	
Model #	SLHFC25EAT47C4BD1001ABDE0G0KL00RT00000	-	
Serial #	C99F08571M / C99F08572M	-	
Cooling Type	R22, DX	N/A	
Cooling Capacity (Tons)	25.0	N/A	
Cooling Efficiency (SEER/EER)	10.2 EER	N/A	
Approx Age	12	12	
ASHRAE Service Life	15	15	
Remaining Life	3	3	
Comments	*10 HP Supply Motor & 5 HP Return Motor @ 90% NEMA Efficiency		

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

Boilers

Tag	Boiler - 1	Boiler - 2	Boiler - 3/4
Unit Type	Cast Iron Boiler	Firetube Boiler	Condensing Boiler
Qty	1	1	2
Location	Boiler Room	Secondary Boiler Room	Addition Boiler Room
Area Served	Heating Hot Water Loop - Original Building	Heating Hot Water Loop - Original Building	Heating Hot Water Loop - Addition
Manufacturer	H.B. Smith	Cleaver Brooks	Aerco
Model #	-	CB900-125	Benchmark 2.0
Serial #	N98-790	79533	-
Input Capacity (Btu/Hr)	4,632 MBH	6,799 MBH	2,120 MBH
Rated Output Capacity (Btu/Hr)	3,563 MBH	5,230 MBH	2,000 MBH
Approx. Efficiency %	70% (est)	70% (est)	95.0%
Fuel	Natural Gas	Natural Gas	Natural Gas
Approx Age	29	29	12
ASHRAE Service Life	35	25	25
Remaining Life	6	(4)	13
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

Domestic Water Heaters

Tag	DHW - 1/2	Boiler - DHW	
Unit Type	Domestic Hot Water Heater Tank	Boiler DHW	
Qty	2	1	
Location	Kitchen Storage Area	Boiler Room	
Area Served	Kitchen Hot Water	Domestic Hot Water	
Manufacturer	Rheem	Lochinvar	
Model #	G65-360A	-	
Serial #	1002G02580 / 1201G01183	65068	
Size (Gallons)	65	N/A	
Input Capacity (MBH/KW)	360 MBH	336 MBH	
Recovery (Gal/Hr)	327 GPH	Rated Output: 269 MBH	
Efficiency %	76%	80%	
Fuel	Natural Gas	Natural Gas	
Approx Age	9	15	
ASHRAE Service Life	12	15	
Remaining Life	3	10	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

Pumps

Tag	P - 1/2	P - 3/4	P - 5/6
Unit Type	Base Mounted	Base Mounted	Base Mounted
Qty	1	2	2
Location	Boiler Room	Boiler Room	Boiler Room
Area Served	Boiler Pump	Zone Pump	Zone Pump
Manufacturer	-	Taco	Varies
Model #	-	-	-
Serial #	-	1619C3E3	-
Horse Power	10	1.5	3
Flow	-	-	160
Motor Info	Baldor	Emerson	Baldor
RPM	3450	1725	1725
Motor Efficiency %	88% (est)	87% (est)	86.5%
Approx Age	10 (est)	10 (est)	15 (est)
ASHRAE Service Life	20	20	20
Remaining Life	10	10	5
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lazar Middle School

Pumps

Tag	P - 7/8	P - 9/10	
Unit Type	In - Line	Base Mounted	
Qty	2	2	
Location	Boiler Room	New Section Boiler Room	
Area Served	Zone Pump	Boiler Pump	
Manufacturer	B & G	Taco	
Model #	-	FE2508E2E1F2LOA	
Serial #	-	-	
Horse Power	2	7.5	
Flow	48	-	
Motor Info	B & G	Baldor	
RPM	1725	1760	
Motor Efficiency %	81.5%	88.5%	
Approx Age	12	13	
ASHRAE Service Life	10	20	
Remaining Life	(2)	7	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

Investment Grade Lighting Audit

CEG Job #: 9C11044
Project: Montville Twp BOE — **Lazar Middle School** — **KWH COST:** $0.181
123 Changebridge Road
Montville, NJ
Bldg. Sq. Ft. 114,000

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Main Lobby	3000	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	1,116.0	$202.00	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
231.33	Café	2600	64	3	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	86	5.50	14,310.4	$2,590.18	64	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	Café Storage # 1	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.06	58.0	$10.50	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	Café Storage #2	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.06	58.0	$10.50	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.12	Kitchen	2600	11	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	1.18	3,060.2	$553.90	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
612	Kitchen JC	1000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	100.0	$18.10	1	1	(1) 26w CFL Lamp	26	0.03	26	$4.71	$20.00	$20.00	0.07	74	$13.39	1.49
610	Kitchen Toilet	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312.0	$56.47	1	2	13w CFL Lamps	26	0.03	67.6	$12.24	$25.00	$25.00	0.09	244.4	$44.24	0.57
242.12	Kitchen Closet	1000	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.21	214.0	$38.73	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.12	Kitchen Dish Washer	2600	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.21	556.4	$100.71	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
612	Electrical Closet #2	1000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	100.0	$18.10	1	1	(1) 26w CFL Lamp	26	0.03	26	$4.71	$20.00	$20.00	0.07	74	$13.39	1.49
612	Women's Toilet Room	2600	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	260.0	$47.06	1	1	(1) 26w CFL Lamp	26	0.03	67.6	$12.24	$20.00	$20.00	0.07	192.4	$34.82	0.57
242.12	Girl's Toilet Room	2600	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.21	556.4	$100.71	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.12	Boy's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.11	278.2	$50.35	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
231.33	Faculty Room	2600	20	3	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	86	1.72	4,472.0	$809.43	20	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
612	Electrical Closet #6	1000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	100.0	$18.10	1	1	(1) 26w CFL Lamp	26	0.03	26	$4.71	$20.00	$20.00	0.07	74	$13.39	1.49
222.21	Corridor Room 18 - Room 25	3000	15	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.93	2,790.0	$504.99	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	Classroom 26	2600	30	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	2.34	6,084.0	$1,101.20	30	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	1.50	3900	$705.90	$80.00	$2,400.00	0.84	2184	$395.30	6.07
222.21	Corridor Room 26 - Room 56	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	2,232.0	$403.99	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Corridor Room 28 - Library	3000	27	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.67	5,022.0	$908.98	27	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Copy Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	322.4	$58.35	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Storage Room	1000	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.17	172.0	$31.13	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Boy's Toilet Room	2600	3	2	2x2, 2 Lamp, 34w T12 U-Tube, Mag. Ballast, Surface Mnt., Parabolic Lens	72	0.22	561.6	$101.65	3	2	2x2, 2 Lamp, 14w T5, Indirect; Fixture	31	0.09	241.8	$43.77	$215.00	$645.00	0.12	319.8	$57.88	11.14
649	JC	1000	1	2	1x1 Surface Mount, Prismatic Lens, (2) 13w CFL Lamp	26	0.03	26.0	$4.71	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 32	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Classroom 32	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.62	1,622.4	$293.65	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Electrical Closet #3	1000	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.21	208.0	$37.65	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Electrical Closet #3	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	62.0	$11.22	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Head Custodian 8	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.25	644.8	$116.71	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Women's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.10	270.4	$48.94	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Men's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.10	270.4	$48.94	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Electrical Closet #4	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.10	104.0	$18.82	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Girl's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	322.4	$58.35	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Girl's Toilet Room	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	88.4	$16.00	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Boy's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	322.4	$58.35	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Boy's Toilet Room	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	88.4	$16.00	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	JC 4	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	34.0	$6.15	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Boiler Room #3	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.17	452.4	$81.88	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 40	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4,056.0	$734.14	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	SAC Office	2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.12	301.6	$54.59	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	GYM	2600	18	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.87	4,867.2	$880.96	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
745	GYM	2600	28	1	250w MH LoBay w/Prismatic Lens	291	8.15	21,184.8	$3,834.45	28	4	2x4, 4 Lamp, 54w T5HO, Elect. Ballast, Lo Bay	231	6.47	16816.8	$3,043.84	$370.00	$10,360.00	1.68	4368	$790.61	13.10
111	Stage	2600	16	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.77	1,996.8	$361.42	16	1	1 Lamp, 32w T8, Elect. Ballast; retrofit	30	0.48	1248	$225.89	$80.00	$1,280.00	0.29	748.8	$135.53	9.44
242.33	Stage Storage	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	104	0.10	104.0	$18.82	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.33	Stage Storage	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	104	0.10	104.0	$18.82	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	GYM Exit	3000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.19	558.0	$101.00	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Girl's Locker Room	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$109.18	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Girl's Locker Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.62	1,622.4	$293.65	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
730	Girl's Locker Room Shower	2600	4	1	150w MH Flood	125	0.50	1,300.0	$235.30	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Girl's Locker Room Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
100	Girl's Locker Room Toilet	2600	1	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.04	109.2	$19.77	1	2	Reballast & Relamp; 17w T8 Elec. Ballast	33	0.03	85.8	$15.53	$60.00	$60.00	0.01	23.4	$4.24	14.17
121.16	Girl's Locker Room Toilet	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Clear Acrylic Lens	78	0.16	405.6	$73.41	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	58	0.12	301.6	$54.59	$80.00	$160.00	0.04	104	$18.82	8.50
242.212	Boy's Locker Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.62	1,622.4	$293.65	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
730	Boy's Locker Room Shower	2600	4	1	150w MH Flood	125	0.50	1,300.0	$235.30	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.16	Boy's Locker Room Toilet	2600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Clear Acrylic Lens	78	0.08	202.8	$36.71	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	58	0.06	150.8	$27.29	$80.00	$80.00	0.02	52	$9.41	8.50
221.31	GYM Storage	1000	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.12	124.0	$22.44	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	GYM Office	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	322.4	$58.35	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.31	GYM Electrical Room	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.11	107.0	$19.37	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Closet 40	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.19	186.0	$33.67	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.31	Office 40	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.21	556.4	$100.71	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.31	Classroom 43	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.96	2,503.8	$453.19	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.211	Storage Room	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	34.0	$6.15	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 50	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 52	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	JC 5	1000	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	62.0	$11.22	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Electrical Closet #5	1000	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	62.0	$11.22	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Cumputer HUB	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	322.4	$58.35	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 56	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 56 Supplies	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.19	186.0	$33.67	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 56 Ceramics	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	161.2	$29.18	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.22	Electrical Closet	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.17	174.0	$31.49	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Storage Room	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	34.0	$6.15	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	JC	1000	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	62.0	$11.22	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Men's Toilet Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$27.29	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Women's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.10	270.4	$48.94	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Girl's Toilet Room	2600	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	322.4	$58.35	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Asst. Principal	2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.12	301.6	$54.59	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Asst. Principal Conference Room	2600	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	322.4	$58.35	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Office	2600	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.17	447.2	$80.94	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
610	Women's Toilet Room	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312.0	$56.47	1	2	13w CFL Lamps	26	0.03	67.6	$12.24	$25.00	$25.00	0.09	244.4	$44.24	0.57
610	Women's Toilet Room	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312.0	$56.47	1	2	13w CFL Lamps	26	0.03	67.6	$12.24	$25.00	$25.00	0.09	244.4	$44.24	0.57
121.14	Boiler Room #2	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$73.41	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$47.06	$80.00	$160.00	0.06	145.6	$26.35	6.07

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
121.14	Boiler Room #1	2600	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.39	1,014.0	$183.53	5	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.25	650	$117.65	$80.00	$400.00	0.14	364	$65.88	6.07
613	Boiler Room #1	2600	1	1	Industrial Fixture, 100w A19 Lamp	100	0.10	260.0	$47.06	1	1	(1) 26w CFL Lamp	26	0.03	67.6	$12.24	$20.00	$20.00	0.07	192.4	$34.82	0.57
613	Boiler Room #1	2600	1	1	Industrial Fixture, 100w A19 Lamp	100	0.10	260.0	$47.06	1	1	(1) 26w CFL Lamp	26	0.03	67.6	$12.24	$20.00	$20.00	0.07	192.4	$34.82	0.57
3520	Boiler Room #1 Toilet	2600	1	1	Ceiling Mount White Globe, (2) 26w CFL Lamp	125	0.13	325.0	$58.83	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
3520	JC 1	1000	1	1	Ceiling Mount White Globe, (2) 26w CFL Lamp	125	0.13	125.0	$22.63	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Guidance	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Office #1	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Office #2	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Office #3	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Guidance Copy Room	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	88.4	$16.00	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Guidance Storage	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	34.0	$6.15	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	GYM Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	GYM Toilet	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	161.2	$29.18	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Faculty Toilet Room	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	161.2	$29.18	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	GYM Corridor	3000	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.50	1,488.0	$269.33	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 41	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4,056.0	$734.14	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 43	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 42	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4,056.0	$734.14	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 42 Prep Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.42	1,081.6	$195.77	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 44	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 45	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 47	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 46	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 48	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 49	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 50	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 51	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 52	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 53	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 54	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 57	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 56	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 59	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 58	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 58 Closet	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.19	186.0	$33.67	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 60	2600	18	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.87	4,867.2	$880.96	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 62	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 64	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 65	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 63	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 61	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Classroom 61	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.03	88.4	$16.00	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 61 Storage	1000	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.42	416.0	$75.30	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Corridor - Room 64 - Room 40	3000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.10	312.0	$56.47	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Corridor - Room 64 - Room 40	3000	22	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.75	2,244.0	$406.16	22	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Corridor - Room 64 - Room 40	3000	26	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	2.70	8,112.0	$1,468.27	26	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Library	2600	54	2	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	3.13	8,143.2	$1,473.92	54	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Library	2600	23	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	1.33	3,468.4	$627.78	23	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Library Office #1	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Library Office #2	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Library Office #3	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$97.88	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Library Closet	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.10	104.0	$18.82	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.33	Classroom 35	2600	20	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/ Indirect	58	1.16	3,016.0	$545.90	20	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 33	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.62	1,622.4	$293.65	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 34	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.62	1,622.4	$293.65	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 31	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.33	Classroom 31 Lab	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/ Indirect	58	0.35	904.8	$163.77	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 31 Closet	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	161.2	$29.18	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 29	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 30	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 27	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 28	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$587.31	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Classroom 25	2600	15	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.87	2,262.0	$409.42	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.34	Classroom 23	2600	15	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.87	2,262.0	$409.42	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.34	Classroom 24	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3,042.0	$550.60	15	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.75	1950	$352.95	$80.00	$1,200.00	0.42	1092	$197.65	6.07
121.34	Classroom 21	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3,042.0	$550.60	15	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.75	1950	$352.95	$80.00	$1,200.00	0.42	1092	$197.65	6.07
121.34	Classroom 22	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3,042.0	$550.60	15	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.75	1950	$352.95	$80.00	$1,200.00	0.42	1092	$197.65	6.07
221.11	Classroom 19	2600	9	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.56	1,450.8	$262.59	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.34	Classroom 20	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3,042.0	$550.60	15	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.75	1950	$352.95	$80.00	$1,200.00	0.42	1092	$197.65	6.07
121.34	Classroom 18	2600	24	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.87	4,867.2	$880.96	24	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	1.20	3120	$564.72	$80.00	$1,920.00	0.67	1747.2	$316.24	6.07
121.34	Classroom 17	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3,042.0	$550.60	15	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.75	1950	$352.95	$80.00	$1,200.00	0.42	1092	$197.65	6.07
121.34	Classroom 16	2600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	0.08	202.8	$36.71	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.05	130	$23.53	$80.00	$80.00	0.03	72.8	$13.18	6.07
121.14	Office 16 Office #1	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$73.41	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$47.06	$80.00	$160.00	0.06	145.6	$26.35	6.07
121.14	Office 16 Office #2	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$73.41	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$47.06	$80.00	$160.00	0.06	145.6	$26.35	6.07
121.14	Office 16 Office #3	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$73.41	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$47.06	$80.00	$160.00	0.06	145.6	$26.35	6.07
121.14	Office 16 Office #4	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$73.41	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$47.06	$80.00	$160.00	0.06	145.6	$26.35	6.07
121.14	Classroom 15	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	1.17	3,042.0	$550.60	15	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.75	1950	$352.95	$80.00	$1,200.00	0.42	1092	$197.65	6.07
221.34	Classroom 13	2600	10	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.58	1,508.0	$272.95	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	Classroom 14	2600	16	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	1.25	3,244.8	$587.31	16	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.80	2080	$376.48	$80.00	$1,280.00	0.45	1164.8	$210.83	6.07
121.14	Classroom 12	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.23	608.4	$110.12	3	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.15	390	$70.59	$80.00	$240.00	0.08	218.4	$39.53	6.07
242.11	Classroom 12	2600	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.21	556.4	$100.71	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Main Office	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.94	2,433.6	$440.48	9	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Main Office Copy Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.26	670.8	$121.41	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Principal Office	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.42	1,081.6	$195.77	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Classroom 10	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 8	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 7	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 6	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 5	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 4	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 2	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 1	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.30	3,385.2	$612.72	21	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.11	Nurse's Office	2600	7	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.75	1,947.4	$352.48	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.11	Nurse's Office Toilet	2600	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.11	278.2	$50.35	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor Lobby - GYM	3000	26	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.61	4,836.0	$875.32	26	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor Room 2 - Room 29	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	2,232.0	$403.99	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor Room 17 - Café	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.74	2,232.0	$403.99	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
725	Exterior	4200	10	1	150w HPS Wallpack	125	1.25	5,250.0	$950.25	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
725	Exterior	4200	27	1	150w HPS Wallpack	125	3.38	14,175.0	$2,565.68	27	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
744	Exterior Parking	4200	8	1	250w MH "Shoe Box" Area Light	125	1.00	4,200.0	$760.20	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		1,440	438				257,168	$46,547	1,101	47			16.4	23,353	$7,710		$27,100	7.9	20,180	$3,653	7.42

CEG Job #:
Project: Montville Twp BOE
Address: 123 Changebridge Road
Montville, NJ
Building SF: 114,000

Lazar Middle School

KWH COST: $0.181

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Main Lobby	3000	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	1116	201.996	6	0	no change	62	0.37	0%	1116	$202.00	$0.00	$0.00	0.00	0	$0.00	0.00
231.33	Café	2600	64	3	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	86	5.504	14310.4	2590.1824	64	0	no change	86	5.50	0%	14310.4	$2,590.18	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	Café Storage # 1	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.058	58	10.498	1	0	no change	58	0.06	0%	58	$10.50	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	Café Storage #2	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.058	58	10.498	1	0	no change	58	0.06	0%	58	$10.50	$0.00	$0.00	0.00	0	$0.00	0.00
242.12	Kitchen	2600	11	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	1.177	3060.2	553.8962	11	0	no change	107	1.18	0%	3060.2	$553.90	$0.00	$0.00	0.00	0	$0.00	0.00
612	Kitchen JC	1000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.1	100	18.1	1	0	no change	100	0.10	0%	100	$18.10	$0.00	$0.00	0.00	0	$0.00	0.00
610	Kitchen Toilet	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312	56.472	1	0	no change	120	0.12	0%	312	$56.47	$0.00	$0.00	0.00	0	$0.00	0.00
242.12	Kitchen Closet	1000	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.214	214	38.734	2	0	no change	107	0.21	0%	214	$38.73	$0.00	$0.00	0.00	0	$0.00	0.00
242.12	Kitchen Dish Washer	2600	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.214	556.4	100.7084	2	0	no change	107	0.21	0%	556.4	$100.71	$0.00	$0.00	0.00	0	$0.00	0.00
612	Electrical Closet #2	1000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.1	100	18.1	1	0	no change	100	0.10	0%	100	$18.10	$0.00	$0.00	0.00	0	$0.00	0.00
612	Women's Toilet Room	2600	1	1	Pendant Mnt., 100w A19 Lamp	100	0.1	260	47.06	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	100	0.08	20%	208	$37.65	$150.00	$150.00	0.00	52	$9.41	15.94
242.12	Girl's Toilet Room	2600	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.214	556.4	100.7084	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.17	20%	445.12	$80.57	$150.00	$150.00	0.00	111.28	$20.14	7.45
242.12	Boy's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.107	278.2	50.3542	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.09	20%	222.56	$40.28	$150.00	$150.00	0.00	55.64	$10.07	14.89
231.33	Faculty Room	2600	20	3	1x4, 3 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	86	1.72	4472	809.432	20	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	1.38	20%	3577.6	$647.55	$300.00	$300.00	0.00	894.4	$161.89	1.85
612	Electrical Closet #6	1000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.1	100	18.1	1	0	no change	100	0.10	0%	100	$18.10	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Corridor Room 18 - Room 25	3000	15	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.93	2790	504.99	15	0	no change	62	0.93	0%	2790	$504.99	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	Classroom 26	2600	30	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	2.34	6084	1101.204	30	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	1.87	20%	4867.2	$880.96	$300.00	$300.00	0.00	1216.8	$220.24	1.36
222.21	Corridor Room 26 - Room 56	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	2232	403.992	12	0	no change	62	0.74	0%	2232	$403.99	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor Room 28 - Library	3000	27	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.674	5022	908.982	27	0	no change	62	1.67	0%	5022	$908.98	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Copy Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	322.4	58.3544	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$46.68	$150.00	$150.00	0.00	64.48	$11.67	12.85
232.21	Storage Room	1000	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.172	172	31.132	2	0	no change	86	0.17	0%	172	$31.13	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Boy's Toilet Room	2600	3	2	2x2, 2 Lamp, 34w T12 U-Tube, Mag. Ballast, Surface Mnt., Parabolic Lens	72	0.216	561.6	101.6496	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	72	0.17	20%	449.28	$81.32	$150.00	$150.00	0.00	112.32	$20.33	7.38
649	JC	1000	1	2	1x1 Surface Mount, Prismatic Lens, (2) 13w CFL Lamp	26	0.026	26	4.706	1	0	no change	26	0.03	0%	26	$4.71	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 32	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.212	Classroom 32	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.624	1622.4	293.6544	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.50	20%	1297.92	$234.92	$300.00	$300.00	0.00	324.48	$58.73	5.11
242.212	Electrical Closet #3	1000	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.208	208	37.648	2	0	no change	104	0.21	0%	208	$37.65	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Electrical Closet #3	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	62	11.222	1	0	no change	62	0.06	0%	62	$11.22	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Head Custodian 8	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.248	644.8	116.7088	4	0	no change	62	0.25	0%	644.8	$116.71	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Women's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.104	270.4	48.9424	1	0	no change	104	0.10	0%	270.4	$48.94	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Men's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.104	270.4	48.9424	1	0	no change	104	0.10	0%	270.4	$48.94	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Electrical Closet #4	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.104	104	18.824	1	0	no change	104	0.10	0%	104	$18.82	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Girl's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	322.4	58.3544	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$46.68	$150.00	$150.00	0.00	64.48	$11.67	12.85
227.211	Girl's Toilet Room	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	88.4	16.0004	1	0	no change	34	0.03	0%	88.4	$16.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Boy's Toilet Room	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	322.4	58.3544	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$46.68	$150.00	$150.00	0.00	64.48	$11.67	12.85
227.211	Boy's Toilet Room	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	88.4	16.0004	1	0	no change	34	0.03	0%	88.4	$16.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	JC 4	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	34	6.154	1	0	no change	34	0.03	0%	34	$6.15	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Boiler Room #3	2600	3	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.174	452.4	81.8844	3	0	no change	58	0.17	0%	452.4	$81.88	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 40	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4056	734.136	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.25	20%	3244.8	$587.31	$300.00	$300.00	0.00	811.2	$146.83	2.04
221.14	SAC Office	2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.116	301.6	54.5896	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.09	20%	241.28	$43.67	$150.00	$150.00	0.00	60.32	$10.92	13.74
242.22	GYM	2600	18	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.872	4867.2	880.9632	18	2	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.50	20%	3893.76	$704.77	$300.00	$600.00	0.00	973.44	$176.19	3.41
745	GYM	2600	28	1	250w MH LoBay w/Prismatic Lens	291	8.148	21184.8	3834.4488	28	2	Dual Technology Occupancy Sensor - Remote Mnt.	291	6.52	20%	16947.84	$3,067.56	$300.00	$600.00	0.00	4236.96	$766.89	0.78
111	Stage	2600	16	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.768	1996.8	361.4208	16	0	no change	48	0.77	0%	1996.8	$361.42	$0.00	$0.00	0.00	0	$0.00	0.00
242.33	Stage Storage	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	104	0.104	104	18.824	1	0	no change	104	0.10	0%	104	$18.82	$0.00	$0.00	0.00	0	$0.00	0.00
242.33	Stage Storage	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	104	0.104	104	18.824	1	0	no change	104	0.10	0%	104	$18.82	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	GYM Exit	3000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.186	558	100.998	3	0	no change	62	0.19	0%	558	$101.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Girl's Locker Room	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	109.1792	4	0	no change	58	0.23	0%	603.2	$109.18	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Girl's Locker Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.624	1622.4	293.6544	6	0	no change	104	0.62	0%	1622.4	$293.65	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
730	Girl's Locker Room Shower	2600	4	1	150w MH Flood	125	0.5	1300	235.3	4	0	no change	125	0.50	0%	1300	$235.30	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Girl's Locker Room Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.208	540.8	97.8848	2	0	no change	104	0.21	0%	540.8	$97.88	$0.00	$0.00	0.00	0	$0.00	0.00
100	Girl's Locker Room Toilet	2600	1	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.042	109.2	19.7652	1	0	no change	42	0.04	0%	109.2	$19.77	$0.00	$0.00	0.00	0	$0.00	0.00
121.16	Girl's Locker Room Toilet	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Clear Acrylic Lens	78	0.156	405.6	73.4136	2	0	no change	78	0.16	0%	405.6	$73.41	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Boy's Locker Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.624	1622.4	293.6544	6	0	no change	104	0.62	0%	1622.4	$293.65	$0.00	$0.00	0.00	0	$0.00	0.00
730	Boy's Locker Room Shower	2600	4	1	150w MH Flood	125	0.5	1300	235.3	4	0	no change	125	0.50	0%	1300	$235.30	$0.00	$0.00	0.00	0	$0.00	0.00
121.16	Boy's Locker Room Toilet	2600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Clear Acrylic Lens	78	0.078	202.8	36.7068	1	0	no change	78	0.08	0%	202.8	$36.71	$0.00	$0.00	0.00	0	$0.00	0.00
221.31	GYM Storage	1000	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	62	0.124	124	22.444	2	0	no change	62	0.12	0%	124	$22.44	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	GYM Office	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	322.4	58.3544	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$46.68	$150.00	$150.00	0.00	64.48	$11.67	12.85
242.31	GYM Electrical Room	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.107	107	19.367	1	0	no change	107	0.11	0%	107	$19.37	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Closet 40	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.186	186	33.666	3	0	no change	62	0.19	0%	186	$33.67	$0.00	$0.00	0.00	0	$0.00	0.00
242.31	Office 40	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.214	556.4	100.7084	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.17	20%	445.12	$80.57	$150.00	$150.00	0.00	111.28	$20.14	7.45
242.31	Classroom 43	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.963	2503.8	453.1878	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	0.77	20%	2003.04	$362.55	$300.00	$300.00	0.00	500.76	$90.64	3.31
227.211	Storage Room	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	34	6.154	1	0	no change	34	0.03	0%	34	$6.15	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 50	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 52	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	JC 5	1000	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	62	11.222	1	0	no change	62	0.06	0%	62	$11.22	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Electrical Closet #5	1000	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	62	11.222	1	0	no change	62	0.06	0%	62	$11.22	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Cumputer HUB	2600	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	322.4	58.3544	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$46.68	$150.00	$150.00	0.00	64.48	$11.67	12.85
242.22	Classroom 56	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
222.21	Classroom 56 Supplies	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.186	186	33.666	3	0	no change	62	0.19	0%	186	$33.67	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Classroom 56 Ceramics	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	161.2	29.1772	1	0	no change	62	0.06	0%	161.2	$29.18	$0.00	$0.00	0.00	0	$0.00	0.00
222.22	Electrical Closet	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.174	174	31.494	3	0	no change	58	0.17	0%	174	$31.49	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Storage Room	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	34	6.154	1	0	no change	34	0.03	0%	34	$6.15	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	JC	1000	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	62	11.222	1	0	no change	62	0.06	0%	62	$11.22	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Men's Toilet Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	27.2948	1	0	no change	58	0.06	0%	150.8	$27.29	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Women's Toilet Room	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.104	270.4	48.9424	1	0	no change	104	0.10	0%	270.4	$48.94	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Girl's Toilet Room	2600	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	322.4	58.3544	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$46.68	$150.00	$150.00	0.00	64.48	$11.67	12.85
221.34	Asst. Principal	2600	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.116	301.6	54.5896	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	58	0.09	20%	241.28	$43.67	$150.00	$150.00	0.00	60.32	$10.92	13.74
221.11	Asst. Principal Conference Room	2600	2	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	322.4	58.3544	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$46.68	$150.00	$150.00	0.00	64.48	$11.67	12.85
232.21	Office	2600	2	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.172	447.2	80.9432	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.14	20%	357.76	$64.75	$150.00	$150.00	0.00	89.44	$16.19	9.27
610	Women's Toilet Room	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312	56.472	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	120	0.10	20%	249.6	$45.18	$150.00	$150.00	0.00	62.4	$11.29	13.28

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
610	Women's Toilet Room	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312	56.472	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	120	0.10	20%	249.6	$45.18	$150.00	$150.00	0.00	62.4	$11.29	13.28
121.14	Boiler Room #2	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	73.4136	2	0	no change	78	0.16	0%	405.6	$73.41	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	Boiler Room #1	2600	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.39	1014	183.534	5	0	no change	78	0.39	0%	1014	$183.53	$0.00	$0.00	0.00	0	$0.00	0.00
613	Boiler Room #1	2600	1	1	Industrial Fixture, 100w A19 Lamp	100	0.1	260	47.06	1	0	no change	100	0.10	0%	260	$47.06	$0.00	$0.00	0.00	0	$0.00	0.00
613	Boiler Room #1	2600	1	1	Industrial Fixture, 100w A19 Lamp	100	0.1	260	47.06	1	0	no change	100	0.10	0%	260	$47.06	$0.00	$0.00	0.00	0	$0.00	0.00
3520	Boiler Room #1 Toilet	2600	1	1	Ceiling Mount White Globe, (2) 26w CFL Lamp	125	0.125	325	58.825	1	0	no change	125	0.13	0%	325	$58.83	$0.00	$0.00	0.00	0	$0.00	0.00
3520	JC 1	1000	1	1	Ceiling Mount White Globe, (2) 26w CFL Lamp	125	0.125	125	22.625	1	0	no change	125	0.10	20%	100	$18.10	$1.00	$0.00	0.00	25	$4.53	0.00
242.22	Guidance	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
242.22	Office #1	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
242.22	Office #2	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
242.22	Office #3	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
227.211	Guidance Copy Room	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	88.4	16.0004	1	0	no change	34	0.03	0%	88.4	$16.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Guidance Storage	1000	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	34	6.154	1	0	no change	34	0.03	0%	34	$6.15	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	GYM Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
222.21	GYM Toilet	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	161.2	29.1772	1	0	no change	62	0.06	0%	161.2	$29.18	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Faculty Toilet Room	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	161.2	29.1772	1	0	no change	62	0.06	0%	161.2	$29.18	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	GYM Corridor	3000	8	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.496	1488	269.328	8	0	no change	62	0.50	0%	1488	$269.33	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 41	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4056	734.136	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.25	20%	3244.8	$587.31	$300.00	$300.00	0.00	811.2	$146.83	2.04
242.22	Classroom 43	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 42	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4056	734.136	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.25	20%	3244.8	$587.31	$300.00	$300.00	0.00	811.2	$146.83	2.04
242.22	Classroom 42 Prep Room	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.416	1081.6	195.7696	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.33	20%	865.28	$156.62	$300.00	$300.00	0.00	216.32	$39.15	7.66
242.22	Classroom 44	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 45	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 47	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 46	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 48	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 49	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 50	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 51	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 52	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 53	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 54	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 57	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 56	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 59	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
242.22	Classroom 58	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.75	20%	1946.88	$352.39	$300.00	$300.00	0.00	486.72	$88.10	3.41
222.21	Classroom 58 Closet	1000	3	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.186	186	33.666	3	0	no change	62	0.19	0%	186	$33.67	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 60	2600	18	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.872	4867.2	880.9632	18	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.50	20%	3893.76	$704.77	$300.00	$300.00	0.00	973.44	$176.19	1.70
242.22	Classroom 62	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 64	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 65	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 63	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 61	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
227.211	Classroom 61	2600	1	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.034	88.4	16.0004	1	0	no change	34	0.03	0%	88.4	$16.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 61 Storage	1000	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.416	416	75.296	4	0	no change	104	0.42	0%	416	$75.30	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Corridor - Room 64 - Room 40	3000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.104	312	56.472	1	0	no change	104	0.10	0%	312	$56.47	$0.00	$0.00	0.00	0	$0.00	0.00
227.211	Corridor - Room 64 - Room 40	3000	22	2	2x2, 2 Lamp, 17w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	34	0.748	2244	406.164	22	0	no change	34	0.75	0%	2244	$406.16	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Corridor - Room 64 - Room 40	3000	26	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	2.704	8112	1468.272	26	0	no change	104	2.70	0%	8112	$1,468.27	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.212	Library	2600	54	2	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	58	3.132	8143.2	1473.9192	54	0	no change	58	3.13	0%	8143.2	$1,473.92	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Library	2600	23	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	1.334	3468.4	627.7804	23	0	no change	58	1.33	0%	3468.4	$627.78	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	Library Office #1	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
242.22	Library Office #2	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
242.22	Library Office #3	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	97.8848	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$78.31	$150.00	$150.00	0.00	108.16	$19.58	7.66
242.22	Library Closet	1000	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.104	104	18.824	1	0	no change	104	0.10	0%	104	$18.82	$0.00	$0.00	0.00	0	$0.00	0.00
221.33	Classroom 35	2600	20	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/ Indirect	58	1.16	3016	545.896	20	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.93	20%	2412.8	$436.72	$300.00	$300.00	0.00	603.2	$109.18	2.75
242.22	Classroom 33	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.624	1622.4	293.6544	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.50	20%	1297.92	$234.92	$300.00	$300.00	0.00	324.48	$58.73	5.11
242.22	Classroom 34	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.624	1622.4	293.6544	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.50	20%	1297.92	$234.92	$300.00	$300.00	0.00	324.48	$58.73	5.11
242.22	Classroom 31	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
221.33	Classroom 31 Lab	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Direct/ Indirect	58	0.348	904.8	163.7688	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.28	20%	723.84	$131.02	$300.00	$300.00	0.00	180.96	$32.75	9.16
222.21	Classroom 31 Closet	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	161.2	29.1772	1	0	no change	62	0.06	0%	161.2	$29.18	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 29	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 30	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 27	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
242.22	Classroom 28	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	587.3088	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.34	Classroom 25	2600	15	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.87	2262	409.422	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.70	20%	1809.6	$327.54	$300.00	$300.00	0.00	452.4	$81.88	3.66
221.34	Classroom 23	2600	15	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.87	2262	409.422	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.70	20%	1809.6	$327.54	$300.00	$300.00	0.00	452.4	$81.88	3.66
121.34	Classroom 24	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3042	550.602	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.94	20%	2433.6	$440.48	$300.00	$300.00	0.00	608.4	$110.12	2.72
121.34	Classroom 21	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3042	550.602	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.94	20%	2433.6	$440.48	$300.00	$300.00	0.00	608.4	$110.12	2.72
121.34	Classroom 22	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3042	550.602	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.94	20%	2433.6	$440.48	$300.00	$300.00	0.00	608.4	$110.12	2.72
221.11	Classroom 19	2600	9	2	1x4, 2 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.558	1450.8	262.5948	9	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.45	20%	1160.64	$210.08	$300.00	$300.00	0.00	290.16	$52.52	5.71
121.34	Classroom 20	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3042	550.602	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.94	20%	2433.6	$440.48	$300.00	$300.00	0.00	608.4	$110.12	2.72
121.34	Classroom 18	2600	24	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.872	4867.2	880.9632	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	1.50	20%	3893.76	$704.77	$300.00	$300.00	0.00	973.44	$176.19	1.70
121.34	Classroom 17	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	1.17	3042	550.602	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.94	20%	2433.6	$440.48	$300.00	$300.00	0.00	608.4	$110.12	2.72
121.34	Classroom 16	2600	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	0.078	202.8	36.7068	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.06	20%	162.24	$29.37	$300.00	$300.00	0.00	40.56	$7.34	40.86
121.14	Office 16 Office #1	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	73.4136	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.12	20%	324.48	$58.73	$150.00	$150.00	0.00	81.12	$14.68	10.22
121.14	Office 16 Office #2	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	73.4136	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.12	20%	324.48	$58.73	$150.00	$150.00	0.00	81.12	$14.68	10.22
121.14	Office 16 Office #3	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	73.4136	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.12	20%	324.48	$58.73	$150.00	$150.00	0.00	81.12	$14.68	10.22
121.14	Office 16 Office #4	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	73.4136	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.12	20%	324.48	$58.73	$150.00	$150.00	0.00	81.12	$14.68	10.22
121.14	Classroom 15	2600	15	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	1.17	3042	550.602	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.94	20%	2433.6	$440.48	$300.00	$300.00	0.00	608.4	$110.12	2.72
221.34	Classroom 13	2600	10	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.58	1508	272.948	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	58	0.46	20%	1206.4	$218.36	$300.00	$300.00	0.00	301.6	$54.59	5.50

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
121.14	Classroom 14	2600	16	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	1.248	3244.8	587.3088	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	1.00	20%	2595.84	$469.85	$300.00	$300.00	0.00	648.96	$117.46	2.55
121.14	Classroom 12	2600	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.234	608.4	110.1204	3	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.19	20%	486.72	$88.10	$300.00	$300.00	0.00	121.68	$22.02	13.62
242.11	Classroom 12	2600	2	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.214	556.4	100.7084	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	0.17	20%	445.12	$80.57	$300.00	$300.00	0.00	111.28	$20.14	14.89
242.22	Main Office	2600	9	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.936	2433.6	440.4816	9	0	no change	104	0.94	0%	2433.6	$440.48	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Main Office Copy Room	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.258	670.8	121.4148	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.21	20%	536.64	$97.13	$150.00	$150.00	0.00	134.16	$24.28	6.18
242.22	Principal Office	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.416	1081.6	195.7696	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.33	20%	865.28	$156.62	$150.00	$300.00	0.00	216.32	$39.15	7.66
222.21	Classroom 10	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
222.21	Classroom 8	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
222.21	Classroom 7	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
222.21	Classroom 6	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
222.21	Classroom 5	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
222.21	Classroom 4	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
222.21	Classroom 2	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
222.21	Classroom 1	2600	21	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.302	3385.2	612.7212	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.04	20%	2708.16	$490.18	$300.00	$300.00	0.00	677.04	$122.54	2.45
242.11	Nurse's Office	2600	7	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.749	1947.4	352.4794	7	0	no change	107	0.75	0%	1947.4	$352.48	$0.00	$0.00	0.00	0	$0.00	0.00
242.11	Nurse's Office Toilet	2600	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	107	0.107	278.2	50.3542	1	0	no change	107	0.11	0%	278.2	$50.35	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Corridor Lobby - GYM	3000	26	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.612	4836	875.316	26	0	no change	62	1.61	0%	4836	$875.32	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor Room 2 - Room 29	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	2232	403.992	12	0	no change	62	0.74	0%	2232	$403.99	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor Room 17 - Café	3000	12	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.744	2232	403.992	12	0	no change	62	0.74	0%	2232	$403.99	$0.00	$0.00	0.00	0	$0.00	0.00
725	Exterior	4200	10	1	150w HPS Wallpack	125	1.25	5250	950.25	10	0	no change	125	1.25	0%	5250	$950.25	$0.00	$0.00	0.00	0	$0.00	0.00
725	Exterior	4200	27	1	150w HPS Wallpack	125	3.375	14175	2565.675	27	0	no change	125	3.38	0%	14175	$2,565.68	$0.00	$0.00	0.00	0	$0.00	0.00
744	Exterior Parking	4200	8	1	250w MH "Shoe Box" Area Light	125	1	4200	760.2	8	0	no change	125	1.00	0%	4200	$760.20	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		1,440	438			125.3	333,763.0	$60,411	1,440	101			108.0		288,920.2	$52,294.56		$25,800	0.00	44,843	$8,117	3.18

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Lazar Middle School	32000	SHARP NU-U235F2	1280	17.5	22,452	300.80	347,589	243.0	53,632	13.40

.= Proposed PV Layout

Notes:

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

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	300.8 kW
DC to AC Derate Factor:	0.810
AC Rating:	243.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.39	18048	2021.38
2	3.17	21879	2450.45
3	4.07	30622	3429.66
4	4.83	33926	3799.71
5	5.70	40363	4520.66
6	5.94	39442	4417.50
7	5.77	39135	4383.12
8	5.38	36248	4059.78
9	4.65	31187	3492.94
10	3.61	25672	2875.26
11	2.35	16374	1833.89
12	2.01	14692	1645.50
Year	4.16	347589	38929.97

Project Name: **Montville BOE**
Location: **Woodmont School**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$1,844,044
Annual kWh Production	347,589
Annual Energy Cost Reduction	$62,914
Average Annual SREC Revenue	$71,026

Simple Payback: **13.77** Years

Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.181**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.204

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$0	0	0	0	$0	0	0	0	0
1	$0	347,589	$62,914	$0	$104,277	$108,515	$78,218	($19,543)	($19,543)
2	$0	345,851	$64,801	$0	$103,755	$103,691	$83,043	($18,177)	($37,720)
3	$0	344,122	$66,745	$0	$86,030	$98,569	$88,164	($33,958)	($71,677)
4	$0	342,401	$68,747	$0	$85,600	$93,131	$93,602	($32,385)	($104,063)
5	$0	340,689	$70,810	$3,509	$68,138	$87,358	$99,375	($51,295)	($155,357)
6	$0	338,986	$72,934	$3,492	$67,797	$81,228	$105,505	($49,493)	($204,851)
7	$0	337,291	$75,122	$3,474	$67,458	$74,721	$112,012	($47,627)	($252,478)
8	$0	335,604	$77,376	$3,457	$67,121	$67,813	$118,921	($45,693)	($298,171)
9	$0	333,926	$79,697	$3,439	$66,785	$60,478	$126,255	($43,690)	($341,861)
10	$0	332,257	$82,088	$3,422	$66,451	$52,691	$134,043	($41,616)	($383,477)
11	$0	330,595	$84,551	$3,405	$49,589	$44,423	$142,310	($55,998)	($439,475)
12	$0	328,942	$87,087	$3,388	$49,341	$35,646	$151,087	($53,693)	($493,168)
13	$0	327,298	$89,700	$3,371	$49,095	$26,327	$160,406	($51,310)	($544,478)
14	$0	325,661	$92,391	$3,354	$48,849	$16,434	$170,300	($48,847)	($593,325)
15	$0	324,033	$95,162	$3,338	$48,605	$5,930	$180,803	($46,303)	($639,629)
	Totals:	5,035,246	$1,170,125	$37,649	$1,028,893	$956,953	$1,844,044	($639,629)	($4,579,271)

Net Present Value (NPV) **($467,483)**

MONTVILLE TOWNSHIP
BOARD OF EDUCATION

VALLEY VIEW ELEMENTARY SCHOOL

30 MONTGOMERY AVENUE
MONTVILLE, NJ 07045

FACILITY ENERGY REPORT

TABLE OF CONTENTS

I. HISTORIC ENERGY CONSUMPTION/COST 2

II. FACILITY DESCRIPTION 7

III. MAJOR EQUIPMENT LIST 10

IV. ENERGY CONSERVATION MEASURES 11

V. ADDITIONAL RECOMMENDATIONS 54

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start® Program Incentives

Appendix C – Portfolio Manager "Statement of Energy Performance"

Appendix D – Major Equipment List

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

I. HISTORIC ENERGY CONSUMPTION/COST

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.

Electric Utility Provider:	Jersey Central Power and Light (JCP&L)
Electric Utility Rate Structure:	General Service Secondary Three-Phase
Third Party Supplier:	None

Natural Gas Utility Provider:	New Jersey Natural Gas
Utility Rate Structure:	General Service Large (GSL)
Third Party Supplier:	Amerada HESS

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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

Description	Average
Electricity	16.5¢ / kWh
Natural Gas	$1.19 / Therm

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Jersey Central Power & Light
Rate: GSS 3 Phase
Meter No: G117891442
Account # 110007497850
Third Party Utility Provider: N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Aug-10	34,800	172	$6,442
Sep-10	50,800	170	$8,576
Oct-10	43,920	184	$7,416
Nov-10	46,480	145	$7,765
Dec-10	37,840	142	$6,414
Jan-11	50,780	132	$8,183
Feb-11	46,640	146	$7,561
Mar-11	50,160	131	$7,587
Apr-11	41,760	153	$6,693
May-11	50,640	176	$8,279
Jun-11	34,720	163	$5,766
Jul-11	45,280	167	$7,202
Totals	**533,820**	**184 Max**	**$87,884**

AVERAGE DEMAND **156.8 KW average**
AVERAGE RATE **$0.165** **$/kWh**

Figure 1
Valley View Elementary School
Electric Usage Profile
August - 10 through July - 11

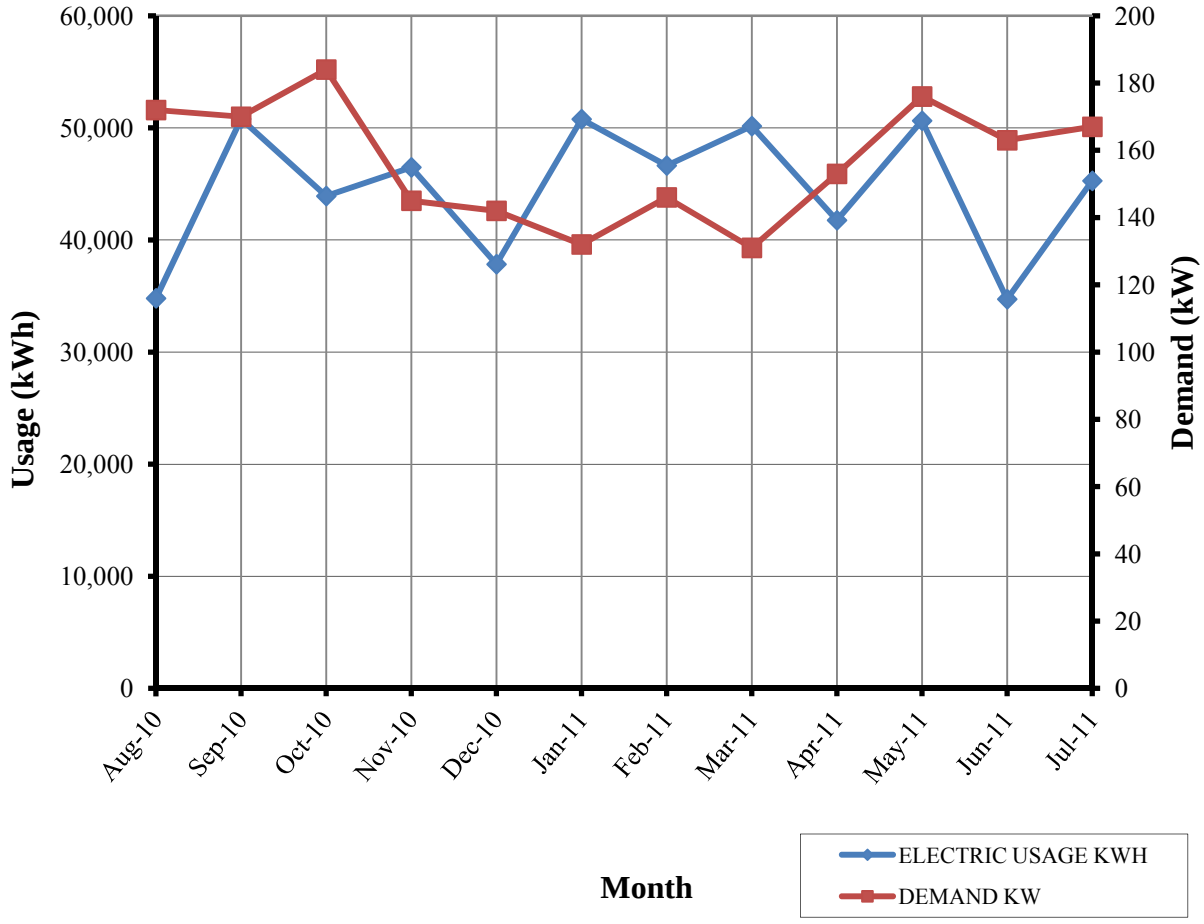
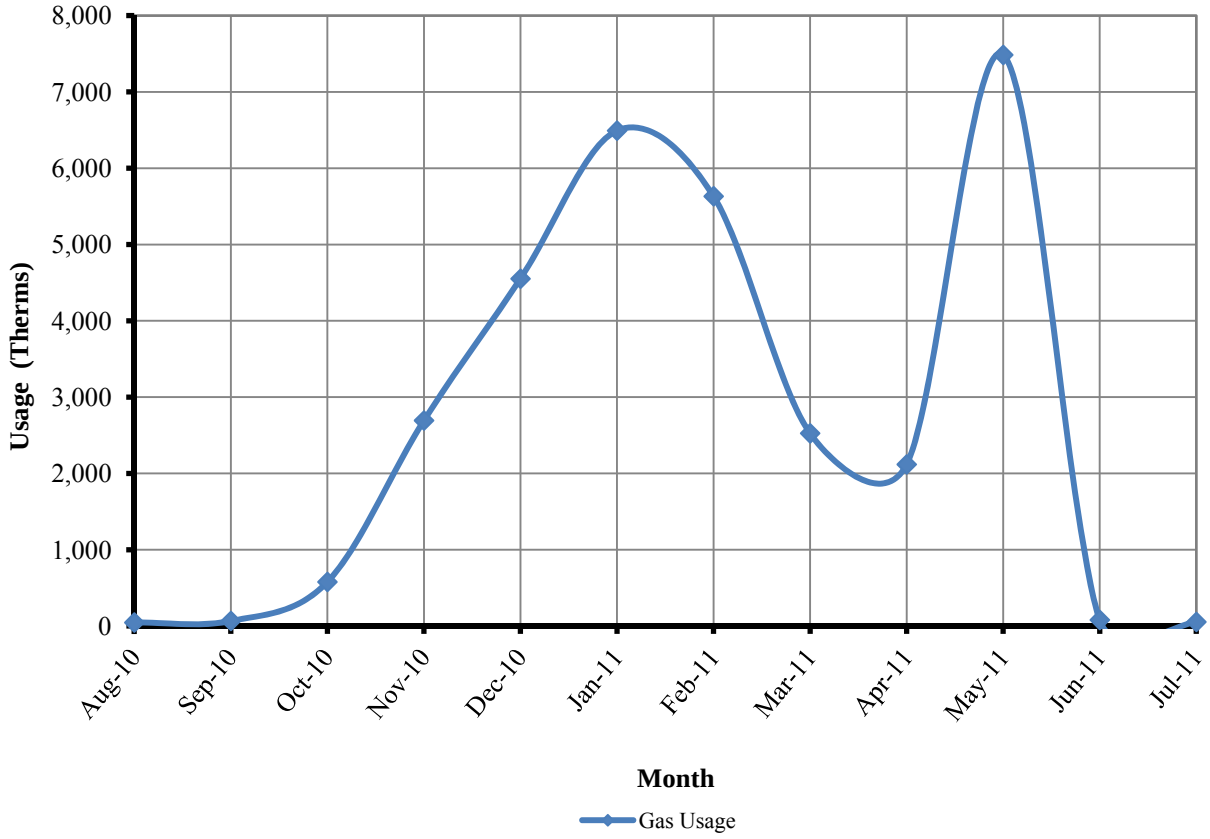


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: New Jersey Natural Gas		
Rate: GSL		
Meter No: 810929		
Point of Delivery ID: 04-1219-3823-19		
Third Party Utility Provider: Amerada Hess		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Aug-10	47	$532
Sep-10	67	$547
Oct-10	579	$1,067
Nov-10	2,694	$3,213
Dec-10	4,552	$5,172
Jan-11	6,493	$7,186
Feb-11	5,633	$6,292
Mar-11	2,526	$3,088
Apr-11	2,119	$2,668
May-11	7,485	$7,989
Jun-11	81	$303
Jul-11	55	$538
TOTALS	**32,331**	**$38,595**
AVERAGE RATE:	**$1.19**	**$/THERM**

Figure 2
Valley View Elementary School
Gas Usage Profile
August - 10 through July - 11



II. FACILITY DESCRIPTION

The 55,000 SF Valley View Elementary School is a two (2) story facility comprised of classrooms, media center, cafeteria, kitchen, gymnasium, administration office, restrooms, boiler rooms, and storage closets. The School was built in 1973 with several renovations over the years and an addition in 2000. The addition consists primarily of the school cafeteria and three classrooms.

Building Profile

The school hours are between 8:20 AM and 2:50 PM on the weekdays. The teachers start arriving several hours before the classes. The school remains open till 6:00 PM in the evening for after school activities. The gymnasium, cafeteria and library are used after hours for sports and other events during the weekdays and weekends.

The student enrollment at the Valley View Elementary School School is approximately 407. Estimated total number of staff is 75.

Building Envelope

The exterior of the buildings consists of block construction with brick façade. Estimated insulation within the walls is 1". The original structure roof consists of a flat built up style roof with an estimated 1 inch rigid insulation below the asphalt sheathing. The cafeteria roof is constructed similarly and has a rubber covering. Majority of the HVAC equipment are located on the roof of this facility. Windows throughout the facility consists of operable, double pane windows with aluminum frames. The windows are in good condition.

HVAC Systems

Heating is provided to the facility from a hot water boiler room housing two (2) firetube, gas fired hot water boilers made by Cleaver Brooks. Each boiler has an input capacity of 2,930 MBH. The boilers were installed in 1973 and they appear to be in poor condition. The boiler water is circulated throughout the facility by six (6) constant speed pumps driven by 1.5, 2 and 7.5 HP motors. The pumps are driven with standard efficiency motors. There are a total of five (5) heating zones in the facility. The boilers provide heating hot water to the hot water baseboard heaters, unit ventilators, heating and ventilation units and rooftop units.

Terminal heating equipment for the classrooms and the perimeter offices consists of unit ventilators made by AAF – Herman Nelson in combination with hydronic baseboard heaters. These units serve the classrooms throughout the original section of the school. The unit ventilators are original to the facility and appear to be in poor condition. The unit ventilators are controlled by the building pneumatic system. Majority of the unit ventilator controls are functioning with low accuracy due to older controls, valves, dampers and actuators. As a result of these issues, some of the classrooms suffer overheating.

Three (3) newer classrooms in the added section utilize unit ventilators made by Trane. Each classroom has a dedicated unit ventilator with hot water heating coils and direct expansion

cooling coils. The unit ventilators are coupled with 3.5 ton Trane split condensing units. Heat is provided by hot water heating coils fed from the boiler room. New Trane units are in good condition and appear to be maintained well.

In addition to the unit ventilators, several spaces utilize packaged rooftop heating and air conditioning units. The Media Room in the first floor and four (4) classrooms in the second floor core are conditioned with two (2) multi-zone HVAC units made by Seasons 4. Multi zone units are approximately 5 years old and appear to be in good condition. A separate 10-ton packaged rooftop AC unit serves the main office, nurse's office, copy room and the faculty lounge in the first floor. The rooftop unit is approximately 5 years old and appears to be in good condition. In addition, a 15-ton packaged rooftop AC unit serves the cafeteria. The unit is approximately 10 years old and appears to be in good condition. AC-1, AC-2 and the rooftop units are equipped with hot water coils for supply air heating.

Exhaust System

The air is exhausted from the hallways and corridors via dedicated exhaust fans located on the roof. It was reported that the fans are interconnected to the HVAC equipment and scheduled to shut off based on occupancy. However, it is recommended to confirm this operation.

HVAC System Controls

The HVAC systems in this facility are controlled via two separate control systems.

The unit ventilators in the original building are controlled via the original pneumatic control system. The old and outdated pneumatic controllers and actuators for the unit ventilators are deteriorated and do not function properly. It is recommended to upgrade the original pneumatic controls to a state of the art DDC control system to enhance comfort conditions in the classrooms and increase energy efficiency.

Three (3) new section unit ventilators, the split condensers, the cafeteria AC unit, the Cleaver Brooks boilers and the pumps are controlled via a DDC Building Management System (BMS) made by Honeywell. The BMS provides control over the equipment and consists of time of day scheduling and temperature set-points for the spaces. Each classroom is equipped with a thermostat with limited override capability. The digital control system appears to be providing adequate control for conditioning of the building and occupant comfort. The BMS currently does not have optimal start/stop controls.

The rooftop air conditioning units are controlled via pneumatic thermostats. The multi-zone HVAC units are controlled via the DDC system but the zone dampers are controlled via pneumatic thermostats located in each zone.

Domestic Hot Water

Domestic hot water for the facility is provided with tank type domestic hot water heater. The unit is an 81 gallon gas fired domestic hot water heater with 154 MBH input capacity. The gas fired

hot water heater is made by AO Smith and installed in 2000. Domestic hot water is circulated throughout the spaces via a circulator. The circulator is connected to an aqua-stat.

Lighting

Typical lighting throughout the building is fluorescent tube fixtures with T8 lamps and electronic ballasts. There are a number of spaces with older fluorescent fixtures with magnetic ballasts and incandescent lamps. A space by space breakdown of the lighting throughout the facility is provided in the **Investment Grade Lighting Appendix**.

III. 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.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 3
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	General Lighting Equipment Upgrade	$3,560	$589	6.0	148%
ECM #2	General Lighting Controls Upgrade	$9,500	$3,500	2.7	453%
ECM #3	Gymnasium Lighting Equipment and Controls	$3,995	$507	7.9	281%
ECM #4	Automatic Computer Stand-by / Hibernate	$125	$382	0.3	2956%
ECM #5	NEMA Premium Efficiency Motors	$3,762	$144	26	-42%
ECM #6	Unit Ventilators with Energy Recovery	$308,000	$6,684	46	-67%
ECM #7	DDC Control System Expansion	$115,000	$7,088	16	-8%
ECM #8	Water Efficiency	$41,883	$1,634	26	-41%
ECM #9	CRT Monitor Upgrades	$14,160	$1,799	7.9	27%
ECM #10	Multi-zone Rooftop Units - VAV Conversion	$72,675	$1,853	39	-62%
ECM #11	Install VFDs for Hot Water Pumps	$18,000	$862	21	-28.1%
ECM #12	Install High Efficiency Condensing Boilers	$249,000	$6,767	37	-18.5%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	139 KW Solar System	$844,155	$59,374	14.2	5.5%

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

Table 4
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
ECM #1	General Lighting Equipment Upgrade	1.5	3,490	-
ECM #2	General Lighting Controls Upgrade	-	21,214	-
ECM #3	Gymnasium Lighting Equipment and Controls	0.6	1,560	-
ECM #4	Automatic Computer Stand-by / Hibernate	-	2,315	-
ECM #5	NEMA Premium Efficiency Motors	0.4	874	-
ECM #6	Unit Ventilators with Energy Recovery	-	4,741	4,959
ECM #7	DDC Control System Expansion	-	26,691	2,255
ECM #8	Water Efficiency	-	-	335
ECM #9	CRT Monitor Upgrades	-	10,903	-
ECM #10	Multi-zone Rooftop Units - VAV Conversion	4.2	4,842	886
ECM #11	Install VFDs for Hot Water Pumps	-	5,226	-
ECM #12	Install High Efficiency Condensing Boilers	-	-	5,267
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	139 KW Solar System	112.7	160,760	-

Table 5
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
General Lighting Equipment Upgrade	$589	$3,740	$180	$3,560	6.0
General Lighting Controls Upgrade	$3,500	$10,800	$1,300	$9,500	2.7
Gymnasium Lighting Equipment and Controls	$507	$4,600	$605	$3,995	7.9
Automatic Computer Stand-by / Hibernate	$382	$125	$0	$125	0.3
NEMA Premium Efficiency Motors	$144	$3,942	$180	$3,762	26
~~Unit Ventilators with Energy Recovery~~	~~$6,684~~	~~$308,000~~	~~$0~~	~~$308,000~~	~~46~~
DDC Control System Expansion	$7,088	$115,000	$0	$115,000	16
~~Water Efficiency~~	~~$1,634~~	~~$41,883~~	~~$0~~	~~$41,883~~	~~26~~
CRT Monitor Upgrades	$1,799	$14,160	$0	$14,160	7.9
~~Multi-zone Rooftop Units - VAV Conversion~~	~~$1,853~~	~~$75,000~~	~~$2,325~~	~~$72,675~~	~~39~~
Install VFDs for Hot Water Pumps	$862	$18,000	$0	$18,000	21
~~Install High Efficiency Condensing Boilers~~	~~$6,767~~	~~$255,000~~	~~$6,000~~	~~$249,000~~	~~37~~
Design / Construction Extras (15%)	*$0*	*$26,995*	*$0*	*$26,995*	
Total Project	**$16,506**	**$239,245**	**$2,265**	**$236,980**	**14.4**

ECMs marked with strikethrough font are not included in total.
Design / Construction Extras is shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the Valley View Elementary School is primarily made up of fluorescent fixtures with T8 lamps and electronic ballasts. Only select locations still have T12 lamps with magnetic ballasts.

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

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

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

Retrofit fluorescent T12 lamps and magnetic ballast with T5 or T8 lamps w/electronic ballast (1-4 lamp retrofitted) = $10 per fixture.

$$\text{Smart Start®}\ \textit{Incentive} = \left(\#\ \textit{of}\ 1-4\ \textit{lamp fixtures retrofitted} \times\ \$10\right)$$
$$\text{Smart Start®}\ \textit{Incentive} = \left(18 \times\ \$10\right) = \underline{\$180}$$

From the Smart Start Incentive appendix, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Replacement and Maintenance Savings:

Replacement and Maintenance Savings are calculated as follows:

Savings = (Reduction in lamps replaced/year) x (Replacement $/lamp + Labor $/lamp)

Savings = 1.87 x ($2/lamp + $5/lamp) = $13

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,740
NJ Smart Start Equipment Incentive ($):	$180
Net Installation Cost ($):	$3,560
Maintenance Savings ($/Yr):	$13
Energy Savings ($/Yr):	$576
Total Yearly Savings ($/Yr):	$589
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.0
Simple Lifetime ROI	148.1%
Simple Lifetime Maintenance Savings	$197
Simple Lifetime Savings	$8,833
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$3,470.22

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

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

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

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

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

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

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

Energy Savings Calculations:

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

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

Incentives:

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

Occupancy Sensor Fixture Mounted (existing facility only) = $20 per sensor
Occupancy Sensor Remote Mounted (existing facility only) = $35 per sensor

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,800
NJ Smart Start Equipment Incentive ($):	$1,300
Net Installation Cost ($):	$9,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,500
Total Yearly Savings ($/Yr):	$3,500
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.7
Simple Lifetime ROI	453%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$52,500
Internal Rate of Return (IRR)	36%
Net Present Value (NPV)	$32,283

ECM #3: Gymnasium Lighting Equipment and Controls Upgrade

Description:

The Gymnasium at Valley View School utilizes 250W metal halide fixtures for its lighting. Metal halide bulbs provide a reasonably efficient option for bay lighting however a few drawbacks that are common. Metal halide fixtures often have poor overall efficacy which limits the amount of light actually leaving the fixture. Also metal halide bulbs require a significant warm-up period and even longer cool down period eliminating the potential for occupancy sensors frequent switching. This symptom encourages the gymnasium lighting to be left on continuously during the day. Another drawback is the reduced lumen output (Lumen Maintenance) of the metal halide bulb over its life time. Average bulb output or "mean lumens," is approximately 25% less than the bulb's initial lumens for typical metal halide lamps. In addition the most rapid rate of light output decline is during the beginning of its life, approximately 15-20% light loss within the first 20% of its rated life. It is important to note that the light loss has no savings in energy used; therefore the overall light efficiency is continuously decreasing with age. The final drawback is the light quality or Color Rendering Index (CRI). Typical values for metal halide bulbs is 65, which is a measure of how close the light is to true "full spectrum" light produced by sunlight or incandescent lighting. Metal halide bulbs also show noticeable color shifting when the bulb is reaching the end of its life. Utilizing fluorescent fixtures in low and high bay spaces is a superior option over metal halide fixtures in all areas described above. Although metal halide fixtures provide light very efficiently at the start of the bulb life, the average efficiency over the life is below that of fluorescent fixtures.

This ECM includes replacement of each of the existing gymnasium high bay metal halide light fixtures with T5HO fixtures with reflective lenses. The retrofit for the metal halide fixtures includes a one for one fixture replacement. The fluorescent fixtures selected will provide equivalent light compared to the average light output of the existing metal halide fixtures. The bulb replacement cost for T-5 HO lamps compared to the existing metal halide lamps were found to be approximately equal and therefore not included in the savings calculations.

This ECM also includes installation of occupancy sensors for the proposed fluorescent gymnasium light fixtures. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives

Metal Halide Fixtures

From the **Smart Start Incentive Appendix**, the following incentives are warranted:
For replacement of HID (250-399W) with new T-5 or T-8 fixtures = $50/Fixture

$$\text{Smart Start ® Incentive} = (\#\text{ of Metal Halide Fixture Replaced} \times \$50)$$

$$\text{Smart Start ® Incentive} = (10 \times \$50) = \$500$$

Occupancy Sensors

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

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

$$\text{Smart Start ® Incentive} = (3 \times \$35) = \$105$$

There is no significant replacement or maintenance savings generated with this ECM.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$4,600
NJ Smart Start Equipment Incentive ($):	$605
Net Installation Cost ($):	$3,995
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$507
Total Yearly Savings ($/Yr):	$507
Estimated ECM Lifetime (Yr):	30
Simple Payback	7.9
Simple Lifetime ROI	280.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$15,212
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$5,943.95

ECM #4: Set Computers to Automatic Stand-by or Hibernate Modes

Description:

During the survey, it was noticed that the majority of the computers were left at ON position with the monitors at Screen Saver or OFF positions. According to interviews with some of the personnel, the computers require significant amount of time to boot up therefore they are typically left ON.

Many personal computers (PC) came equipped with automatic Stand-by or Hibernate (power down) features. Normally computers boot up from Stand-by or Hibernate modes much faster than powering up from Shut Down position.

Based on an independent study by the U.S. Department of Energy, Energy star® rated computers use approximately 70% less power during Stand-by Mode. It is recommended to set up the PCs at this facility to switch into Stand-by Mode after a short period of inactivity and Hibernate mode after a long period of inactivity.

This ECM includes configuring the computers in the classrooms and the library such that they automatically:

- Stand-by after 15 minutes of inactivity
- Hibernate after 60 minutes of inactivity

The inactivity times above can be adjusted based on experience or preference. Even though this ECM can be implemented easily in house, the calculations assume an independent computer technician performing the task at a typical market rate.

Energy Savings Calculations:

No. of CRT Monitors:	15
Operating Weeks per Yr:	42
Estimated percentage of computers left ON over night:	75%

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

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

The cost of configuring the computers to automatically sleep or hibernate is based on 10 minutes per computer per technician at an hourly rate indicated below.

Implementation Costs: = # Computers X Configuration Time X Cost per Hour
= 15 Monitors X 10 Minutes/Computer X $100 per Hour

= $125

AUTOMATIC SLEEP OR HIBERNATE MODES FOR COMPUTERS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Manual Operation	Auto Power Save	-
# of Computers	15	15	-
% Computers left ON	75%	75%	-
Power when left ON (Watt)	50	50	-
Power at Stand-by (Watt)	5	5	-
Power at Hibernate (Watt)	4	4	-
Power when OFF (Watt)	0	0	-
Operating Weeks per Yr	42	42	-
Operating Hours per Week	168	168	-
Hours/Wk Computers ON	120	20	-
Hours/Wk at Sleep Mode	0	20	-
Hours/Wk at Hibernate Mode	0	80	-
Hours/Wk at Power Down	48	48	-
Elec Cost ($/kWh)	0.165	0.165	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	2,835	520	2,315
Energy Cost ($)	$468	$86	$382
COMMENTS:	Calculation assumes computers currently run throughout work week and get shut down over the weekend.		

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$125
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$125
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$382
Total Yearly Savings ($/Yr):	$382
Estimated ECM Lifetime (Yr):	10
Simple Payback	0.3
Simple Lifetime ROI	2956.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,820
Internal Rate of Return (IRR)	306%
Net Present Value (NPV)	$3,133.68

ECM #5: Install NEMA Premium® Efficiency Motors

Description:

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

The school has a number of motors that are candidates to be replaced with NEMA Premium® efficiency motors. The motors are located in the boiler room which serves the hot water loop and zone loops.

Boiler operating hours were estimated based on hours of operation obtained from the school. The pumps operate in pairs with one pump on standby; this reduces the overall operating hours of each pump individually by approximately 50%.

This energy conservation measure replaces the existing lower efficiency electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today. The energy savings and payback are subject to change based on the pool filtration usage during the year. An implementation summary of the motor is provided below.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
P - 3	Zone Pump	7.5	2,190	88.5%	91.7%
P - 4	Zone Pump	7.5	2,190	88.5%	91.7%

Energy Savings Calculations:

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

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

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

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

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

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	**MOTOR HP**	**LOAD FACTOR**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**POWER SAVINGS kW**	**ENERGY SAVINGS kWH**	**COST SAVINGS**
P - 3	7.5	90%	88.5%	91.7%	0.20	437	$72
P - 4	7.5	90%	88.5%	91.7%	0.20	437	$72
TOTAL					**0.4**	**874**	**$144**

Equipment Cost and Incentives

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

INCENTIVES	
HORSE POWER	**NJ SMART START INCENTIVE**
1	$45
1.5	$45
2	$54
3	$54
5	$54
7.5	$81
10	$90
15	$104
20	$113
25	$117
30	$135
40	$162

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

MOTOR REPLACEMENT SUMMARY						
EQMT ID	**MOTOR POWER HP**	**INSTALLED COST**	**SMART START INCENTIVE**	**NET COST**	**TOTAL SAVINGS**	**SIMPLE PAYBACK**
P - 3	7.5	$1,971	$90	$1,881	$72	26.1
P - 4	7.5	$1,971	$90	$1,881	$72	26.1
TOTAL		**$3,942**	**$180**	**$3,762**	**$144**	**26.1**

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,942
NJ Smart Start Equipment Incentive ($):	$180
Net Installation Cost ($):	$3,762
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$144
Total Yearly Savings ($/Yr):	$144
Estimated ECM Lifetime (Yr):	15
Simple Payback	26.1
Simple Lifetime ROI	-42.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,164
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	($2,039.78)

ECM #6: Install Unit Ventilators with Energy Recovery

Description:

The heating and air conditioning for the classrooms in the original section of the School are provided by AAF - Herman Nelson unit ventilators, which are original to the building. The unit ventilators are over 30 years old and far beyond the end of expected useful service life, which is fifteen (15) years per ASHRAE.

The estimated total number of older unit ventilators in this facility is 22. The units are heating only and controlled with pneumatic controllers and actuators. It is recommended to replace older unit ventilators with modern unit ventilators with energy recovery wheels. The advantage of this setup is the utilization of the energy recovery system to recover the energy in the exhaust air in order to reduce the heating and cooling demand of the classrooms.

This ECM replaces existing older unit ventilators with new unit ventilators with hot water heating coils and built-in energy recovery wheels. The basis for this ECM is Trane HUVC series unit ventilator with corresponding Energy Recovery ventilators. The ECM also includes attaching the unit ventilator controls to the Building Energy Management System to achieve superior scheduling and controls.

Energy Savings Calculations:

The energy savings calculations are based reduction of the outside air heating, reduction of the overheating and infiltration due to opening of the windows and temperature setback during nights and weekends.

Nominal recovery capacity of the proposed unit is calculated based on typical outside air percentage, heating degree days and design day temperature difference. Total energy recovery of each unit at heating modes is calculated using heating degree days:

$$\text{Heating Energy Recovered}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Recovery Rate}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}(\text{Day }^{\circ}\text{F})\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times(0.60)}{65(^{\circ}\text{F})\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\,(\%)}$$

Amount of addition infiltration at each classroom due to open windows:

$$\text{Infiltration}\left(\text{BTU/Hr}\right)=\frac{\text{Ave Classroom Size (SF)}\times 10'\text{ Ceiling}\times\frac{\text{\# Air Changes}}{\text{Hr}}}{\frac{\text{60 Minutes}}{\text{Hr}}}\times 1.08\times 65°\text{F}$$

$$\text{Infiltration Energy}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Infiltration}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}\left(\text{Day }°\text{F}\right)\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times\left(0.60\right)}{65\left(°\text{F}\right)\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency }(\%)}$$

Fan Energy Cost:

$$\text{Fan Energy, kWh}=\frac{\text{Fan Power (HP)}\times\frac{0.746\text{kW}}{\text{HP}}\times 0.8\text{ (Load Factor)}\times\text{Annual Hrs}}{0.9\text{ (Power Factor)}}$$

Results of the calculations can be found in the table below:

UNIT VENTILATOR CALCULATIONS			
ECM INPUTS	**EXISTING UNITS**	**PROPOSED UNITS**	**SAVINGS**
ECM INPUTS	Existing Unit Ventilators UVs	New UVs with ERVs	
Number of Units	22	22	-
Ave. Unit Flow Capacity (CFM)	1250	1250	
Outside Air %	30%	30%	
Outside Air Flow (CFM)	375	375	
Heating Design Day Temp. Diff (°F)	65	65	
Average Classroom Size (SF)	1000	1000	
Additional Air Changes per Hour*	2	0	
Infiltration (CFM)	333	0	
Windows Open Hours/Day	2	0	
Infiltration Energy Loss (MBH/Unit)	23.4	0	
Heating Energy Recovery, MBH/Unit	-	26.3	26.3
ERV Operation Hours / Day	-	12	-
Supply Fan Motor HP	1/3	1/4	0
Fan Annual Hours of Operation	1560	780	780
Heating Degree Days	4713	4713	-
Net Heating System Efficiency	70%	70%	-
Electric Cost ($/KWH)	$0.165	$0.165	0.165
Natural Gas Cost ($/Therm)	$1.19	$1.19	$1.19
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED UNITS**	**SAVINGS**
Fan Energy (kWh)	7,586	2,845	4,741
Heating Energy Infiltration (Therms)	640	0	640
Heating Energy Recovery (Therms)	0	-4,319	4,319
Fan Energy Cost ($)	$1,252	$469	$782
Infiltration Energy Cost ($)	$761	$0	$761
Heating Energy Recovered ($)	$0	-$5,140	$5,140
Total ($)	$2,013	-$4,671	$6,684
COMMENTS:	* Due to open windows and overheating		

Project cost, incentives and maintenance savings:

Total installed cost for 22 unit ventilators with hot water coils, energy recovery ventilators (ERV) and controls upgrade is $308,000

The selected equipment does not qualify for any of the NJ Smart Start rebates.

There is no significant maintenance savings associated to this ECM.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$308,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$308,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$6,684
Total Yearly Savings ($/Yr):	$6,684
Estimated ECM Lifetime (Yr):	15
Simple Payback	46.1
Simple Lifetime ROI	-67.4%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$100,255
Internal Rate of Return (IRR)	-12%
Net Present Value (NPV)	($228,210.45)

ECM #7: DDC System Upgrades

Description:

Valley View Elementary School is currently controlled primarily through the use of pneumatic control systems. CE recommends expanding the DDC system to control remaining HVAC systems in the school including the air handling units, unit ventilators, wall thermostats, air conditioning units, rooftop units, and boilers. In addition the existing control systems will be unified under one system allowing easier operation for building facility management personnel.

This ECM includes expansion of the existing Building Automation system to include control of the rest of the HVAC equipment in the facility. The system will include new temperature sensors and new local thermostats with limited over-ride capability, a front end computer and main controller. The system will also include central controls for lighting. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the building may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. 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 referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 5% of the electricity and 15% for the gas utility in this building.

The basis for the DDC system expansion is the Automated Logic Energy Management System or similar.

Energy Savings Calculations:

Since some of the key utility consumption and cost information was not available, estimated values are used for the unit cost of natural gas, total electricity usage and unit cost of electricity.

Energy savings for each utility is calculated with the equation below.

Energy Savings (Utility) = Current Energy Consumption × Estimated Savings, %

Following table summarizes energy savings for this facility via implementation of an Energy Management System:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Pneumatic and partial DDC Controls	Full DDC Controls	
Existing Nat Gas Usage (Therms)	15,035	-	
Existing Electricity Usage (kWh)	533,820	-	
Energy Savings, Nat. Gas	-	15%	
Energy Savings, Electricity	-	5%	
Gas Cost ($/Therm)	*$1.19*	$1.19	
Electricity Cost ($/kWh)	*$0.165*	$0.165	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	15,035	12,780	2,255
Electricity Usage (kWh)	533,820	507,129	26,691
Natural Gas Cost ($)	$17,892	$15,208	$2,684
Electricity Cost ($)	$88,080	$83,676	$4,404
Energy Cost ($)	$105,972	$98,884	$7,088
COMMENTS:			

Demand savings due to implementation of this ECM is minimal.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $2.00 - $2.50 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = $115,000

Currently, there are no prequalified NJ Smart Start Incentives for installation of the DDC system.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$115,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$115,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$7,088
Total Yearly Savings ($/Yr):	$7,088
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.2
Simple Lifetime ROI	-7.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$106,320
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($30,383.92)

ECM #8: Water Efficiency & Conservation

Description:

The facility utilizes standard plumbing fixtures. The typical water closet and urinal water consumption only meet the minimum federally required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the replacement of the existing sink faucets, water closets and urinals within the bathrooms the facility. The estimated usage of the plumbing fixtures is based on the total population of the facility.

The proposed retrofit includes installation of auto flow sink faucets, low flow aerators, low flow flushometer style water closets that utilize 1.28 gallons per flush and ultra-low flushometer style urinals that utilize 1/8 gallons per flush. For the basis of this calculation the LEED rating system was used to estimate the occupancy usage for students within the school. When water consumption information was not available, the GPF values were estimated for the existing fixtures.

Energy Savings Calculations:

Urinals and Toilets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Flush}}{\text{Person per Day}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Flush}}\right)$$

Faucets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Use}}{\text{Person per Day}}\right) \times \text{Use Time}\left(\frac{\text{Sec}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Water Cost} = \frac{\text{Water Consumption (Gallons)} \times \text{Ave Cost}\left(\frac{\$}{1000\,\text{Gal}}\right)}{1000(\text{Gal})}$$

$$\text{Gas Cost (Therms)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.34\,\text{BTU}}{\text{Gal}} \times \frac{\text{Therm}}{100{,}000\,\text{BTU}}$$

WATER CONSERVATION CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Fixtures	Low Flow / Auto Flow Fixtures	-
Total Number of Students	500	500	-
% Male to Female	50%	50%	-
Estimated % Floor Area Served by Older Bathrooms	100%	100%	-
Occupied Days Per Year	195	195	-
Lavatory Uses per Day per Person	3	3	-
Sink flow time per use, sec	15	12	-
Sink Aerator Flow, GPM	1.5	0.5	-
WC Uses per Day per Person	2.0	2.0	-
Urinal Uses per Day per Person	1.0	1.0	-
Total Urinal Flushes Per Day	250	250	-
Total WC Flushes Per Day	500	500	-
Urinal Gallons Per Flush (GPF)	1.0	0.125	0.875
WC Gallons Per Flush (GPF)	1.6	1.28	0.32
**** Water Cost ($/1000 Gal)**	$8.00	$8.00	-
Gas Cost ($/Therm)	$1.19	$1.19	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Water Consumption, Urinal and WC (Gal)	204,750	130,894	73,856
Water Consumption, Faucets (Gal)	109,688	29,250	80,438
Total Water Consumption, (Gal)	314,438	160,144	154,294
Water Cost ($)	$2,516	$1,281	$1,234
Gas Consumption (Therms)	457	122	335
Gas Cost ($/Year)	$544	$145	$399
Total Savings ($/Year)	-	-	$1,634
COMMENTS:	*Savings are based on LEED Reference Guide for Green Building Design and Construction - 2009 Edition for WC and Urinal water usage. ** Cost of Water estimated.		

The cost for installation and materials of water closets, low flow urinals and new auto flow sink faucets throughout the facility is estimated to be $34,345.

There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$41,883
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$41,883
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,634
Total Yearly Savings ($/Yr):	$1,634
Estimated ECM Lifetime (Yr):	15
Simple Payback	25.6
Simple Lifetime ROI	-41.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$24,510
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	($22,376.41)

ECM #9: Computer Monitor Replacement

Description:

The computers throughout the facility utilize a mixture of CRT computer monitors and LCD computer monitors. The CRT computer monitors within the offices and classrooms are outdated and have several disadvantages such as; significantly increased energy consumption, uses large amount of desk space, poor picture quality, distortions and flickering image, secular glare problems, high weight, and electromagnetic emissions. Many of these 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.

By choosing LCD monitors with an LED backlighting system the resulting energy consumption can be reduced even further. LED based LCD monitor's use less energy than conventional LCD monitor, and due to recent advancements have a comparable cost to conventional LCD monitors. For example a typical LCD with LED technology will use an estimated 2 watts when in sleep mode, and 20 watts while in operation (Based on 18.5 inch display).

Based on the site survey it was noted that there are 118 CRT monitors. Some of the monitors were left in screen saver mode, which 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 is based on averages for power usage of various computer monitors.

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

Energy Savings Calculations:

No. of CRT Monitors:	118
Operating Weeks per Yr:	42
Hrs per Week:	40 (8 hrs per day estimated average)

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

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

Installation cost of new monitors is estimated based on current pricing for an 18.5" 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 $120.

Installation Costs: # Monitors X Cost per Monitor
118 Monitors X $120 per Monitor
$14,160

COMPUTER MONITOR CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CRT Monitors	LCD Monitor	-
# of Computers	118	118	-
Monitor Power Cons. (W)	75	20	-
Operating Hrs per Week	40	40	-
Operating Weeks per Yr	42	42	-
Elec Cost ($/kWh)	0.165	0.165	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	14,868	3,965	10,903
Energy Cost ($)	$2,453	$654	$1,799
COMMENTS:	CRT Monitor consumption based on Dell CRT monitor M/N: CRT-E771MM. LCD Monitor based on Dell IN1930 LCD LED. Operating hours estimated.		

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$14,160
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$14,160
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,799
Total Yearly Savings ($/Yr):	$1,799
Estimated ECM Lifetime (Yr):	10
Simple Payback	7.9
Simple Lifetime ROI	27.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$17,990
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	$1,185.83

ECM #10 – Multi-zone Rooftop Units - VAV Conversion

Description:

The existing rooftop air conditioning units (AC-1 and AC-2) operate as central multi-zone style units. The multi-zone air handling units modulate supply air temperature by mixing cool air and heated air to provide a tempered supply air to each zone on the unit. This system relies on a continuous supply of heated air and cooled air year round to satisfy the supply air temperature set point. During the heating season or cooling season the respective heating / cooling damper is full open or closed, however air leakage is inevitable in this system and therefore the heating coil is unintentionally fighting the cooling coil. Air leakage rates range from 3% to 20%. A minimum of 5% leakage is expected for even well-built systems.

Converting the existing rooftop units to VAV and installing downstream VAV boxes will allow the system to respond to space temperature by reduction air-flow in lieu of mixing heated and cooled air streams. This system saves energy by eliminating mixing of hot and cold air at the unit to satisfy space temperature, as well as reducing overall fan horse power through the variable frequency drive on the motors. Also a multi-zone system has poor zone control which accounts for significant overheating of spaces when air is supplied through a constant volume fan such as the existing systems at this facility. The added benefit of this system is reduced noise levels by reducing air discharges volume and pressure. Also the fan motors will be operating at reduced speeds, which will also help reduce overall noise pollution. Another major benefit of this system type is improved zone control through the use of VAV boxes in lieu of the existing multi-zone control.

The ECM includes installation of VAV boxes in lieu of the existing multi-zone dampers. Total estimated air flow through the Multi-zone units is 10,000 CFM.

Energy Savings Calculations:

The calculations are based on damper leakage rate of 5% minimum of the full load capacity of each unit when closed. Assuming a multi-zone system in which the heating capacity equals the cooling capacity, the heating leakage, plus the additional cooling required to cancel it, represents another 10% of full load. At a zone with a momentary 50% cooling load, minor damper leakage adds 20% to energy consumption. The calculations in this ECM are based on 20% total cooling and heating energy savings. In addition to cooling and heating energy savings, VAV conversion will result in fan energy savings due to variable speed fan operation.

Cooling and heating energy savings can be calculated using the equations below:

$$\text{Cooling Energy Usage} = \frac{\text{Cooling(Tons)} \times 12{,}000 \left(\frac{\text{Btu}}{\text{Ton hr}} \right) \times \text{Annual Full Load Cooling Hrs.}}{1000 \left(\frac{\text{Wh}}{\text{kWh}} \right) \times \text{EER} \left(\frac{\text{Btu}}{\text{Wh}} \right)}$$

$$\text{Energy Savings} = \text{Cooling Energy (kWh)} \times \text{Estimated Savings}$$

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

$$\text{Demand Savings} = \frac{\text{Energy Savings (kWh)}}{\text{Full Load Cooling Hours}}$$

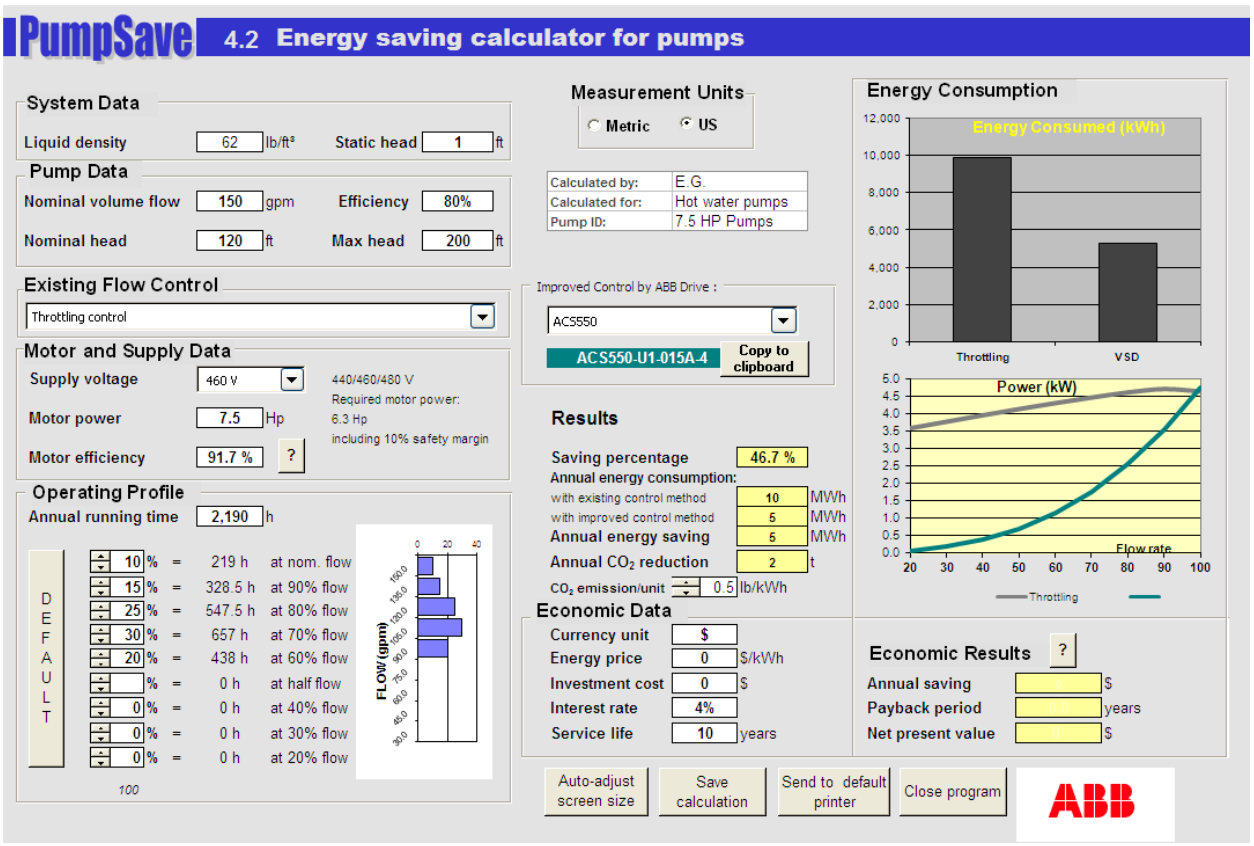
$$\text{Heating Energy (Therms)} = \frac{\text{Outside Air Heating Capacity}\left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD}(\text{Day °F}) \times 24\left(\frac{\text{Hr.}}{\text{Day}}\right) \times (0.60)}{65(\text{°F}) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency (\%)}}$$

$$\text{Energy Savings} = \text{Heating Energy (Therms)} \times \text{Estimated Savings \%}$$

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

VFD fan energy and cost savings calculations are based on basic engineering principles along with a VFD savings calculation software "FanSave Version 4.0.B," provided by ABB.

IMPLEMENTATION SUMMARY			
ECM INPUTS	**EST. MAX COOLING LOAD, TONS**	**EST. MAX HEATING LOAD, MBH**	**SUPPLY FAN MOTOR HP**
AC-1	17.5	340	7.5
AC-2	17.5	340	7.5
TOTAL	**35**	**680**	**15**


PumpSave
4.2 Energy saving calculator for pumps
System Data
Liquid density 62 lb/ft³
Static head 1 ft
Pump Data
Nominal volume flow 150 gpm
Efficiency 80%
Nominal head 120 ft
Max head 200 ft
Existing Flow Control
Throttling control
Motor and Supply Data
Supply voltage 460 V
440/460/480 V
Motor power 7.5 Hp
Required motor power:
6.3 Hp
including 10% safety margin
Motor efficiency 91.7 %
Operating Profile
Annual running time 2,190 h
DEFAULT
10 % = 219 h at nom. flow
15 % = 328.5 h at 90% flow
25 % = 547.5 h at 80% flow
30 % = 657 h at 70% flow
20 % = 438 h at 60% flow
% = 0 h at half flow
0 % = 0 h at 40% flow
0 % = 0 h at 30% flow
0 % = 0 h at 20% flow
100
FLOW (gpm)
Measurement Units
Metric US
Calculated by: E.G.
Calculated for: Hot water pumps
Pump ID: 7.5 HP Pumps
Improved Control by ABB Drive :
ACS550
ACS550-U1-015A-4
Copy to clipboard
Results
Saving percentage 46.7 %
Annual energy consumption:
with existing control method 10 MWh
with improved control method 5 MWh
Annual energy saving 5 MWh
Annual CO2 reduction 2 t
CO2 emission/unit 0.5 lb/kWh
Economic Data
Currency unit $
Energy price 0 $/kWh
Investment cost 0 $
Interest rate 4%
Service life 10 years
Energy Consumption
Energy Consumed (kWh)
Throttling
VSD
Power (kW)
Flow rate
Throttling
Economic Results
Annual saving $
Payback period years
Net present value $
Auto-adjust screen size
Save calculation
Send to default printer
Close program
ABB

VAV CONVERSION	
ECM INPUTS	**VAV CONVERSION**
Equipment	AC-1, AC-2
Est. Total Cooling Capacity, Tons	35
Efficiency (EER)	10
Annual Full Load Cooling Hours	600
Annual Total Operation Hours	2500
Est. Total Heating Capacity, MBh	680
Heating Efficiency (Gas)	80%
Heating Degree Days (65°F)	4703
Est. Heating/Cooling Energy Savings	10%
Total Fan Power (HP)	15
Fan Energy Savings (%)	27.4% (Calculated via FanSave)
Elec Cost ($/kWh)	$0.165
Natural Gas Cost ($/Therm)	$1.19
ENERGY SAVINGS	
ECM RESULTS	**VAV CONVERSION**
Cooling Energy Cnsmption, kWh	25,200
Fan Energy Consumption, kWh	16,919
Heating Energy (Therms)	8,856
Cooling Energy Savings kWh	2,520
Fan Energy Savings, kWh	2,322
Heating Energy Savings (Therms)	886
Demand Savings (kW)	4
Total Electricity Savings (kWh)	4,842
Total Gas Savings (Therms)	886
Electric Energy Cost Savings ($)	$799
Total Gas Cost Savings ($)	$1,054
Total Cost Savings ($)	$1,853
COMMENTS:	HDD estimated based on Newark,NJ.

Cost, Rebates and Incentives

Estimated installed cost for eight (8) VAV boxes, 2 VFD's, controls expansion and wiring is $75,000.

The NJ Clean Energy Program provides incentives for prescriptive energy efficiency measures such as the installation of variable speed drives. The rebate for the installation of new variable speed drives warrants an incentive based on the drive size. See the Incentive / Rebate calculations in the economics section below.

VAV FAN MOTOR REBATE SUMMARY			
UNIT DESCRIPTION	**INCENTIVE $/HP**	**TOTAL CV FAN, HP**	**TOTAL REBATE $**
5 to <10 HP	$155	15	$2,325
TOTAL		15	$2,325

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$75,000
NJ Smart Start Equipment Incentive ($):	$2,325
Net Installation Cost ($):	$72,675
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,853
Total Yearly Savings ($/Yr):	$1,853
Estimated ECM Lifetime (Yr):	15
Simple Payback	39.2
Simple Lifetime ROI	-61.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$27,792
Internal Rate of Return (IRR)	-10%
Net Present Value (NPV)	($50,556.51)

ECM #11: Install VFDs for Hot Water Pumps

Description:

The unit ventilators in this school utilize a constant speed pumping design with 2-way throttling valves. As a result the pumping head and the energy vary as the load in the building changes.
2-way control valves provide flow through the heat exchanger equipment only when there is a call for heating or cooling, unlike 3-way control valves that allow constant flow of the water loop. 3-way control valves require full pumping energy continuously, while 2-way control valves allow the system to reduce flow when it is not needed. Variable frequency drives allow the pumps to slow down in response to a reduction in overall system flow. The reduction in operating flow allows the pumps to reduce energy consumption for all hours that the heating system is not at its peak load.

This ECM includes the installation of Variable Frequency Drives on the existing hot water pumps without any modifications to the piping. The VFD's would be controlled by a differential pressure sensor in the hot water loop to measure demand for water. The furthest unit ventilator or the air handling unit from the loop pumps would remain as 3-way control valves (constant flow) to eliminate dead heading potential. In addition, a minimum flow amount should be set based on hot water boilers' minimum firing rate.

This ECM also includes replacement of the existing pump motors with inverter duty motors that meet NEMA Premium Efficiency Standard, which also helps to reduce energy consumption.

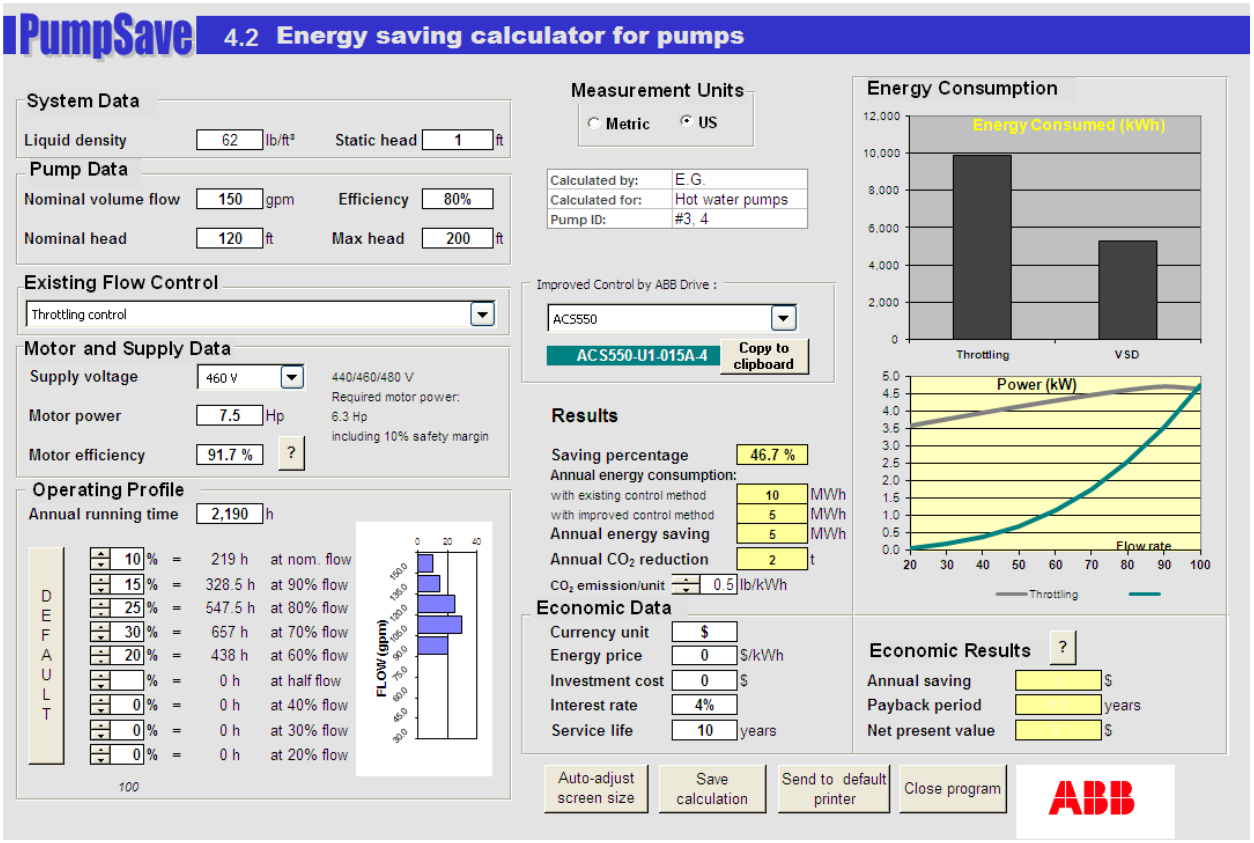
Energy and cost savings calculations are based on calculation software "PumpSave v4.2," provided by ABB. The PumpSave calculation software is used to estimate the pumping energy for the variable speed pump system. The hot water loop pump operations are estimated to be 4,380 Hrs per year since the system is used for about 6 months total. The pump flow, head pressure, and resultant energy are estimated based on the existing pump horse power installed.

Energy Savings Calculations:

$$\text{Cons. Volume Power}\left(\text{HP}\right) = \frac{\text{Specific Gravity} \times \text{Flow Rate}\left(\frac{\text{Gal}}{\text{min}}\right) \times \text{Head}\left(\text{Ft}\right)}{3960 \times \text{Pump Efficiency}\left(\%\right) \times \text{Motor Efficiency}\left(\%\right)}$$

$$\text{Energy Cons.}\left(\text{kWh}\right) = \text{Power}\left(\text{HP}\right) \times 0.746\left(\frac{\text{KW}}{\text{HP}}\right) \times \text{Operation}\left(\text{Hrs.}\right)$$

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


PumpSave
4.2 Energy saving calculator for pumps
System Data
Liquid density 62 lb/ft³
Static head 1 ft
Pump Data
Nominal volume flow 150 gpm
Efficiency 80%
Nominal head 120 ft
Max head 200 ft
Existing Flow Control
Throttling control
Motor and Supply Data
Supply voltage 460 V
440/460/480 V
Motor power 7.5 Hp
Required motor power:
6.3 Hp
including 10% safety margin
Motor efficiency 91.7 %
Operating Profile
Annual running time 2,190 h
DEFAULT
10 % = 219 h at nom. flow
15 % = 328.5 h at 90% flow
25 % = 547.5 h at 80% flow
30 % = 657 h at 70% flow
20 % = 438 h at 60% flow
% = 0 h at half flow
0 % = 0 h at 40% flow
0 % = 0 h at 30% flow
0 % = 0 h at 20% flow
100
FLOW (gpm)
Measurement Units
Metric US
Calculated by: E.G.
Calculated for: Hot water pumps
Pump ID: #3, 4
Improved Control by ABB Drive :
ACS550
ACS550-U1-015A-4
Copy to clipboard
Results
Saving percentage 46.7 %
Annual energy consumption:
with existing control method 10 MWh
with improved control method 5 MWh
Annual energy saving 5 MWh
Annual CO2 reduction 2 t
CO2 emission/unit 0.5 lb/kWh
Economic Data
Currency unit $
Energy price 0 $/kWh
Investment cost 0 $
Interest rate 4%
Service life 10 years
Energy Consumption
Energy Consumed (kWh)
Throttling
VSD
Power (kW)
Flow rate
Throttling
Economic Results
Annual saving $
Payback period years
Net present value $
Auto-adjust screen size
Save calculation
Send to default printer
Close program
ABB

HOT WATER PUMPS VFD CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CV Pumps	VFD Pumps	
Flow Control	Throttling Valves-2Way	VFD	-
Flow* (GPM)	150	150	-
Head* (Ft)	120	120	-
Pump Efficiency (%)	80%	80%	-
Motor Efficiency (%)	88.5%	91.7%	3.2%
Operating Hrs	2190	2190	-
Estimated Power (HP)	6.4	6.2	0.22
Elec Cost ($/kWh)	0.165	0.165	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	10,489	5,263	5,226
Electric Energy Cost ($)	$1,731	$868	$862
COMMENTS:	- VFD pump energy is based on ABB energy savings calculator for pumps, "Pump Save," version 4.2. Flow rate for VFD Pump calculation is summarized in the operating profile shown in the Pump Save output. - Hot water flow & head estimated based on boiler capacity		

Total installation cost for two (2) VFDs and controls is estimated to be $18,000.

Currently there are no **NJ Smart Start® Program Incentives** for installation of hot water pump Variable Frequency Drives. The incentives are for chilled water pump Frequency Drives over 20HP and above. Therefore, this ECM does not qualify rebates related to Variable Frequency Drives.

Below is a summary of SmartStart Building® incentives for premium efficiency motors for the hot water and chilled water pumps.

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$18,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$18,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$862
Total Yearly Savings ($/Yr):	$862
Estimated ECM Lifetime (Yr):	15
Simple Payback	20.9
Simple Lifetime ROI	-28.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$12,934
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	($7,706.11)

ECM #12: Boiler Systems Upgrade – Condensing Boilers

Description:

Space heating for Valley View Elementary School is provided by a heating hot water loop. The source of hot water for this equipment is two (2) Cleaver Brooks, firetube hot water boilers located in the boiler room.

The output capacity of each boiler is 2336 MBH. The boilers were installed with the original construction and are 38 years old, which brings them significantly past their ASHRAE service life. The units are still in service put are in poor condition and should be replaced with newer high efficiency units. This ECM provides insight into the energy efficiency benefit of condensing boiler technology compared to standard cast iron and firetube boilers.

Standard (non-condensing) boilers provide lower than nominal efficiency compared to condensing boilers. Standard boilers suffer further efficiency losses at part load operating conditions mainly due to limitations in the reduction of the flue gas temperature. Current average combustion efficiency of each boiler is estimated to be 70% due to standard non-condensing boiler technology, limited turn down ratio, cycling losses and outdated design and controls. A new condensing boiler could substantially improve the operating efficiency of the heating system of the building. Condensing boiler's peak efficiency tops out at 99% depending on return water temperature.

Currently only one boiler can satisfy the building heat load and the second boiler serves as a backup. This ECM is based on replacement of the existing hot water boilers with two (2) Aerco BMK 3.0 condensing boilers.

The annual average operating efficiency of the proposed boiler set is expected to be 90%, which gives the heating system a 20% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature. The owner is recommended to retain a professional engineer to confirm equipment sizing and finalize design.

BOILER REPLACEMENT SUMMARY		
EXISTING UNIT	**LOCATION**	**PROPOSED UNITS**
(2) Firetube Boilers	Boiler Room	(2) Aerco BMK 3.0

First, domestic hot water usage is estimated and subtracted from the total usage in order to estimate the net natural gas usage for space heating.

Current total hot water usage can be found in the table below:

ANNUAL GAS USAGE				
MONTH	TOTAL USAGE THERMS	DOMESTIC HW USAGE	HEATING ONLY	COST
Jul-10	47	47	0	$0
Aug-10	67	63	3	$4
Sep-10	579	63	387	$461
Oct-10	2,694	63	1,973	$2,348
Nov-10	4,552	63	3,367	$4,006
Dec-10	6,493	63	4,823	$5,739
Jan-11	5,633	63	4,178	$4,971
Feb-11	2,526	63	1,847	$2,198
Mar-11	2,119	63	1,542	$1,835
Apr-11	7,485	63	5,567	$6,624
May-11	81	63	14	$16
Jun-11	55	55	0	$0
TOTAL	**32,331**	**732**	**23,699**	**$28,202**

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

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

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

Energy savings calculations are summarized in the table below:

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	(2) Existing Hot Water Boiler	(2) New Condensing Boilers	-
Boiler Input Capacity (MBH)	5,858	6,000	-
Boiler Output Capacity (MBH)	4,686	5,400	-
Existing Nat Gas (Therms)	23,699	-	-
Boiler Efficiency (%)	70%	90%	20%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	-
Building Heating Energy Usage (MMBTUs)	1,659	1,659	-
Ave. Gas Cost ($/Therm)	1.19	1.19	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	23,699	18,433	5,267
Energy Cost ($)	$28,202	$21,935	$6,267
COMMENTS:			

Project Cost, Incentives and Maintenance Savings

Estimated cost for removing the existing boilers and installing (2) Aerco BMK 3.0 condensing boilers plus labor is estimated to be $255,000.

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

GAS FIRED BOILER REBATE SUMMARY					
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/MBH**	**PROPOSED CAPACITY, MBH**	**NUMBER OF UNITS**	**TOTAL REBATE, $**
>1500 - ≤ 4000 MBH	84% AFUE for Hot Water boilers	$1	3,000	2	$6,000
TOTAL					**$6,000**

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

Energy Savings Summary:

ECM #12 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$255,000
NJ Smart Start Equipment Incentive ($):	$6,000
Net Installation Cost ($):	$249,000
Maintenance Savings ($/Yr):	$500
Energy Savings ($/Yr):	$6,267
Total Yearly Savings ($/Yr):	$6,767
Estimated ECM Lifetime (Yr):	30
Simple Payback	36.8
Simple Lifetime ROI	-18.5%
Simple Lifetime Maintenance Savings	$15,000
Simple Lifetime Savings	$203,014
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($116,361.17)

REM #1: 139 KW Solar System

Description:

Valley View Elementary School has available roof space that could accommodate a solar system. Based on the available area a 139 kilowatt solar array could be installed, assuming the existing roof structure is capable of supporting an array. The array will peak at approximately 112.7 kW of AC power, which will result in approximately 160,760 kilowatt-hours of generation annually that will reduce the overall electric usage of the facility by 30%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period. This model has been adjusted based on current SREC market values as of December 2011.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
System Size (KW_{DC}):	139.12
Electric Generation (KWH/Yr):	160,760
Installation Cost ($):	$844,155
SREC Revenue ($/Yr):	$32,849
Energy Savings ($/Yr):	$26,525
Total Yearly Savings ($/Yr):	$59,375
ECM Analysis Period (Yr):	15
Simple Payback (Yrs):	14.2
Analysis Period Electric Savings ($):	$493,344
Analysis Period SREC Revenue ($):	$475,863
Net Present Value (NPV)	($241,580.44)

V. 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. Turn off computers when not in use. Ensure computers are not running in screen saver mode which saves the monitor screen not energy.

F. Ensure outside air dampers are functioning properly and only open during occupied mode.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Valley View Elementary School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	General Lighting Equipment Upgrade	$3,740	$0	$180	$3,560	$576	$13	$589	15	$8,833	$197	148.1%	6.0	14.32%	$3,470.22
ECM #2	General Lighting Controls Upgrade	$10,800	$0	$1,300	$9,500	$3,500	$0	$3,500	15	$52,500	$0	452.6%	2.7	36.50%	$32,282.77
ECM #3	Gymnasium Lighting Equipment and Controls Upgrade	$4,600	$0	$605	$3,995	$507	$0	$507	30	$15,212	$0	280.8%	7.9	12.30%	$5,943.95
ECM #4	Automatic Computer Stand-by / Hibernate	$125	$0	$0	$125	$382	$0	$382	10	$3,820	$0	2956.1%	0.3	305.61%	$3,133.68
ECM #5	NEMA Premium Efficiency Motors	$3,942	$0	$180	$3,762	$144	$0	$144	15	$2,164	$0	-42.5%	26.1	-6.23%	($2,039.78)
ECM #6	Unit Ventilators with Energy Recovery	$198,000	$110,000	$0	$308,000	$6,684	$0	$6,684	15	$100,255	$0	-67.4%	46.1	-11.58%	($228,210.45)
ECM #7	DDC Control System Expansion	$115,000	$0	$0	$115,000	$7,088	$0	$7,088	15	$106,320	$0	-7.5%	16.2	-0.97%	($30,383.92)
ECM #8	Water Efficiency	$20,942	$20,942	$0	$41,883	$1,634	$0	$1,634	15	$24,510	$0	-41.5%	25.6	-6.05%	($22,376.41)
ECM #9	CRT Monitor Upgrades	$14,160	$0	$0	$14,160	$1,799	$0	$1,799	10	$17,990	$0	27.0%	7.9	4.61%	$1,185.83
ECM #10	Multi-zone Rooftop Units - VAV Conversion	$30,000	$45,000	$2,325	$72,675	$1,853	$0	$1,853	15	$27,792	$0	-61.8%	39.2	-10.15%	($50,556.51)
ECM #11	Install VFDs for Hot Water Pumps	$9,000	$9,000	$0	$18,000	$862	$0	$862	15	$12,934	$0	-28.1%	20.9	-3.87%	($7,706.11)
ECM #12	Install High Efficiency Condensing Boilers	$102,000	$153,000	$6,000	$249,000	$6,267	$500	$6,767	30	$203,014	$15,000	-18.5%	36.8	-1.27%	($116,361.17)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	139 KW Solar System	$844,155	$0	$0	$844,155	$26,525	$32,849	$59,374	15	$890,610	$492,735	5.5%	14.2	0.68%	($135,352.04)

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

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-2 lamps) $30 per fixture (3-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Premium Motors

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Valley View School

Building ID: 2957227
For 12-month Period Ending: July 31, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: January 12, 2012

Facility
Valley View School
Montgomery Ave.
Montville, NJ 07045

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

Year Built: 1973
Gross Floor Area (ft²): 55,000

Energy Performance Rating[2] (1-100) 34

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,821,394
Natural Gas (kBtu)[4]	3,233,100
Total Energy (kBtu)	5,054,494

Energy Intensity[4]

Site (kBtu/ft²/yr)	92
Source (kBtu/ft²/yr)	172

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	430

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

National Median Comparison

National Median Site EUI	80
National Median Source EUI	150
% Difference from National Median Source EUI	15%
Building Type	K-12 School

Stamp of Certifying Professional

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

Meets Industry Standards[5] **for Indoor Environmental Conditions:**

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

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) 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	Valley View School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	Montgomery Ave., Montville, NJ 07045	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 a hospital (general medical and surgical)) nor can they be submitted as representing only a portion of a building		☐
Valley View (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	55,000 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.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	100	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	1	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	70 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Light Co [FirstEnergy Corp]

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2011	07/31/2011	45,280.00
06/01/2011	06/30/2011	34,720.00
05/01/2011	05/31/2011	50,640.00
04/01/2011	04/30/2011	41,760.00
03/01/2011	03/31/2011	50,160.00
02/01/2011	02/28/2011	46,640.00
01/01/2011	01/31/2011	50,780.00
12/01/2010	12/31/2010	37,840.00
11/01/2010	11/30/2010	46,480.00
10/01/2010	10/31/2010	43,920.00
09/01/2010	09/30/2010	50,800.00
08/01/2010	08/31/2010	34,800.00
Electric Consumption (kWh (thousand Watt-hours))		**533,820.00**
Electric Consumption (kBtu (thousand Btu))		**1,821,393.84**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,821,393.84**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
07/01/2011	07/31/2011	55.00
06/01/2011	06/30/2011	81.00
05/01/2011	05/31/2011	7,485.00
04/01/2011	04/30/2011	2,119.00
03/01/2011	03/31/2011	2,526.00
02/01/2011	02/28/2011	5,633.00
01/01/2011	01/31/2011	6,493.00
12/01/2010	12/31/2010	4,552.00
11/01/2010	11/30/2010	2,694.00
10/01/2010	10/31/2010	579.00

09/01/2010	09/30/2010	67.00
08/01/2010	08/31/2010	47.00
Gas Consumption (therms)		**32,331.00**
Gas Consumption (kBtu (thousand Btu))		**3,233,100.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**3,233,100.00**
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.

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
Valley View School
Montgomery Ave.
Montville, NJ 07045

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

General Information

Valley View School	
Gross Floor Area Excluding Parking: (ft^2)	55,000
Year Built	1973
For 12-month Evaluation Period Ending Date:	July 31, 2011

Facility Space Use Summary

Valley View	
Space Type	K-12 School
Gross Floor Area(ft^2)	55,000
Open Weekends?	No
Number of PCs	100
Number of walk-in refrigeration/freezer units	1
Presence of cooking facilities	Yes
Percent Cooled	70
Percent Heated	100
Months[o]	N/A
High School?	No
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2011)	**Baseline** (Ending Date 07/31/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	34	34	75	N/A	50
Energy Intensity					
Site ($kBtu/ft^2$)	92	92	63	N/A	80
Source ($kBtu/ft^2$)	172	172	117	N/A	150
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					
$MtCO_2e$/year	430	430	293	N/A	375
$kgCO_2e/ft^2$/year	8	8	5	N/A	7

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Median column presents energy performance data your building would have if your building had a median rating of 50.

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

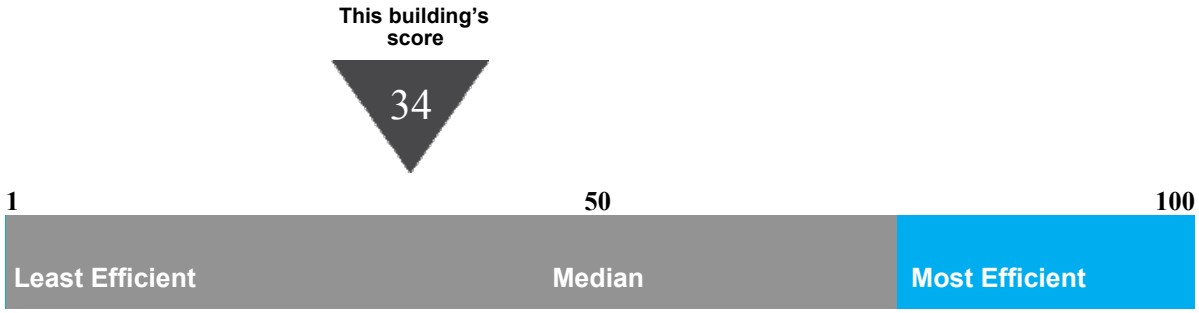
Statement of Energy Performance

2011

Valley View School
Montgomery Ave.
Montville, NJ 07045

Portfolio Manager Building ID: 2957227

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 172 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2011

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 01/12/2012

MAJOR EQUIPMENT LIST

Concord Engineering Group

Valley View Elementary School

Unit Ventilators

Tag	UV	UV	
Unit Type	Horizontal Floor Mount	Horizontal Floor Mount	
Qty	22 (Est)	3	
Location	Original Section	New Section	
Manufacturer	AAF Herman Nelson	Trane	
Model #	-	-	
Serial #	-	-	
Flow (CFM)	1200 (Est)	1500	
Cooling Capacity (Tons)	N/A	3.5	
Estimated Cooling Efficiency (EER)	N/A	10	
Heating Type	Hot Water Coil	Hot Water Coil	
Heating Input (MBH)	-	-	
Approx Age	38	5 (Est)	
Ashrae Service Life	15	15	
Remaining Life	(23)	10	
Comments	Poor condition	Good condition	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Valley View Elementary School

Boilers

Tag	Boiler - 1 & 2		
Unit Type	Firetube Boiler		
Qty	1		
Location	Boiler Room		
Area Served	Heating Hot Water Loop		
Manufacturer	Cleaver Brooks		
Model #	CB800-70		
Serial #	L-56158 L-56159		
Input Capacity (Btu/Hr)	2,929 MBH		
Rated Output Capacity (Btu/Hr)	2336 MBH		
Approx. Efficiency %	70% (est)		
Fuel	Natural Gas		
Approx Age	38		
ASHRAE Service Life	25		
Remaining Life	(13)		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Valley View Elementary School

Domestic Water Heaters

Tag	DHW - 1		
Unit Type	Domestic Hot Water		
Qty	1		
Location	Boiler Room		
Area Served	Bathrooms		
Manufacturer	A.O. Smith		
Model #	BTR 154 106		
Serial #	MC000919307		
Size (Gallons)	81		
Input Capacity (MBH/KW)	154 MBH		
Recovery (Gal/Hr)	149		
Efficiency %	81%		
Fuel	Natural Gas		
Approx Age	11		
ASHRAE Service Life	12		
Remaining Life	1		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Valley View Elementary School

Pumps

Tag	P - 1 / 2	P - 3 / 4	P - 5 / 6
Unit Type	Base Mounted	Base Mounted	In - Line
Qty	2	2	2
Location	Boiler Room	Boiler Room	Boiler Room
Area Served	Zone Pump	Zone Pump	Circulation Pump
Manufacturer	B & G	Goulds Pumps	Taco
Model #	1510	3756	-
Serial #	1BF002	K9950285 / K9950283	-
Horse Power	1.5	7.5	1.0
Flow	-	-	-
Motor Info	Baldor	Emerson	Baldor
Electrical Power	208-230/460	208-230/460	208-230/460
RPM	1755	1760	1760
Motor Efficiency %	84.0%	88.5%	81.5%
Approx Age	4	15 (est)	5 (est)
ASHRAE Service Life	20	20	10
Remaining Life	16	5	5
Comments	* Flow Data Missing On Pump	* Flow Data Missing On Pump	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Valley View Elementary School

AC Units

Tag	RTU	RTU	SS
Unit Type	Rooftop Unit	Rooftop Unit	Split System Condensing Unit
Qty	1	1	3
Location	Roof	Roof	Roof
Area Served	1st Floor Offices	Cafeteria	Addition Classrooms
Manufacturer	York	Trane	Trane
Model #	HBHB-W120AE	TCD0181	-
Serial #	NFKM065022	-	-
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	10	15	3.5
Cooling Efficiency (SEER/EER)	9.6 EER	9.9 EER	10 EER
Approx Age	5	9	9 (est)
ASHRAE Service Life	15	15	15
Remaining Life	10	6	6
Comments		*Majority of label is unreadable	

Note:

"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Valley View Elementary School

AC Units

Tag	AC-1 & AC-2		
Unit Type	Multi-zone Rooftop HVAC Unit		
Qty	2		
Location	Roof		
Area Served	Library & 2nd Floor Core Classrooms		
Manufacturer	Season 4		
Model #	TUE3G-GR44		
Serial #	-		
Cooling Type	DX		
Cooling Capacity (Tons)	20.0		
Cooling Efficiency (SEER/EER)	10 (Est)		
Approx Age	5 (Est)		
ASHRAE Service Life	15		
Remaining Life	-		
Comments	*7.5 Motor @ 91.7% efficiency		

Note:

"N/A" = Not Applicable.
"-" = Info Not Available

Investment Grade Lighting Audit

CEG Job #: 9C11044

Project: Montville Twp BOE — **Valley View Elementary School** — **KWH COST:** $0.165

30 Montgomery Avenue

Montville, NJ

Bldg. Sq. Ft. 55,000

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 18	2600	10	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.04	2,704.0	$446.16	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Clssroom 18	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$24.88	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Clssroom 18 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 17	2600	11	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.14	2,974.4	$490.78	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 17	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$24.88	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Classroom 17 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 16	2600	10	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.04	2,704.0	$446.16	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 16	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$24.88	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Classroom 16 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	MPR	2600	30	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.58	6,708.0	$1,106.82	30	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	MPR Closet	100	5	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.31	31.0	$5.12	5	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor 18 - Main Lobby	3000	10	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.62	1,860.0	$306.90	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Main Lobby	3000	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.37	1,116.0	$184.14	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.34	Eletrical Room	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	0.08	78.0	$12.87	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	58	0.06	58	$9.57	$80.00	$80.00	0.02	20	$3.30	24.24

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
740	GYM	2600	8	1	250w Pulse Start MH Lo-Bay	291	2.33	6,052.8	$998.71	8	4	2x4, 4 Lamp, 54w T5HO, Lo Bay	231	1.85	4804.8	$792.79	$370.00	$2,960.00	0.48	1248	$205.92	14.37
221.14	GYM Closet	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.06	58.0	$9.57	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
612	GYM	2600	15	1	Recessed Mnt., 60w A19 Lamp	60	0.90	2,340.0	$386.10	15	1	(1) 26w CFL Lamp	26	0.39	1014	$167.31	$20.00	$300.00	0.51	1326	$218.79	1.37
740	Stage	2600	2	1	250w Pulse Start MH Lo-Bay	291	0.58	1,513.2	$249.68	2	4	2x4, 4 Lamp, 54w T5HO, Lo Bay	231	0.46	1201.2	$198.20	$370.00	$740.00	0.12	312	$51.48	14.37
551	GYM Exits	3000	2	1	Recessed Down Light, 100w A Lamp	100	0.20	600.0	$99.00	2	1	26w CFL Lamp	26	0.05	156	$25.74	$20.00	$40.00	0.15	444	$73.26	0.55
222.21	GYM Corridor	3000	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	372.0	$61.38	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Stairs Exit	3000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	186.0	$30.69	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 5	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.46	3,785.6	$624.62	14	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	Classroom 5 Cubby	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.06	150.8	$24.88	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
100	Classroom 5 Toilet	2600	1	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.04	109.2	$18.02	1	2	Reballast & Relamp; 17w T8 Elec. Ballast	33	0.03	85.8	$14.16	$60.00	$60.00	0.01	23.4	$3.86	15.54
211.25	Classroom 5 & 6 Storage	1000	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	30	0.06	60.0	$9.90	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 6	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4,056.0	$669.24	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.14	Classroom 6 Cubby	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.06	150.8	$24.88	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
100	Classroom 6 Toilet	2600	1	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.04	109.2	$18.02	1	2	Reballast & Relamp; 17w T8 Elec. Ballast	33	0.03	85.8	$14.16	$60.00	$60.00	0.01	23.4	$3.86	15.54
211.25	Corridor 5 - 6	3000	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	30	0.03	90.0	$14.85	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 3B	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.35	3,515.2	$580.01	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 3A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Conference Room D	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$89.23	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Conference Room D	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Stair Landing	3000	5	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.33	975.0	$160.88	5	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Conference Room C	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$89.23	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Conference Room C	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 2B	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.35	3,515.2	$580.01	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 2A	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.35	3,515.2	$580.01	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Conference Room B	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$89.23	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Conference Room B	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
111	Boiler Room	2600	6	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.29	748.8	$123.55	6	1	1 Lamp, 32w T8, Elect. Ballast; retrofit	30	0.18	468	$77.22	$80.00	$480.00	0.11	280.8	$46.33	10.36
111	Boiler Room	2600	16	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.77	1,996.8	$329.47	16	1	1 Lamp, 32w T8, Elect. Ballast; retrofit	30	0.48	1248	$205.92	$80.00	$1,280.00	0.29	748.8	$123.55	10.36
242.22	Conference Room A	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$89.23	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 1B	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.35	3,515.2	$580.01	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 1A	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.35	3,515.2	$580.01	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Conference Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$89.23	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.22	Conference Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$24.88	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Stairs Landing	3000	5	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.29	870.0	$143.55	5	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Media Center Office	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.26	670.8	$110.68	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 4B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 4A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Corridor Media Center	3000	24	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	1.39	4,176.0	$689.04	24	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
3530	Corridor Media Center	3000	30	1	Ceiling Mount White Globe, (3) 13w PL Lamp	125	3.75	11,250.0	$1,856.25	30	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
3530	Media Center	2600	60	1	Ceiling Mount White Globe, (3) 13w PL Lamp	125	7.50	19,500.0	$3,217.50	60	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.37	Media Center	2600	16	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.48	1,248.0	$205.92	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
211.37	Media Center	2600	8	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.24	624.0	$102.96	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	General Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$89.23	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Library Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.21	540.8	$89.23	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Boy's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.20	507.0	$83.66	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.11	Boy's Room	2600	1	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.10	270.4	$44.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Girl's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.20	507.0	$83.66	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
241.11	Girl's Room	2600	1	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.10	270.4	$44.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.22	Media Center Corridor	3000	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	3,096.0	$510.84	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Teachers Rest Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
200	Teachers Rest Room	2600	1	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.03	88.4	$14.59	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Faculty Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.64	1,669.2	$275.42	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Faculty Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Copy Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.62	1,622.4	$267.70	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	Electrical Room	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.08	78.0	$12.87	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.05	50	$8.25	$80.00	$80.00	0.03	28	$4.62	17.32
242.22	PTA	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.31	811.2	$133.85	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Main Office	2600	8	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	2,225.6	$367.22	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Principal Office	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.43	1,112.8	$183.61	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Stair 2nd Floor	3000	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.12	372.0	$61.38	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
111	2nd Floor ElectricalCloset	1000	6	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.29	288.0	$47.52	6	1	1 Lamp, 32w T8, Elect. Ballast; retrofit	30	0.18	180	$29.70	$80.00	$480.00	0.11	108	$17.82	26.94
121.14	2nd Floor Closet	1000	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.23	234.0	$38.61	3	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.15	150	$24.75	$80.00	$240.00	0.08	84	$13.86	17.32
242.22	Classroom 15	2600	16	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.66	4,326.4	$713.86	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 15	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$99.53	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 13	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.35	3,515.2	$580.01	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.22	Classroom 13	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$99.53	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 14	2600	16	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.66	4,326.4	$713.86	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 14	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$99.53	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 12	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.35	3,515.2	$580.01	13	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 12	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.23	603.2	$99.53	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Electrical Closet	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.06	58.0	$9.57	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Teachers Rest Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$27.89	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Boy's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.20	507.0	$83.66	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	Boy's Room	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$66.92	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$42.90	$80.00	$160.00	0.06	145.6	$24.02	6.66
227.11	Girl's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.20	507.0	$83.66	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	Girl's Room	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.16	405.6	$66.92	2	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	260	$42.90	$80.00	$160.00	0.06	145.6	$24.02	6.66
242.22	Classroom 10A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 10B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	2nd Floor Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.08	78.0	$12.87	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.05	50	$8.25	$80.00	$80.00	0.03	28	$4.62	17.32
121.14	2nd Floor Electrical Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.08	78.0	$12.87	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.05	50	$8.25	$80.00	$80.00	0.03	28	$4.62	17.32
242.22	Classroom 7B	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.46	3,785.6	$624.62	14	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.22	Classroom 7B	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.12	301.6	$49.76	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 9B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 9A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 8B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 8A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	2nd Floor Electrical Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.08	78.0	$12.87	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.05	50	$8.25	$80.00	$80.00	0.03	28	$4.62	17.32
121.14	2nd Floor Storage Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.08	78.0	$12.87	1	2	Reballast & Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.05	50	$8.25	$80.00	$80.00	0.03	28	$4.62	17.32
242.22	Classroom 11A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 11	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$535.39	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 7A	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.46	3,785.6	$624.62	14	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 7A	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.12	301.6	$49.76	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 7C	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.46	3,785.6	$624.62	14	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 7C	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.12	301.6	$49.76	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 7D	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.42	1,081.6	$178.46	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 7D	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.12	301.6	$49.76	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor 2nd Floor Circle	3000	23	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.43	4,278.0	$705.87	23	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.11	Cooridor 2nd Floor Circle	3000	12	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.78	2,340.0	$386.10	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	2nd Floor Main Corridor	3000	16	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.99	2,976.0	$491.04	16	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
712	Exterior	4000	7	1	100w HPS Surface, 18", Fresnel Lens	125	0.88	3,500.0	$577.50	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
706	Exterior	4000	14	1	70w HPS Wallpack	92	1.29	5,152.0	$850.08	14	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
744	Exterior Parking	4000	12	1	250w MH "Shoe Box" Area Light	125	1.50	6,000.0	$990.00	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		383	155				97,293	$16,053	383	17			4.3	9,762	$1,687		$7,440	2.1	5,050	$833	8.93

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

CEG Job #:
Project: Montville Twp BOE
Address: 30 Montgomery Avenue
Montville, NJ
Building SF: 55,000

Valley View Elementary School

KWH COST: $0.165

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 18	2600	10	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.04	2704	446.16	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.83	20%	2163.2	$356.93	$300.00	$300.00	0.00	540.8	$89.23	3.36
227.22	Clssroom 18	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	24.882	1	0	no change	58	0.06	0%	150.8	$24.88	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Clssroom 18 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 17	2600	11	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.144	2974.4	490.776	11	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.92	20%	2379.52	$392.62	$300.00	$300.00	0.00	594.88	$98.16	3.06
227.22	Classroom 17	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	24.882	1	0	no change	58	0.06	0%	150.8	$24.88	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Classroom 17 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 16	2600	10	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.04	2704	446.16	10	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.83	20%	2163.2	$356.93	$300.00	$300.00	0.00	540.8	$89.23	3.36
227.22	Classroom 16	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	24.882	1	0	no change	58	0.06	0%	150.8	$24.88	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Classroom 16 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	MPR	2600	30	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	2.58	6708	1106.82	30	0	no change	86	2.58	0%	6708	$1,106.82	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	MPR Closet	100	5	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.31	31	5.115	5	0	no change	62	0.31	0%	31	$5.12	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor 18 - Main Lobby	3000	10	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.62	1860	306.9	10	0	no change	62	0.62	0%	1860	$306.90	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Main Lobby	3000	6	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.372	1116	184.14	6	0	no change	62	0.37	0%	1116	$184.14	$0.00	$0.00	0.00	0	$0.00	0.00
121.34	Eletrical Room	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., No Lens	78	0.078	78	12.87	1	0	no change	78	0.08	0%	78	$12.87	$0.00	$0.00	0.00	0	$0.00	0.00
740	GYM	2600	8	1	250w Pulse Start MH Lo-Bay	291	2.328	6052.8	998.712	8	2	Dual Technology Occupancy Sensor - Remote Mnt.	291	1.86	20%	4842.24	$798.97	$300.00	$600.00	0.00	1210.56	$199.74	3.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.14	GYM Closet	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.058	58	9.57	1	0	no change	58	0.06	0%	58	$9.57	$0.00	$0.00	0.00	0	$0.00	0.00
612	GYM	2600	15	1	Recessed Mnt., 60w A19 Lamp	60	0.9	2340	386.1	15	0	no change	60	0.90	0%	2340	$386.10	$0.00	$0.00	0.00	0	$0.00	0.00
740	Stage	2600	2	1	250w Pulse Start MH Lo-Bay	291	0.582	1513.2	249.678	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	291	0.47	20%	1210.56	$199.74	$300.00	$300.00	0.00	302.64	$49.94	6.01
551	GYM Exits	3000	2	1	Recessed Down Light, 100w A Lamp	100	0.2	600	99	2	0	no change	100	0.20	0%	600	$99.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	GYM Corridor	3000	2	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	372	61.38	2	0	no change	62	0.12	0%	372	$61.38	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Stairs Exit	3000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	186	30.69	1	0	no change	62	0.06	0%	186	$30.69	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 5	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.456	3785.6	624.624	14	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.16	20%	3028.48	$499.70	$300.00	$300.00	0.00	757.12	$124.92	2.40
221.14	Classroom 5 Cubby	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.058	150.8	24.882	1	0	no change	58	0.06	0%	150.8	$24.88	$0.00	$0.00	0.00	0	$0.00	0.00
100	Classroom 5 Toilet	2600	1	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.042	109.2	18.018	1	0	no change	42	0.04	0%	109.2	$18.02	$0.00	$0.00	0.00	0	$0.00	0.00
211.25	Classroom 5 & 6 Storage	1000	2	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	30	0.06	60	9.9	2	0	no change	30	0.06	0%	60	$9.90	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 6	2600	15	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.56	4056	669.24	15	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.25	20%	3244.8	$535.39	$300.00	$300.00	0.00	811.2	$133.85	2.24
221.14	Classroom 6 Cubby	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., No Lens	58	0.058	150.8	24.882	1	0	no change	58	0.06	0%	150.8	$24.88	$0.00	$0.00	0.00	0	$0.00	0.00
100	Classroom 6 Toilet	2600	1	2	2' Vanity Light, 2-Lamp, 20w T12, Mag. Ballast, Wall Mnt., Glass Lens	42	0.042	109.2	18.018	1	0	no change	42	0.04	0%	109.2	$18.02	$0.00	$0.00	0.00	0	$0.00	0.00
211.25	Corridor 5 - 6	3000	1	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	30	0.03	90	14.85	1	0	no change	30	0.03	0%	90	$14.85	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 3B	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.352	3515.2	580.008	13	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.08	20%	2812.16	$464.01	$300.00	$300.00	0.00	703.04	$116.00	2.59
242.22	Classroom 3A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Conference Room D	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	89.232	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$71.39	$150.00	$150.00	0.00	108.16	$17.85	8.41
227.11	Conference Room D	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Stair Landing	3000	5	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.325	975	160.875	5	0	no change	65	0.33	0%	975	$160.88	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Conference Room C	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	89.232	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$71.39	$150.00	$150.00	0.00	108.16	$17.85	8.41
227.11	Conference Room C	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 2B	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.352	3515.2	580.008	13	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.08	20%	2812.16	$464.01	$300.00	$300.00	0.00	703.04	$116.00	2.59
242.22	Classroom 2A	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.352	3515.2	580.008	13	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.08	20%	2812.16	$464.01	$300.00	$300.00	0.00	703.04	$116.00	2.59
242.22	Conference Room B	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	89.232	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$71.39	$150.00	$150.00	0.00	108.16	$17.85	8.41
227.11	Conference Room B	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
111	Boiler Room	2600	6	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.288	748.8	123.552	6	0	no change	48	0.29	0%	748.8	$123.55	$0.00	$0.00	0.00	0	$0.00	0.00
111	Boiler Room	2600	16	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.768	1996.8	329.472	16	0	no change	48	0.77	0%	1996.8	$329.47	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Conference Room A	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	89.232	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$71.39	$150.00	$150.00	0.00	108.16	$17.85	8.41
242.22	Classroom 1B	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.352	3515.2	580.008	13	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.08	20%	2812.16	$464.01	$300.00	$300.00	0.00	703.04	$116.00	2.59
242.22	Classroom 1A	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.352	3515.2	580.008	13	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.08	20%	2812.16	$464.01	$300.00	$300.00	0.00	703.04	$116.00	2.59
242.22	Conference Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	89.232	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$71.39	$150.00	$150.00	0.00	108.16	$17.85	8.41
227.22	Conference Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	24.882	1	0	no change	58	0.06	0%	150.8	$24.88	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS											SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.22	Stairs Landing	3000	5	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.29	870	143.55	5	0	no change	58	0.29	0%	870	$143.55	$0.00	$0.00	0.00	0	$0.00	0.00
232.21	Media Center Office	2600	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	86	0.258	670.8	110.682	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.21	20%	536.64	$88.55	$150.00	$150.00	0.00	134.16	$22.14	6.78
242.22	Classroom 4B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
242.22	Classroom 4A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
227.22	Corridor Media Center	3000	24	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	1.392	4176	689.04	24	0	no change	58	1.39	0%	4176	$689.04	$0.00	$0.00	0.00	0	$0.00	0.00
3530	Corridor Media Center	3000	30	1	Ceiling Mount White Globe, (3) 13w PL Lamp	125	3.75	11250	1856.25	30	0	no change	125	3.75	0%	11250	$1,856.25	$0.00	$0.00	0.00	0	$0.00	0.00
3530	Media Center	2600	60	1	Ceiling Mount White Globe, (3) 13w PL Lamp	125	7.5	19500	3217.5	60	0	no change	125	7.50	0%	19500	$3,217.50	$0.00	$0.00	0.00	0	$0.00	0.00
211.37	Media Center	2600	16	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.48	1248	205.92	16	0	no change	30	0.48	0%	1248	$205.92	$0.00	$0.00	0.00	0	$0.00	0.00
211.37	Media Center	2600	8	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	30	0.24	624	102.96	8	0	no change	30	0.24	0%	624	$102.96	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	General Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	89.232	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$71.39	$150.00	$150.00	0.00	108.16	$17.85	8.41
242.22	Library Office	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.208	540.8	89.232	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.17	20%	432.64	$71.39	$150.00	$150.00	0.00	108.16	$17.85	8.41
227.11	Boy's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.195	507	83.655	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	65	0.16	20%	405.6	$66.92	$150.00	$150.00	0.00	101.4	$16.73	8.97
241.11	Boy's Room	2600	1	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.104	270.4	44.616	1	0	no change	104	0.10	0%	270.4	$44.62	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Girl's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.195	507	83.655	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	65	0.16	20%	405.6	$66.92	$150.00	$150.00	0.00	101.4	$16.73	8.97
241.11	Girl's Room	2600	1	4	1x4, 4 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	104	0.104	270.4	44.616	1	0	no change	104	0.10	0%	270.4	$44.62	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Media Center Corridor	3000	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.032	3096	510.84	12	0	no change	86	1.03	0%	3096	$510.84	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
227.11	Teachers Rest Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
200	Teachers Rest Room	2600	1	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.034	88.4	14.586	1	0	no change	34	0.03	0%	88.4	$14.59	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Faculty Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.642	1669.2	275.418	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.51	20%	1335.36	$220.33	$150.00	$150.00	0.00	333.84	$55.08	2.72
227.11	Faculty Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Copy Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.624	1622.4	267.696	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.50	20%	1297.92	$214.16	$150.00	$150.00	0.00	324.48	$53.54	2.80
121.14	Electrical Room	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.078	78	12.87	1	0	no change	78	0.08	0%	78	$12.87	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	PTA	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.312	811.2	133.848	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	104	0.25	20%	648.96	$107.08	$150.00	$150.00	0.00	162.24	$26.77	5.60
242.21	Main Office	2600	8	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.856	2225.6	367.224	8	0	no change	107	0.86	0%	2225.6	$367.22	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Principal Office	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.428	1112.8	183.612	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.34	20%	890.24	$146.89	$150.00	$150.00	0.00	222.56	$36.72	4.08
221.21	Stair 2nd Floor	3000	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.124	372	61.38	2	0	no change	62	0.12	0%	372	$61.38	$0.00	$0.00	0.00	0	$0.00	0.00
111	2nd Floor ElectricalCloset	1000	6	1	4' Channel, 1-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	48	0.288	288	47.52	6	0	no change	48	0.29	0%	288	$47.52	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	2nd Floor Closet	1000	3	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.234	234	38.61	3	0	no change	78	0.23	0%	234	$38.61	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 15	2600	16	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.664	4326.4	713.856	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.33	20%	3461.12	$571.08	$300.00	$300.00	0.00	865.28	$142.77	2.10
227.22	Classroom 15	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	99.528	4	0	no change	58	0.23	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 13	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.352	3515.2	580.008	13	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.08	20%	2812.16	$464.01	$300.00	$300.00	0.00	703.04	$116.00	2.59
227.22	Classroom 13	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	99.528	4	0	no change	58	0.23	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 14	2600	16	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.664	4326.4	713.856	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.33	20%	3461.12	$571.08	$300.00	$300.00	0.00	865.28	$142.77	2.10
227.22	Classroom 14	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	99.528	4	0	no change	58	0.23	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 12	2600	13	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.352	3515.2	580.008	13	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.08	20%	2812.16	$464.01	$300.00	$300.00	0.00	703.04	$116.00	2.59
227.22	Classroom 12	2600	4	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.232	603.2	99.528	4	0	no change	58	0.23	0%	603.2	$99.53	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Electrical Closet	1000	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.058	58	9.57	1	0	no change	58	0.06	0%	58	$9.57	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Teachers Rest Room	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	27.885	1	0	no change	65	0.07	0%	169	$27.89	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Boy's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.195	507	83.655	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	65	0.16	20%	405.6	$66.92	$150.00	$150.00	0.00	101.4	$16.73	8.97
121.14	Boy's Room	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	66.924	2	0	no change	78	0.16	0%	405.6	$66.92	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Girl's Room	2600	3	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.195	507	83.655	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	65	0.16	20%	405.6	$66.92	$150.00	$150.00	0.00	101.4	$16.73	8.97
121.14	Girl's Room	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.156	405.6	66.924	2	0	no change	78	0.16	0%	405.6	$66.92	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 10A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
242.22	Classroom 10B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
121.14	2nd Floor Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.078	78	12.87	1	0	no change	78	0.08	0%	78	$12.87	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	2nd Floor Electrical Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.078	78	12.87	1	0	no change	78	0.08	0%	78	$12.87	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 7B	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.456	3785.6	624.624	14	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.16	20%	3028.48	$499.70	$300.00	$300.00	0.00	757.12	$124.92	2.40
227.22	Classroom 7B	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.116	301.6	49.764	2	0	no change	58	0.12	0%	301.6	$49.76	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 9B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
242.22	Classroom 9A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	0	no change	104	1.25	0%	3244.8	$535.39	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 8B	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
242.22	Classroom 8A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
121.14	2nd Floor Electrical Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.078	78	12.87	1	0	no change	78	0.08	0%	78	$12.87	$0.00	$0.00	0.00	0	$0.00	0.00
121.14	2nd Floor Storage Closet	1000	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	78	0.078	78	12.87	1	0	no change	78	0.08	0%	78	$12.87	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 11A	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
242.22	Classroom 11	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	535.392	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$428.31	$300.00	$300.00	0.00	648.96	$107.08	2.80
242.22	Classroom 7A	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.456	3785.6	624.624	14	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.16	20%	3028.48	$499.70	$300.00	$300.00	0.00	757.12	$124.92	2.40
227.22	Classroom 7A	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.116	301.6	49.764	2	0	no change	58	0.12	0%	301.6	$49.76	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 7C	2600	14	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.456	3785.6	624.624	14	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.16	20%	3028.48	$499.70	$300.00	$300.00	0.00	757.12	$124.92	2.40
227.22	Classroom 7C	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.116	301.6	49.764	2	0	no change	58	0.12	0%	301.6	$49.76	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 7D	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	0.416	1081.6	178.464	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	0.33	20%	865.28	$142.77	$300.00	$300.00	0.00	216.32	$35.69	8.41
227.22	Classroom 7D	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.116	301.6	49.764	2	0	no change	58	0.12	0%	301.6	$49.76	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor 2nd Floor Circle	3000	23	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.426	4278	705.87	23	0	no change	62	1.43	0%	4278	$705.87	$0.00	$0.00	0.00	0	$0.00	0.00
227.11	Cooridor 2nd Floor Circle	3000	12	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.78	2340	386.1	12	0	no change	65	0.78	0%	2340	$386.10	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	2nd Floor Main Corridor	3000	16	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.992	2976	491.04	16	0	no change	62	0.99	0%	2976	$491.04	$0.00	$0.00	0.00	0	$0.00	0.00
712	Exterior	4000	7	1	100w HPS Surface, 18", Fresnel Lens	125	0.875	3500	577.5	7	0	no change	125	0.88	0%	3500	$577.50	$0.00	$0.00	0.00	0	$0.00	0.00
706	Exterior	4000	14	1	70w HPS Wallpack	92	1.288	5152	850.08	14	0	no change	92	1.29	0%	5152	$850.08	$0.00	$0.00	0.00	0	$0.00	0.00
744	Exterior Parking	4000	12	1	250w MH "Shoe Box" Area Light	125	1.5	6000	990	12	0	no change	125	1.50	0%	6000	$990.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		383	155			78.2	210,381.4	$34,713	834	47			69.4		187,654.3	$30,962.96		$11,700	0.00	22,727	$3,750	3.12

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Valley View	14,500	SHARP NU-U235F2	592	17.5	10,384	139.12	160,760	112.7	24,805	13.40

.= Proposed PV Layout

Notes:

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

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	139.1 kW
DC to AC Derate Factor:	0.810
AC Rating:	112.7 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.0 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.39	8347	1252.05
2	3.17	10119	1517.85
3	4.07	14162	2124.30
4	4.83	15691	2353.65
5	5.70	18668	2800.20
6	5.94	18242	2736.30
7	5.77	18100	2715.00
8	5.38	16765	2514.75
9	4.65	14424	2163.60
10	3.61	11873	1780.95
11	2.35	7573	1135.95
12	2.01	6795	1019.25
Year	4.16	160760	24114.00

Project Name: **Montville BOE**
Location: **Valley View**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$844,155
Annual kWh Production	160,760
Annual Energy Cost Reduction	$26,525
Average Annual SREC Revenue	$32,849

Simple Payback: **14.22** Years

Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.165**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.204

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$0	0	0	0	$0	0	0	0	0
1	$0	160,760	$26,525	$0	$48,228	$49,675	$35,806	($10,728)	($10,728)
2	$0	159,956	$27,321	$0	$47,987	$47,467	$38,015	($10,174)	($20,902)
3	$0	159,156	$28,141	$0	$39,789	$45,122	$40,359	($17,552)	($38,453)
4	$0	158,361	$28,985	$0	$39,590	$42,633	$42,849	($16,906)	($55,360)
5	$0	157,569	$29,855	$1,623	$31,514	$39,990	$45,491	($25,736)	($81,096)
6	$0	156,781	$30,750	$1,615	$31,356	$37,184	$48,297	($24,990)	($106,086)
7	$0	155,997	$31,673	$1,607	$31,199	$34,205	$51,276	($24,216)	($130,302)
8	$0	155,217	$32,623	$1,599	$31,043	$31,043	$54,439	($23,414)	($153,716)
9	$0	154,441	$33,602	$1,591	$30,888	$27,685	$57,796	($22,583)	($176,299)
10	$0	153,669	$34,610	$1,583	$30,734	$24,120	$61,361	($21,721)	($198,020)
11	$0	152,900	$35,648	$1,575	$22,935	$20,336	$65,146	($28,473)	($226,493)
12	$0	152,136	$36,717	$1,567	$22,820	$16,318	$69,164	($27,511)	($254,004)
13	$0	151,375	$37,819	$1,559	$22,706	$12,052	$73,430	($26,516)	($280,519)
14	$0	150,618	$38,953	$1,551	$22,593	$7,523	$77,959	($25,487)	($306,006)
15	$0	149,865	$40,122	$1,544	$22,480	$2,715	$82,767	($24,423)	($330,429)
	Totals:	2,328,803	$493,344	$17,413	$475,863	$438,068	$844,155	($330,429)	($2,368,413)

Net Present Value (NPV) **($241,580)**

MONTVILLE TOWNSHIP
BOARD OF EDUCATION

WOODMONT ELEMENTARY SCHOOL

39 WOODMONT ROAD
PINE BROOK, NJ 07058

FACILITY ENERGY REPORT

Table of Contents

I. HISTORIC ENERGY CONSUMPTION/COST 2

II. FACILITY DESCRIPTION 7

III. MAJOR EQUIPMENT LIST 10

IV. ENERGY CONSERVATION MEASURES 11

V. ADDITIONAL RECOMMENDATIONS 50

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start® Program Incentives

Appendix C – Portfolio Manager "Statement of Energy Performance"

Appendix D – Major Equipment List

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

I. HISTORIC ENERGY CONSUMPTION/COST

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.

Electric Utility Provider:	Jersey Central Power and Light (JCP&L)
Electric Utility Rate Structure:	General Service Secondary Three-Phase
Third Party Supplier:	None

Natural Gas Utility Provider:	New Jersey Natural Gas
Utility Rate Structure:	General Service Large (GSL)
Third Party Supplier:	Amerada HESS

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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

Description	Average
Electricity	17.8¢ / kWh
Natural Gas	$1.33 / Therm

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Jersey Central Power & Light
Rate: GSS / GSS 3 Phase / GSS
Meter No: G16459653 / G1511611 / G16459652
Account # 100028296059 / 1000826831 / 100028297412
Third Party Utility Provider: N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Aug-10	21,520	105	$4,215
Sep-10	28,325	106	$5,094
Oct-10	22,247	74	$3,998
Nov-10	26,566	79	$4,657
Dec-10	26,215	83	$4,587
Jan-11	22,165	61	$3,984
Feb-11	21,206	82	$3,816
Mar-11	44,485	87	$6,771
Apr-11	23,207	94	$3,961
May-11	20,967	104	$4,786
Jun-11	15,446	97	$2,961
Jul-11	32,404	106	$5,288
Totals	**304,753**	**106 Max**	**$54,118**

AVERAGE DEMAND **89.8 KW average**
AVERAGE RATE **$0.178** **$/kWh**

Figure 1
Woodmont Elementary School
Electric Usage Profile
August - 10 through July - 11

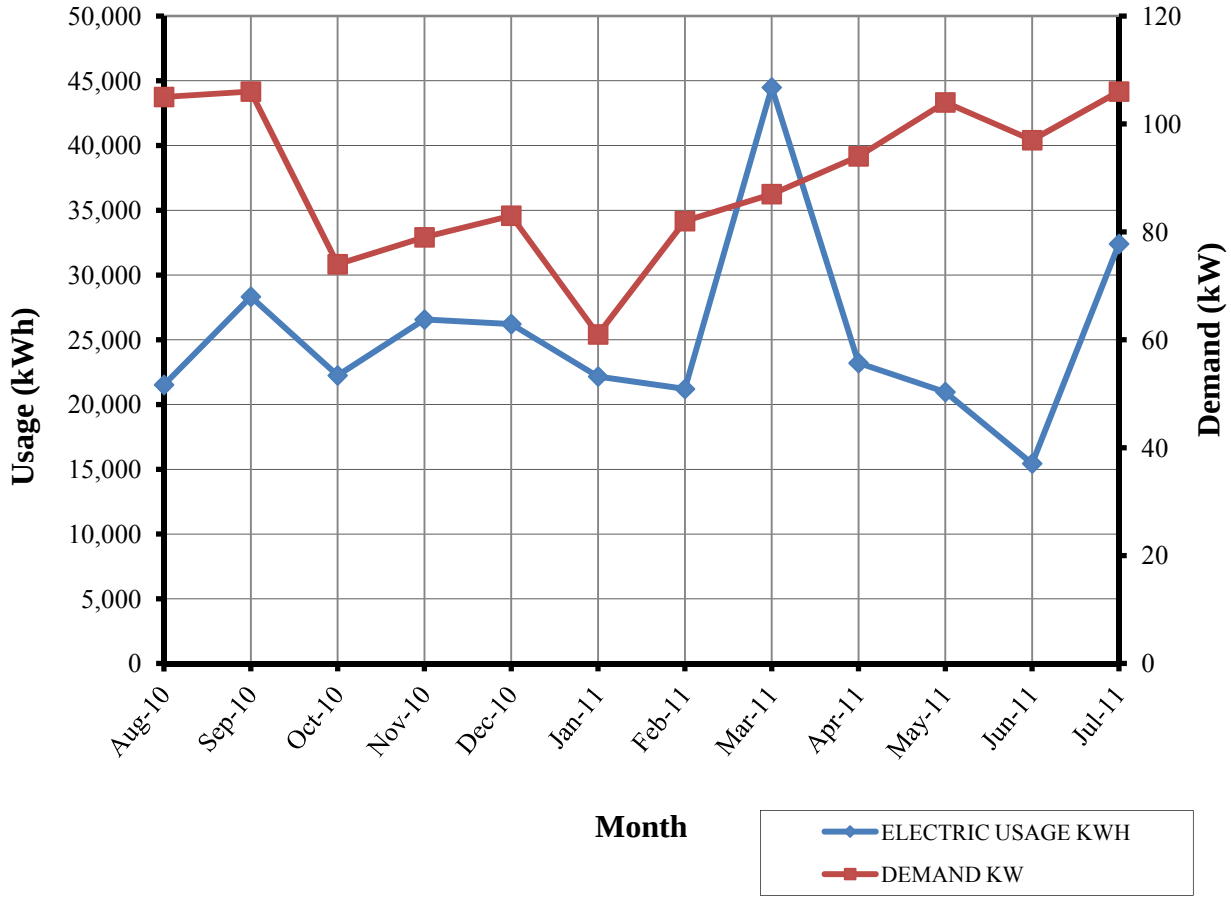
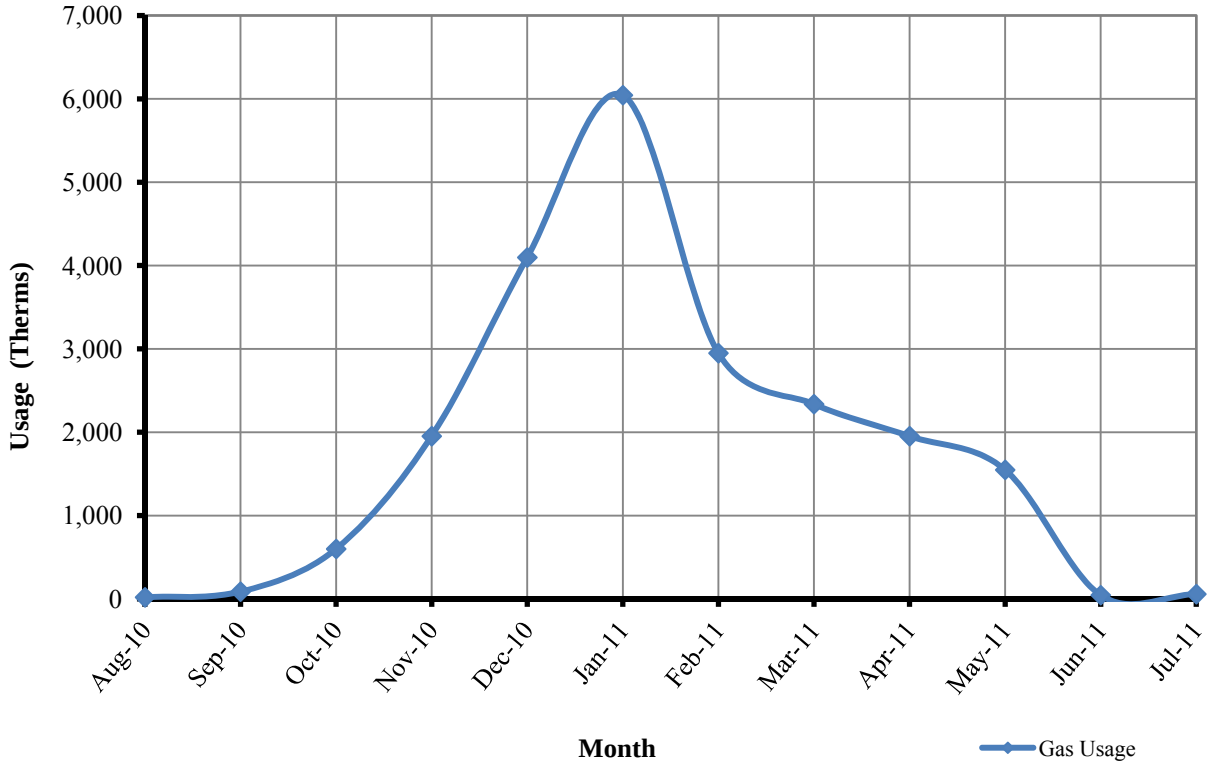


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: New Jersey Natural Gas		
Rate: GSL		
Meter No: 851930		
Point of Delivery ID: 04-1215-0605-15		
Third Party Utility Provider: Amerada Hess		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Aug-10	20	$520
Sep-10	88	$582
Oct-10	600	$1,102
Nov-10	1,953	$2,480
Dec-10	4,097	$4,726
Jan-11	6,044	$6,740
Feb-11	2,949	$3,540
Mar-11	2,337	$2,909
Apr-11	1,953	$2,513
May-11	1,549	$2,576
Jun-11	45	$552
Jul-11	58	$550
TOTALS	**21,693**	**$28,791**
AVERAGE RATE:	**$1.33**	**$/THERM**

Figure 2
Woodmont Elementary School
Gas Usage Profile
August - 10 through July - 11



II. FACILITY DESCRIPTION

The 44,000 SF Woodmont Elementary School is a multi story facility comprised of classrooms, media center, cafeteria, kitchen, gymnasium, administration office, restrooms, boiler rooms, and storage closets. The School was built in 1964 with several renovations and an addition in 2000. The addition consists primarily of classrooms for the 5th grades.

Building Profile

The school hours are between 8:05 AM and 2:50 PM on the weekdays. The teachers start arriving several hours before the classes. The school remains open till 6:00 PM in the evening for after school activities. The gymnasium, cafeteria and library are used after hours for sports and other events during the weekdays and weekends.

The student enrollment at the Woodmont Elementary School is approximately 343. Estimated total number of staff is 60.

Building Envelope

The facility is made up of two main interconnected building structures. The exterior of the buildings consists of a block construction with brick façade. Insulation within the walls is not known. The original structure roof consists of a flat built up style roof with an estimated 1 inch rigid insulation below the rubber covering. The west building roof is recently replaced and covered with asphalt sheathing. The roof of the new addition is covered with a high efficiency reflective type covering in excellent condition. Majority of the rooftop HVAC equipment are on the west building.

Windows throughout the facility consists of operable, double pane windows with aluminum frames. The windows are in good condition.

HVAC Systems

Heating is provided to the facility from a central hot water boiler room. The boiler room is comprised of two (2) condensing hot water boilers made by Aerco. Each boiler has an input capacity of 2,000 MBH. The boiler water is circulated throughout the facility by six (6) constant speed pumps driven by 1.5, 2 and 5 HP motors. Larger pumps are driven with standard efficiency motors. There are a total of three (3) heating zones in the facility. The boilers provide heating hot water to the hot water baseboard heaters, unit ventilators and heating and ventilation units throughout the school. The new boilers and equipment within the new boiler plant were installed in 2000 and they are in excellent condition.

Terminal heating equipment for the classrooms and the perimeter offices consists of unit ventilators made by Nesbitt in combination with hydronic baseboard heat. These units serve the classrooms throughout the original section of the school. The unit ventilators are original to the facility and appear to be in poor condition. The unit ventilators are controlled by the building pneumatic system. The majority of the unit ventilator controls are functioning with low accuracy

due to older equipment, valves, dampers and actuators. As a result of these issues, some of the classrooms suffer overheating.

The newer classrooms in the 5th grade section utilize unit ventilators made by Trane. Each classroom has a dedicated unit ventilator with hot water heating coils and direct expansion cooling coils. The unit ventilators are coupled with 3.5 ton Trane split condensing units. Heat is provided by hot water heating coils fed from the new boiler plant. The new Trane units are in good condition and appear to be maintained well.

In addition to the unit ventilators, several spaces utilize packaged rooftop heating and air conditioning units. Four (4) older Carrier rooftop air conditioning units provide cooling (only) for the rooms 14, 16, 20, 22 and 23. These units have already surpassed their ASHRAE service life and appear to be in poor condition. In addition, there are three (3) relatively newer packaged rooftop HVAC units made by Lennox (2 Ton) and Trane (7.5 Ton). Lennox units are equipped with natural gas heating coils for primary supply air heating. It is recommended to replace older and inefficient HVAC units with new high efficiency units.

Exhaust System

The air is exhausted from the hallways and corridors via dedicated exhaust fans located on the roof. The toilet rooms have a dedicated exhaust fan located in the crawl space below the main school building. Some of the exhaust fans at this facility appear to be running 24 hours per day. It is recommended to operate the exhaust fans based on a time of day schedule.

HVAC System Controls

The HVAC systems in this facility are controlled via a variety of control systems and equipment.

The unit ventilators in the original building are controlled via the original pneumatic control system. The old and outdated pneumatic controllers and actuators for the unit ventilators are deteriorated therefore they do not function properly. It is recommended to upgrade the old and outdated pneumatic controls to a state of the art DDC control system to enhance comfort conditions in the classrooms and increase energy efficiency.

The new section (5th grade classrooms) unit ventilators, the split condensers and the boilers are controlled via a DDC Building Management System (BMS) made by Honeywell. The BMS provides control over the equipment and consists of scheduling, temperature sensors, equipment start stop controls, supply water temperature reset etc. Each classroom is equipped with a thermostat with limited override capability. The digital control system appears to be providing adequate control for conditioning of the building and occupant comfort. The BMS currently does not have optimal start/stop controls.

The rooftop air conditioning units are controlled via a variety of programmable and none-programmable thermostats.

Domestic Hot Water

Domestic hot water for the facility is provided with two (2) domestic hot water heaters in two separate locations. The unit #1 is a 48 gallon gas fired domestic hot water heater with 65 MBH input capacity. The gas fired hot water heat is made by Rheem and installed in 2010. The second unit is a 50 gallon electric hot water heater with 4.5 kW heating element. The electric hot water heater is made by Vanguard and installed in 2009. Both units appear to be in excellent condition. Domestic hot water is circulated throughout the spaces via two (2) separate circulators. Each circulator is connected to an aqua-stat.

Lighting

Typical lighting throughout the building is fluorescent tube fixtures with T-8 lamps and electronic ballasts. There are only a few number of incandescent lamps used in utility areas. A space by space breakdown of the lighting throughout the facility is provided in the **Investment Grade Lighting Appendix**.

III. 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.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 3
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Equipment Upgrade	$8,836	$3,211	2.8	445%
ECM #2	Lighting Controls Upgrade	$9,240	$2,052	4.5	233%
ECM #3	Gymnasium Lighting Equipment and Controls	$2,690	$564	4.8	214%
ECM #4	Unit Ventilator Upgrade	$132,000	$4,648	28	-47%
ECM #5	Automatic Computer Stand-by / Hibernate	$567	$1,868	0.3	3197%
ECM #6	CRT Monitors	$6,800	$1,356	5.0	99%
ECM #7	AC Unit Upgrades	$135,780	$3,639	37	-60%
ECM #8	DDC System Upgrade	$100,000	$7,040	14	6%
ECM #9	NEMA Premium Efficiency Motors	$2,930	$249	12	27%
ECM #10	Programmable Thermostats	$6,500	$3,260	2.0	652%
ECM #11	Water Efficiency	$34,949	$1,479	24	-37%
ECM #12	Schedule Toilet Exhaust Fan	$1,000	$553	1.8	728.8%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	110 KW Solar System	$673,405	$48,697	13.8	8.5%

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

Table 4
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Equipment Upgrade	7.7	18,040	-
ECM #2	Lighting Controls Upgrade	-	13,014	-
ECM #3	Gymnasium Lighting Equipment and Controls	0.8	3,168	-
ECM #4	Unit Ventilator Upgrade	-	2,802	3,119
ECM #5	Automatic Computer Stand-by / Hibernate	-	10,496	-
ECM #6	CRT Monitors	-	7,616	-
ECM #7	AC Unit Upgrades	25.6	20,443	-
ECM #8	DDC System Upgrade	-	15,238	3,254
ECM #9	NEMA Premium Efficiency Motors	0.8	1,398	-
ECM #10	Programmable Thermostats	-	18,316	-
ECM #11	Water Efficiency	-	-	295
ECM #12	Schedule Toilet Exhaust Fan	-	2,061	140
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	110 KW Solar System	89.0	127,365	-

Table 5
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Equipment Upgrade	$3,211	$8,836	$0	$8,836	2.8
Lighting Controls Upgrade	$2,052	$10,500	$1,260	$9,240	4.5
Gymnasium Lighting Equipment and Controls	$564	$3,560	$870	$2,690	4.8
Unit Ventilator Upgrade	$4,648	$132,000	$0	$132,000	28
Automatic Computer Stand-by / Hibernate	$1,868	$567	$0	$567	0.3
CRT Monitors	$1,356	$6,800	$0	$6,800	5.0
~~AC Unit Upgrades~~	~~$3,639~~	~~$141,000~~	~~$5,220~~	~~$135,780~~	~~37~~
DDC System Upgrade	$7,040	$100,000	$0	$100,000	14
NEMA Premium Efficiency Motors	$249	$3,038	$108	$2,930	12
~~Programmable Thermostats~~	~~$3,260~~	~~$6,500~~	~~$0~~	~~$6,500~~	~~2~~
~~Water Efficiency~~	~~$1,479~~	~~$34,949~~	~~$0~~	~~$34,949~~	~~24~~
Schedule Toilet Exhaust Fan	$553	$1,000	$0	$1,000	1.8
Design / Construction Extras (15%)	*$0*	*$35,256*	*$0*	*$35,256*	
Total Project	**$21,540**	**$301,556**	**$2,238**	**$299,318**	**13.9**

ECMs marked with strikethrough font are not included in total.

Design / Construction Extras are shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Lighting Equipment Upgrade

Description:

The majority of the interior lighting throughout this facility is provided with fluorescent fixtures with older generation, 700 series 32W T8 lamps and electronic ballasts. Although 700 series T8 lamps are considered fairly efficient, further energy savings can be achieved by replacing the existing T8 lamps with new generation, 800 series 28W T8 lamps without compromising light output. CEG recommends, re-lamping all of the fixtures with 28W T8 lamps. In addition, some of the storage areas, locker room and gym areas, offices, auditorium, classrooms, restrooms and kitchen areas still have a variety of older fluorescent fixtures with magnetic ballasts and incandescent lamps. It is recommended to retrofit or replace all of the older fluorescent fixtures and the incandescent lights in these areas with high efficiency fluorescent T8 or T5 fixtures with electronic ballasts or compact fluorescent lamps. This ECM includes re-lamping of the existing fluorescent fixtures with 800 series, 28W T8 lamps.

The ECM also includes replacement of the incandescent lamps throughout the spaces with compact fluorescent lamps. 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 energy usage of an incandescent lamp compared to a compact fluorescent lamp 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:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

Rebates and Incentives:

There are no incentives or rebates for this ECM.

Replacement and Maintenance Savings:

There is no significant replacement and maintenance savings due to this ECM.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,836
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$8,836
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,211
Total Yearly Savings ($/Yr):	$3,211
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.8
Simple Lifetime ROI	445.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$48,166
Internal Rate of Return (IRR)	36%
Net Present Value (NPV)	$29,497

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

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

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

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

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

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

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

Energy Savings Calculations:

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

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

Total number of rooms to be retrofitted is 38. Remote mounted sensors are to be used in 32 rooms and switch mounted sensors are to be used in 6 rooms.

Incentives:

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

Occupancy Sensor Fixture Mounted (existing facility only) = $20 per sensor
Occupancy Sensor Remote Mounted (existing facility only) = $35 per sensor

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,500
NJ Smart Start Equipment Incentive ($):	$1,260
Net Installation Cost ($):	$9,240
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,052
Total Yearly Savings ($/Yr):	$2,052
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.5
Simple Lifetime ROI	233.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$30,775
Internal Rate of Return (IRR)	21%
Net Present Value (NPV)	$15,253

ECM #3: Gymnasium Lighting Equipment and Controls Upgrade

Description:

The Gymnasium at the Woodmont Elementary School utilizes 400W metal halide fixtures for its lighting. Metal halide bulbs provide a reasonably efficient option for bay lighting however a few draw-backs that are common. Metal halide fixtures often have poor overall efficacy which limits the amount of light actually leaving the fixture. Also metal halide bulbs require a significant warm-up period and even longer cool down period eliminating the potential for occupancy sensors frequent switching. This symptom encourages the gymnasium lighting to be left on continuously during the day. Another drawback is the reduced lumen output (Lumen Maintenance) of the metal halide bulb over its life time. Average bulb output or "mean lumens," is approximately 25% less than the bulb's initial lumens for typical metal halide lamps. In addition the most rapid rate of light output decline is during the beginning of its life, approximately 15-20% light loss within the first 20% of its rated life. It is important to note that the light loss has no savings in energy used; therefore the overall light efficiency is continuously decreasing with age. The final drawback is the light quality or Color Rendering Index (CRI). Typical values for metal halide bulbs is 65, which is a measure of how close the light is to true "full spectrum" light produced by sunlight or incandescent lighting. Metal halide bulbs also show noticeable color shifting when the bulb is reaching the end of its life. Utilizing fluorescent fixtures in low and high bay spaces is a superior option over metal halide fixtures in all areas described above. Although metal halide fixtures provide light very efficiently at the start of the bulb life, the average efficiency over the life is below that of fluorescent fixtures.

This ECM includes replacement of each of the existing gymnasium high bay metal halide light fixtures with T5HO fixtures with reflective lenses. The retrofit for the metal halide fixtures includes a one for one fixture replacement. The fluorescent fixtures selected will provide equivalent light compared to the average light output of the existing metal halide fixtures. The bulb replacement cost for T-5 HO lamps compared to the existing metal halide lamps were found to be approximately equal and therefore not included in the savings calculations.

This ECM also includes installation of occupancy sensors for the proposed fluorescent gymnasium light fixtures. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives

Metal Halide Fixtures

From the **Smart Start Incentive Appendix**, the following incentives are warranted:
For replacement of HID (400-999W) with new T-5 or T-8 fixtures = $100/Fixture

$$\text{Smart Start ® Incentive} = (\#\text{ of Metal Halide Fixture Replaced} \times \$100)$$

$$\text{Smart Start ® Incentive} = (8 \times \$100) = \$800$$

Occupancy Sensors

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

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

$$\text{Smart Start ® Incentive} = (2 \times \$35) = \$70$$

There is no significant replacement or maintenance savings generated with this ECM.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,560
NJ Smart Start Equipment Incentive ($):	$870
Net Installation Cost ($):	$2,690
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$564
Total Yearly Savings ($/Yr):	$564
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.8
Simple Lifetime ROI	214.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$8,459
Internal Rate of Return (IRR)	20%
Net Present Value (NPV)	$4,042

ECM #4: Install Unit Ventilators with Energy Recovery

Description:

The heating and air conditioning for the classrooms in the original section of the School are provided by Nesbitt unit ventilators, which are original to the building. The unit ventilators are over 30 years old and far beyond the end of expected useful service life, which is fifteen (15) years per ASHRAE.

The estimated total number of older unit ventilators in this facility is 13. The units are heating only and controlled with pneumatic controllers and actuators. It is recommended to replace older unit ventilators with modern unit ventilators with energy recovery wheels. The advantage of this setup is the utilization of the energy recovery system to recover the energy in the exhaust air in order to reduce the heating and cooling demand of the classrooms.

This ECM replaces existing older unit ventilators with new unit ventilators with hot water heating coils and built-in energy recovery wheels. The basis for this ECM is Trane HUVC series unit ventilator with corresponding Energy Recovery ventilators. The ECM also includes attaching the unit ventilator controls to the Building Energy Management System to achieve superior scheduling and controls.

Energy Savings Calculations:

The energy savings calculations are based reduction of the outside air heating, reduction of the overheating and infiltration due to opening of the windows and temperature setback during nights and weekends.

Nominal recovery capacity of the proposed unit is calculated based on typical outside air percentage, heating degree days and design day temperature difference. Total energy recovery of each unit at heating modes is calculated using heating degree days:

$$\text{Heating Energy Recovered}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Recovery Rate}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}(\text{Day }^{\circ}\text{F})\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times(0.60)}{65(^{\circ}\text{F})\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\,(\%)}$$

Amount of additional infiltration at each classroom due to open windows:

$$\text{Infiltration}\,(\text{BTU}/\text{Hr})=\frac{\text{Ave Classroom Size (SF)}\times 10'\,\text{Ceiling}\times\frac{\#\,\text{Air Changes}}{\text{Hr}}}{\frac{60\,\text{Minutes}}{\text{Hr}}}\times 1.08\times 65^{\circ}\text{F}$$

$$\text{Infiltration Energy}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Infiltration}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}(\text{Day }^{\circ}\text{F})\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times(0.60)}{65(^{\circ}\text{F})\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\,(\%)}$$

Fan Energy Cost:

$$\text{Fan Energy, kWh}=\frac{\text{Fan Power (HP)}\times\frac{0.746\text{kW}}{\text{HP}}\times 0.8\,\text{(Load Factor)}\times\text{Annual Hrs}}{0.9\,\text{(Power Factor)}}$$

Results of the calculations can be found in the table below:

UNIT VENTILATOR CALCULATIONS			
ECM INPUTS	**EXISTING UNITS**	**PROPOSED UNITS**	**SAVINGS**
ECM INPUTS	Existing Unit Ventilators UVs	New UVs with ERVs	
Number of Units	13	13	-
Ave. Unit Flow Capacity (CFM)	1250	1250	
Outside Air %	30%	30%	
Outside Air Flow (CFM)	375	375	
Heating Design Day Temp. Diff (°F)	65	65	
Average Classroom Size (SF)	1000	1000	
Additional Air Changes per Hour*	2	0	
Infiltration (CFM)	333	0	
Windows Open Hours/Day	3	0	
Infiltration Energy Loss (MBH/Unit)	23.4	0	
Heating Energy Recovery, MBH/Unit	-	26.3	26.3
ERV Operation Hours / Day	-	12	-
Supply Fan Motor HP	1/3	1/4	0
Fan Annual Hours of Operation	1560	780	780
Heating Degree Days	4713	4713	-
Net Heating System Efficiency	70%	70%	-
Electric Cost ($/KWH)	$0.178	$0.178	0.178
Natural Gas Cost ($/Therm)	$1.33	$1.33	$1.33
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED UNITS**	**SAVINGS**
Fan Energy (kWh)	4,483	1,681	2,802
Heating Energy Infiltration (Therms)	567	0	567
Heating Energy Recovery (Therms)	0	-2,552	2,552
Fan Energy Cost ($)	$798	$299	$499
Infiltration Energy Cost ($)	$754	$0	$754
Heating Energy Recovered ($)	$0	-$3,395	$3,395
Total ($)	$1,552	-$3,095	$4,648
COMMENTS:	* Due to open windows and overheating		

Project cost, incentives and maintenance savings:

Total installed cost for 13 unit ventilators with hot water coils, energy recovery ventilators (ERV) and controls upgrade is $182,000

The selected equipment does not qualify for any of the NJ Smart Start rebates.

There is no significant maintenance savings associated to this ECM.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$182,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$182,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,648
Total Yearly Savings ($/Yr):	$4,648
Estimated ECM Lifetime (Yr):	15
Simple Payback	39.2
Simple Lifetime ROI	-62%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$69,714
Internal Rate of Return (IRR)	-10%
Net Present Value (NPV)	($126,517)

ECM #5: Set Computers to Automatic Stand-by or Hibernate

Description:

During the survey, it was noticed that the majority of the computers were left at ON position with the monitors at Screen Saver or OFF positions. According to interviews with some of the personnel, the computers require significant amount of time to boot up therefore they are typically left ON.

Many personal computers (PC) came equipped with automatic Stand-by or Hibernate (power down) features. Normally computers boot up from Stand-by or Hibernate modes much faster than powering up from Shut Down position.

Based on an independent study by the U.S. Department of Energy, Energy star® rated computers use approximately 70% less power during Stand-by Mode. It is recommended to set up the PCs at this facility to switch into Stand-by Mode after a short period of inactivity and Hibernate mode after a long period of inactivity.

This ECM includes configuring the computers in the classrooms and the library such that they automatically:

- Stand-by after 15 minutes of inactivity
- Hibernate after 60 minutes of inactivity

The inactivity times above can be adjusted based on experience or preference. Even though this ECM can be implemented easily in house, the calculations assume an independent computer technician performing the task at a typical market rate.

Energy Savings Calculations:

No. of CRT Monitors:	68
Operating Weeks per Yr:	42
Estimated percentage of computers left ON over night:	75%

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

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

The cost of configuring the computers to automatically sleep or hibernate is based on 10 minutes per computer per technician at an hourly rate indicated below.

Implementation Costs: = # Computers X Configuration Time X Cost per Hour
= 68 Monitors X 10 Minutes/Computer X $100 per Hour

= $567

AUTOMATIC SLEEP OR HIBERNATE MODES FOR COMPUTERS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Manual Operation	Auto Power Save	-
# of Computers	68	68	-
% Computers left ON	75%	75%	-
Power when left ON (Watt)	50	50	-
Power at Stand-by (Watt)	5	5	-
Power at Hibernate (Watt)	4	4	-
Power when OFF (Watt)	0	0	-
Operating Weeks per Yr	42	42	-
Operating Hours per Week	168	168	-
Hours/Wk Computers ON	120	20	-
Hours/Wk at Sleep Mode	0	20	-
Hours/Wk at Hibernate Mode	0	80	-
Hours/Wk at Power Down	48	48	-
Elec Cost ($/kWh)	0.178	0.178	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	12,852	2,356	10,496
Energy Cost ($)	$2,288	$419	$1,868
COMMENTS:	Calculation assumes computers currently run throughout work week and get shut down over the weekend.		

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$567
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$567
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,868
Total Yearly Savings ($/Yr):	$1,868
Estimated ECM Lifetime (Yr):	10
Simple Payback	0.3
Simple Lifetime ROI	3196.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$18,683
Internal Rate of Return (IRR)	330%
Net Present Value (NPV)	$15,369.91

ECM #6: Computer Monitor Replacement

Description:

The majority of computers throughout the Woodmont Elementary School 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, 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 large 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 and the usage in classrooms. Energy consumption of computer monitors is based on manufacture's specifications.

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

Energy Savings Calculations:

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

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

COMPUTER MONITOR CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CRT Monitors	LCD Monitor	
# of Computers	68	68	
Monitor Power Cons. (W)	75	25	
Run Time %	70%	70%	
Operating Hrs per Week	80	80	
Operating Weeks per Yr	40	40	
Elec Cost ($/kWh)	0.178	0.178	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	11,424	3,808	7,616
Energy Cost ($)	$2,033	$678	$1,356
COMMENTS:			

Installation cost of new monitors is estimated based on current pricing for a 19" 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
68 Monitors X $100 per Monitor
$6800 Total Cost

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,800
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$6,800
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,356
Total Yearly Savings ($/Yr):	$1,356
Estimated ECM Lifetime (Yr):	10
Simple Payback	5.0
Simple Lifetime ROI	99.4%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$13,560
Internal Rate of Return (IRR)	15%
Net Present Value (NPV)	$4,766.96

ECM #7: AC Unit Upgrades

Description:

Sections of Woodmond Elementary School are conditioned by rooftop units and split system condensing units. Units currently serve various classrooms and offices. The remainder of the building does not have air conditioning units of any type. The units currently installed are less efficient compared to modern equipment and can be replaced with new high efficiency units. New air conditioners provide higher full load and part load efficiencies due to advances in inverter motor technologies, heat exchangers and refrigerants.

This ECM includes one-for-one replacement of the older air conditioning units with new higher efficiency systems. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. A summary of the unit replacements for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS	**SERVICE FOR**	**NUMBER OF UNITS**	**COOLING CAPACITY, BTU/HR**	**TOTAL CAPACITY, TONS**	**REPLACE UNIT WITH**
RTU	Room 14 & 16	1	120,000	10	Carrier Weathermaster Series
RTU	Room 15 & 17	1	90,000	7.5	Carrier Weathermaster Series
RTU	Room 18, Room 20	2	24,000	4	Carrier Weathermaster Series
RTU	Room 20	1	90,000	7.5	Carrier Weathermaster Series
RTU	Room 23	1	90,000	7.5	Carrier Weathermaster Series
RTU	Room 22	1	90,000	7.5	Carrier Weathermaster Series
SS	Various	6	42,000	21	Carrier Infinity Series
Total		**13**	**546,000**	**65**	

The manufacturers used as the basis for this calculation is Carrier. All units are one for one style replacements with matching capacity of the new units to the old units. The unit pricing and install cost were estimated based on current rates. The payback may change based on actual unit pricing and install costs if the ECM is implemented. Due to the payback over 15 years CE recommends that Montville BOE review the replacement of rooftop and condensing units as they reach the end of their service life in the coming years.

Energy Savings Calculations:

Cooling Energy Savings:

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

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

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

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

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNITS (S)EER**	**SPLIT UNITS (S)EER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
RTU	120,000	800	8.7 EER	11.5 EER	1	2,687	3.4
RTU	90,000	800	9.8 EER	12 EER	1	1,347	1.7
RTU	24,000	800	9 EER	13 EER	2	1,313	1.6
RTU	90,000	800	7.9 EER	12 EER	1	3,114	3.9
RTU	90,000	800	7.9 EER	12 EER	1	3,114	3.9
RTU	90,000	800	7.9 EER	12 EER	1	3,114	3.9
SS	42,000	800	9.9 EER	13.8 EER	6	5,755	7.2
Total					**13**	**20,443**	**25.6**

Project Cost, Incentives and Maintenance Savings

From the NJ Smart Start® Program appendix, the replacement of split system AC units and unitary systems with high efficiency AC systems falls under the category "Unitary HVAC Split System" and warrants an incentive based on efficiency (EER/SEER). The program incentives are calculated as follows:

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

AC UNITS REBATE SUMMARY				
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/TON**	**PROPOSED CAPACITY TONS**	**TOTAL REBATE $**
≥20 to 30 tons	10.5 EER	$79	0	$0
≥ 11.25 to < 20 tons	11.5 EER	$79	0	$0
≥ 5.4 to < 11.25 tons	11.5 EER	$73	40	$2,920
5.4 tons or less Unitary AC and Split System	≥14 SEER	$92	25.0	$2,300
TOTAL			**65**	**$5,220**

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**
RTU	$17,500	1	$17,500	$730	$16,770	$478	35.1
RTU	$16,250	1	$16,250	$548	$15,703	$240	65.5
RTU	$7,500	2	$15,000	$368	$14,632	$234	62.6
RTU	$16,250	1	$16,250	$548	$15,703	$554	28.3
RTU	$16,250	1	$16,250	$548	$15,703	$554	28.3
RTU	$16,250	1	$16,250	$548	$15,703	$554	28.3
SS	$7,250	6	$43,500	$1,932	$41,568	$1,024	40.6
Total	**$97,250**	**13**	**$141,000**	**$5,220**	**$135,780**	**$3,639**	**37.3**

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

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$141,000
NJ Smart Start Equipment Incentive ($):	$5,220
Net Installation Cost ($):	$135,780
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,639
Total Yearly Savings ($/Yr):	$3,639
Estimated ECM Lifetime (Yr):	15
Simple Payback	37.3
Simple Lifetime ROI	-60%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$54,585
Internal Rate of Return (IRR)	-10%
Net Present Value (NPV)	($92,338)

ECM #8: DDC System Upgrades

Description:

Woodmont Elementary School is currently controlled primarily through the use of pneumatic control systems. CE recommends expanding the DDC system to control remaining HVAC systems in the school including the air handling units, unit ventilators, wall thermostats, air conditioning units, rooftop units, and boilers. In addition, the existing control systems will be unified under one system allowing easier operation for building facility management personnel.

This ECM includes expansion of the existing Building Automation system to include control of the rest of the HVAC equipment in the facility. The system will include new temperature sensors and new local thermostats with limited over-ride capability, a front end computer and main controller. The system will also include central controls for lighting. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the building may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. 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 referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 5% of the electricity and 15% for the gas utility in this building.

The basis for the DDC system expansion is the Automated Logic Energy Management System or similar.

Energy Savings Calculations:

Since some of the key utility consumption and cost information was not available, estimated values are used for the unit cost of natural gas, total electricity usage and unit cost of electricity.

Energy savings for each utility is calculated with the equation below.

Energy Savings (Utility) = Current Energy Consumption × Estimated Savings, %

Following table summarizes energy savings for this facility via implementation of an Energy Management System:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Controls w/ Local Thermostats	DDC Controls	
Existing Nat Gas Usage (Therms)	21,693	-	
Existing Electricity Usage (kWh)	304,753	-	
Energy Savings, Nat. Gas	-	15%	
Energy Savings, Electricity	-	5%	
Gas Cost ($/Therm)	*$1.33*	$1.33	
Electricity Cost ($/kWh)	*$0.178*	$0.178	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	21,693	18,439	3,254
Electricity Usage (kWh)	304,753	289,515	15,238
Natural Gas Cost ($)	$28,851	$24,524	$4,328
Electricity Cost ($)	$54,246	$51,534	$2,712
Energy Cost ($)	$83,097	$76,057	$7,040
COMMENTS:			

Demand savings due to implementation of this ECM is minimal.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $2.00 to 2.50 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be

from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.
Estimated cost of complete DDC System = $100,000

Currently, there are no prequalified NJ SmartSmart Incentives for installation of the DDC system.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$100,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$100,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$7,040
Total Yearly Savings ($/Yr):	$7,040
Estimated ECM Lifetime (Yr):	15
Simple Payback	14.2
Simple Lifetime ROI	5.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$105,600
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($15,957)

ECM #9: Install NEMA Premium® Efficiency Motors

Description:

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

The school has a number of motors that are candidates to be replaced with NEMA Premium® efficiency motors. The motors are located in the boiler room which serves the hot water loop and zone loops. Boiler operating hours were estimated based on hours of operation obtained from the school based on daily usage and after school activities or weekend use.

This energy conservation measure replaces the existing lower efficiency electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today. The energy savings and payback are subject to change based on the pool filtration usage during the year. An implementation summary of the motor is provided below.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
P - 3	Zone 2	5	1,750	81.5%	90.2%
P - 4	Zone 2	5	1,750	81.5%	90.2%

Energy Savings Calculations:

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

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

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

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

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

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWH	COST SAVINGS
P - 3	5	90%	81.5%	90.2%	0.40	699	$124
P - 4	5	90%	81.5%	90.2%	0.40	699	$124
TOTAL					**0.8**	**1,398**	**$249**

Equipment Cost and Incentives

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

INCENTIVES	
HORSE POWER	NJ SMART START INCENTIVE
1	$45
1.5	$45
2	$54
3	$54
5	$54
7.5	$81
10	$90
15	$104
20	$113
25	$117
30	$135
40	$162

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

MOTOR REPLACEMENT SUMMARY						
EQMT ID	MOTOR POWER HP	INSTALLED COST	SMART START INCENTIVE	NET COST	TOTAL SAVINGS	SIMPLE PAYBACK
P - 3	5	$1,519	$90	$1,429	$124	11.5
P - 4	5	$1,519	$90	$1,429	$124	11.5
TOTAL		**$3,038**	**$540**	**$2,858**	**$249**	**11.5**

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,038
NJ Smart Start Equipment Incentive ($):	$108
Net Installation Cost ($):	$2,930
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$249
Total Yearly Savings ($/Yr):	$249
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.8
Simple Lifetime ROI	27.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,733
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$41

ECM #10: Programmable Thermostats for AC Units

Description:

The air conditioning for the Woodmont Elementary School is achieved via rooftop air conditioners with a total of 65-tons of cooling capacity. The system is controlled with various types of mechanical and digital thermostats, some of which does not allow for a night setback.

Energy consumption of the air conditioning system can be reduced by installing a programmable thermostat. Programmable thermostats for air conditioning units are available to utilize time-of-day schedules for occupied and unoccupied times and set-backs.

This energy conservation measure will install programmable thermostats to control the individual packaged or split air conditioning systems. The thermostats shall have password lock-out with limited override capability in order to make sure units set-back and/or reset based on occupancy. Basis for this ECM is Honeywell Vision Pro thermostat, model# T7351F2010 or equivalent.

Energy Savings Calculations:

Energy savings calculations are derived from the annual energy consumption of the units based on total cooling capacity and seasonal integrated energy efficiency of the system. The calculation uses the number of annual cooling degree days (CDDs) and the estimated hours of setback during the unoccupied period on each day.

First total energy consumption of the unit in occupied and unoccupied modes are calculated using the total cooling capacity and the CDDs.

$$\text{Energy Consp., kWh (Occupied)} = \frac{\text{Cooling Capacity}, \frac{\text{BTU}}{\text{Hr}} \times \text{Operation Hours } (\text{CDDs}_{65^\circ\text{F}})}{\text{IEER} \times 1000 \frac{\text{W}}{\text{kWh}}}$$

$$\text{Energy Consp., kWh (Unoccupied)} = \frac{\text{Cooling Capacity}, \frac{\text{BTU}}{\text{Hr}} \times \text{Operation Hours } (\text{CDDs}_{70^\circ\text{F}})}{\text{IEER} \times 1000 \frac{\text{W}}{\text{kWh}}}$$

Total Annual Energy Consumption of the unit in partly occupied and unoccupied settings are calculated simply by proportioning the hours of day in occupied mode and unoccupied modes using equation below:

$$\text{Total Energy Consp., kWh (Partly Occupied \& } \textit{Unoccupied Modes}\text{)}$$

$$= \frac{\text{Cooling Capacity}, \frac{\text{BTU}}{\text{Hr}}}{\text{IEER} \times 1000 \frac{\text{W}}{\text{kWh}}} \times \left(\frac{(24 - \text{HoursSetback}) \times \text{CDDs}_{65°\text{F}}}{24} - \frac{\text{HrsSetback} \times \text{CDDs}_{70°\text{F}}}{24} \right)$$

Energy savings is the difference between the energy consumption of the unit at always occupied mode and partly occupied mode.

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

Demand savings cannot be achieved in this facility via installing programmable thermostats.

Energy savings calculations are summarized in the table below.

PROGRAMMABLE THERMOSTAT for AIR CONDITIONING			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Mechanical Thermostat	Programmable Thermostat	
Total Cooling Capacity, Tons	65	65	-
Number of Programmable Thermostat	13	13	
Annual Cooling Degree Days, Base 65°F	1,624	1,624	-
Annual Cooling Degree Days, Base 70°F	990	990	-
Unit Efficiency (Estimated, IEER)	9	9	-
Hours Set-back	0	8	
Elec Cost ($/kWh)	$0.178	$0.178	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Cons. (Non Set-back)	140,747	93,831	46,916
Electric Cons. (Set-back)	0	28,600	(28,600)
Electric Cons. (Total)	140,747	122,431	18,316
Electric Energy Cost ($)	$25,053	$21,793	$3,260
COMMENTS:	HDDs estimated based on Newark,NJ.		

Cost

Installed cost of programmable thermostats is $500/Unit. Each unit will require an individual programmable thermostat. **The total cost of the installed units is $6,500.**

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$6,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,260
Total Yearly Savings ($/Yr):	$3,260
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.0
Simple Lifetime ROI	652.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$48,900
Internal Rate of Return (IRR)	50%
Net Present Value (NPV)	$32,418

ECM #11: Water Efficiency & Conservation

Description:

The facility utilizes standard plumbing fixtures. The typical water closet and urinal water consumption only meet the minimum federally required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the replacement of the existing sink faucets, water closets and urinals within the bathrooms the facility. The estimated usage of the plumbing fixtures is based on the total population of the facility.

The proposed retrofit includes installation of auto flow sink faucets, low flow aerators, low flow flushometer style water closets that utilize 1.28 gallons per flush and ultra-low flushometer style urinals that utilize 1/8 gallons per flush. For the basis of this calculation the LEED rating system was used to estimate the occupancy usage for students within the school. When water consumption information was not available, the GPF values were estimated for the existing fixtures.

Energy Savings Calculations:

Urinals and Toilets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Flush}}{\text{Person per Day}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Flush}}\right)$$

Faucets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Use}}{\text{Person per Day}}\right) \times \text{Use Time}\left(\frac{\text{Sec}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Water Cost} = \frac{\text{Water Consumption (Gallons)} \times \text{Ave Cost}\left(\frac{\$}{1000\ \text{Gal}}\right)}{1000(\text{Gal})}$$

$$\text{Gas Cost (Therms)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.34\ \text{BTU}}{\text{Gal}} \times \frac{\text{Therm}}{100{,}000\ \text{BTU}}$$

WATER CONSERVATION CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Fixtures	Low Flow / Auto Flow Fixtures	-
Total Number of Students	440	440	-
% Male to Female	50%	50%	-
Estimated % Floor Area Served by Older Bathrooms	100%	100%	-
Occupied Days Per Year	195	195	-
Lavatory Uses per Day per Person	3	3	-
Sink flow time per use, sec	15	12	-
Sink Aerator Flow, GPM	1.5	0.5	-
WC Uses per Day per Person	2.0	2.0	-
Urinal Uses per Day per Person	1.0	1.0	-
Total Urinal Flushes Per Day	220	220	-
Total WC Flushes Per Day	440	440	-
Urinal Gallons Per Flush (GPF)	1.0	0.125	0.875
WC Gallons Per Flush (GPF)	1.6	1.28	0.32
**** Water Cost ($/1000 Gal)**	$8.00	$8.00	-
Gas Cost ($/Therm)	$1.33	$1.33	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Water Consumption, Urinal and WC (Gal)	180,180	115,187	64,994
Water Consumption, Faucets (Gal)	96,525	25,740	70,785
Total Water Consumption, (Gal)	276,705	140,927	135,779
Water Cost ($)	$2,214	$1,127	$1,086
Gas Consumption (Therms)	403	107	295
Gas Cost ($/Year)	$535	$143	$393
Total Savings ($/Year)	-	-	$1,479
COMMENTS:	*Savings are based on LEED Reference Guide for Green Building Design and Construction - 2009 Edition for WC and Urinal water usage. ** Cost of Water estimated.		

The cost for installation and materials of water closets, low flow urinals and new auto flow sink faucets throughout the facility is estimated to be $34,949.

There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$34,949
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$34,949
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,479
Total Yearly Savings ($/Yr):	$1,479
Estimated ECM Lifetime (Yr):	15
Simple Payback	23.6
Simple Lifetime ROI	-36.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$22,185
Internal Rate of Return (IRR)	-5%
Net Present Value (NPV)	($17,292.79)

ECM #12: Schedule Toilet Exhaust Fan

Description:

Ventilation air for this facility is supplied through the unit ventilators and excess air is discharged from the corridors and bathrooms via exhaust fans located on the roof and in the basement. During the survey it was noted that one of the exhaust fans were controlled manually with a switch. After investigation, it was noted that this fan ran 24 hours per day year round. It is recommended to implement time-of-day schedule and control for this exhaust fan so that it can be scheduled to turn on and off based on occupancy.

This ECM includes expansion of the existing Building Management System at this facility to implement time-of-day controls for the bathroom exhaust fan located in the crawl space in the boiler room to achieve superior scheduling and controls.

Energy Savings Calculations:

The energy savings calculations are based reduction of the outside air heating during nights and weekends.

First nominal heat load caused by the operation of this fan is calculated based on outside air, heating degree days and design day temperature difference.

$$\text{Nominal Heat Load}\left(\frac{\text{BTU}}{\text{Hr}}\right) = 1.08 \times \text{Exhaust Flow (CFM)} \times \text{Design Day Temp Difference (°F)}$$

The energy consumption of the exhaust system is calculated using heating degree days equation:

$$\text{Heating Energy}\left(\frac{\text{Therms}}{\text{Yr} \times \text{Unit}}\right) = \frac{\text{Heat Load}\left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD(Day °F)} \times \#\left(\frac{\text{Hr.}}{\text{Day}}\right) \times (0.60)}{65(\text{°F}) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency (\%)}}$$

Fan Energy Cost:

$$\text{Fan Energy, kWh} = \frac{\text{Fan Power (HP)} \times \frac{0.746\text{kW}}{\text{HP}} \times 0.8\,\text{(Load Factor)} \times \text{Annual Hrs}}{0.9\,\text{(Power Factor)}}$$

Results of the calculations can be found in the table below:

EXHAUST FAN CALCULATIONS			
ECM INPUTS	**EXISTING CONTROLS**	**PROPOSED CONTROLS**	**SAVINGS**
ECM INPUTS	24/7	12hr/day on weekdays	
Number of Units	1	1	-
Exhaust Flow (CFM)	200	200	
Operation Weeks/Yr	52	42	
Operation Days/Week	7	5	
Windows Open Hours/Day	24	12	
Supply Fan Motor HP	1/2	1/2	
Fan Annual Hours of Operation*	8736	2520	6216
Design Day Temp. Diff (°F)	65	65	
Heating Degree Days	4713	4713	-
Net Heating System Efficiency	70%	70%	-
Infiltration Energy Loss (MBH/Unit)	14.0	14.0	
Electric Cost ($/KWH)	$0.178	$0.178	0.178
Natural Gas Cost ($/Therm)	$1.33	$1.33	$1.33
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED UNITS**	**SAVINGS**
Fan Energy (kWh)	2,896	836	2,061
Heating Energy Infiltration (Therms)	209	70	140
Fan Energy Cost ($)	$516	$149	$367
Infiltration Energy Cost ($)	$279	$93	$186
Total ($)	$794	$242	$553
COMMENTS:			

Project cost, incentives and maintenance savings:

Cost of implementation of this ECM is $1,000

There is no significant maintenance savings associated to this ECM.

Energy Savings Summary:

ECM #12 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$553
Total Yearly Savings ($/Yr):	$553
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.8
Simple Lifetime ROI	728.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$8,288
Internal Rate of Return (IRR)	55%
Net Present Value (NPV)	$5,596.11

REM #1: 110 KW Solar System

Description:

Woodmont Elementary School has available roof and parking space that could accommodate a solar system. Based on the available area, a 110 kilowatt solar array could be installed, assuming the existing roof structure is capable of supporting an array. The array will peak at approximately 89 kW of AC power, which will produce 127,365 kilowatt-hours annually. The system will reduce the overall electric usage of the facility by 41%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period. This model has been adjusted based on current SREC market values as of December 2011.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
System Size (KW_{DC}):	110.22
Electric Generation (KWH/Yr):	127,365
Installation Cost ($):	$673,405
SREC Revenue ($/Yr):	$26,026
Energy Savings ($/Yr):	$22,671
Total Yearly Savings ($/Yr):	$48,696
ECM Analysis Period (Yr):	15
Simple Payback (Yrs):	13.8
Analysis Period Electric Savings ($):	$421,655
Analysis Period SREC Revenue ($):	$377,011
Net Present Value (NPV)	($173,915.55)

V. 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. Turn off computers when not in use. Ensure computers are not running in screen saver mode which saves the monitor screen not energy.

F. Ensure outside air dampers are functioning properly and only open during occupied mode.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Woodmont Elementary School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Equipment Upgrade	$8,836	$0	$0	$8,836	$3,211	$0	$3,211	15	$48,166	$0	445.1%	2.8	35.98%	$29,497.29
ECM #2	Lighting Controls Upgrade	$10,500	$0	$1,260	$9,240	$2,052	$0	$2,052	15	$30,775	$0	233.1%	4.5	20.92%	$15,252.88
ECM #3	Gymnasium Lighting Equipment and Controls Upgrade	$3,560	$0	$870	$2,690	$564	$0	$564	15	$8,459	$0	214.4%	4.8	19.52%	$4,041.85
ECM #4	Unit Ventilator Upgrade	$84,857	$47,143	$0	$132,000	$4,648	$0	$4,648	15	$69,714	$0	-47.2%	28.4	-7.09%	($76,517.44)
ECM #5	Automatic Computer Stand-by / Hibernate	$567	$0	$0	$567	$1,868	$0	$1,868	10	$18,683	$0	3196.9%	0.3	329.69%	$15,369.91
ECM #6	CRT Monitors	$6,800	$0	$0	$6,800	$1,356	$0	$1,356	10	$13,560	$0	99.4%	5.0	15.02%	$4,766.96
ECM #7	AC Unit Upgrades	$141,000	$0	$5,220	$135,780	$3,639	$0	$3,639	15	$54,585	$0	-59.8%	37.3	-9.70%	($92,337.85)
ECM #8	DDC System Upgrade	$100,000	$0	$0	$100,000	$7,040	$0	$7,040	15	$105,600	$0	5.6%	14.2	0.69%	($15,956.94)
ECM #9	NEMA Premium Efficiency Motors	$3,038	$0	$108	$2,930	$249	$0	$249	15	$3,733	$0	27.4%	11.8	3.19%	$40.61
ECM #10	Programmable Thermostats	$2,600	$3,900	$0	$6,500	$3,260	$0	$3,260	15	$48,900	$0	652.3%	2.0	50.04%	$32,417.67
ECM #11	Water Efficiency	$34,949	$0	$0	$34,949	$1,479	$0	$1,479	15	$22,185	$0	-36.5%	23.6	-5.21%	($17,292.79)
ECM #12	Schedule Toilet Exhaust Fan	$500	$500	$0	$1,000	$553	$0	$553	15	$8,288	$0	728.8%	1.8	55.18%	$5,596.11
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	110 KW Solar System	$673,405	$0	$0	$673,405	$22,671	$26,026	$48,697	15	$730,455	$390,390	8.5%	13.8	1.03%	($92,063.38)

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

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-2 lamps) $30 per fixture (3-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Premium Motors

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Woodmont School

Building ID: 2957254
For 12-month Period Ending: July 31, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: January 12, 2012

Facility
Woodmont School
39 Woodmont Road
Pine Brook, NJ 07058

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

Year Built: 1973
Gross Floor Area (ft²): 39,000

Energy Performance Rating[2] (1-100) 59

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,039,817
Natural Gas (kBtu)[4]	2,169,276
Total Energy (kBtu)	3,209,093

Energy Intensity[4]

Site (kBtu/ft²/yr)	82
Source (kBtu/ft²/yr)	147

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	263

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

National Median Comparison

National Median Site EUI	89
National Median Source EUI	160
% Difference from National Median Source EUI	-8%
Building Type	K-12 School

Stamp of Certifying Professional

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

Meets Industry Standards[5] **for Indoor Environmental Conditions:**

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

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) 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	Woodmont School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	39 Woodmont Road, Pine Brook, NJ 07058	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 a hospital (general medical and surgical)) nor can they be submitted as representing only a portion of a building		☐
Woodmont School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	39,000 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.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	68	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	1	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	70 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Light Co [FirstEnergy Corp]

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2011	07/31/2011	32,404.00
06/01/2011	06/30/2011	15,446.00
05/01/2011	05/31/2011	20,967.00
04/01/2011	04/30/2011	23,207.00
03/01/2011	03/31/2011	44,485.00
02/01/2011	02/28/2011	21,206.00
01/01/2011	01/31/2011	22,165.00
12/01/2010	12/31/2010	26,215.00
11/01/2010	11/30/2010	26,566.00
10/01/2010	10/31/2010	22,247.00
09/01/2010	09/30/2010	28,325.00
08/01/2010	08/31/2010	21,520.00
Electric Consumption (kWh (thousand Watt-hours))		**304,753.00**
Electric Consumption (kBtu (thousand Btu))		**1,039,817.24**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,039,817.24**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
07/01/2011	07/31/2011	58.00
06/01/2011	06/30/2011	45.00
05/01/2011	05/31/2011	1,549.00
04/01/2011	04/30/2011	1,953.00
03/01/2011	03/31/2011	2,337.00
02/01/2011	02/28/2011	2,949.00
01/01/2011	01/31/2011	6,044.00
12/01/2010	12/31/2010	4,097.00
11/01/2010	11/30/2010	1,953.00
10/01/2010	10/31/2010	600.42

09/01/2010	09/30/2010	87.56
08/01/2010	08/31/2010	19.78
Gas Consumption (therms)		**21,692.76**
Gas Consumption (kBtu (thousand Btu))		**2,169,276.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**2,169,276.00**
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.

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
Woodmont School
39 Woodmont Road
Pine Brook, NJ 07058

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

General Information

Woodmont School	
Gross Floor Area Excluding Parking: (ft^2)	39,000
Year Built	1973
For 12-month Evaluation Period Ending Date:	July 31, 2011

Facility Space Use Summary

Woodmont School	
Space Type	K-12 School
Gross Floor Area(ft^2)	39,000
Open Weekends?	No
Number of PCs	68
Number of walk-in refrigeration/freezer units	1
Presence of cooking facilities	Yes
Percent Cooled	70
Percent Heated	100
Months°	N/A
High School?	No
School District°	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2011)	**Baseline** (Ending Date 07/31/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	59	59	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	82	82	70	N/A	89
Source (kBtu/ft^2)	147	147	125	N/A	160
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					
$MtCO_2e$/year	263	263	223	N/A	286
$kgCO_2e/ft^2$/year	7	7	6	N/A	8

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Median column presents energy performance data your building would have if your building had a median rating of 50.

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

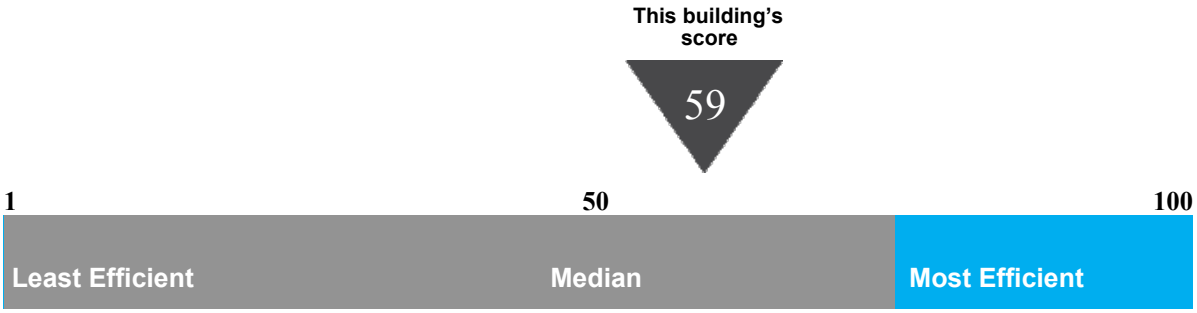
Statement of Energy Performance

2011

Woodmont School
39 Woodmont Road
Pine Brook, NJ 07058

Portfolio Manager Building ID: 2957254

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 147 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2011

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 01/12/2012

MAJOR EQUIPMENT LIST

Concord Engineering Group

Woodmont Elementary School

Unit Ventilators

Tag	UV	UV	
Unit Type	Horizontal Floor Mount	Horizontal Floor Mount	
Qty	13	3	
Location	Original Section	New Section	
Manufacturer	Nesbitt	Trane	
Model #	-	-	
Serial #	-	-	
Flow (CFM)	1200 (Est)	1500	
Cooling Capacity (Tons)	N/A	3.5	
Estimated Cooling Efficiency (EER)	N/A	10	
Heating Type	Hot Water Coil	Hot Water Coil	
Heating Input (MBH)	-	-	
Approx Age	30	10 (Est)	
Ashrae Service Life	15	15	
Remaining Life	(15)	5	
Comments	Poor condition	Coupled with Split Condensers. Good condition	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Woodmont Elementary School

RTU / AC Units

Tag			
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	2
Location	Roof	Roof	Roof
Area Served	Room 14 & 16	Room 15 & 17	Room 18 Room 24
Manufacturer	Carrier	Trane	Lennox
Model #	50DR012520AA	TSC090A3E0A1P	GCS16-024-50-1P
Serial #	894819	525101786L	5697G03686 / 5697G03685
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	10	7.5	2.0
Cooling Efficiency (SEER/EER)	8.7 EER	9.8	9.0 EER (est)
Heating Type	N/A	N/A	Natural Gas
Heating Capacity (MBH)	N/A	N/A	50 MBH Input (80% Efficiency)
Approx Age	22	12	14
ASHRAE Service Life	15	15	15
Remaining Life	(7)	3	1
Comments	* Heater Accessory		

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Woodmont Elementary School

RTU / AC Units

Tag			
Unit Type	Rooftop Unit	Rooftop Unit	Rooftop Unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Room 20	Room 23	Room 22
Manufacturer	Carrier	Carrier	Carrier
Model #	50CD008500	50CD006500	50CD006500
Serial #	1083084	1483G87301	1483667302
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	7.5	7.5	7.5
Cooling Efficiency (SEER/EER)	7.9 EER	7.9 EER	7.9 EER
Heating Type	N/A	N/A	N/A
Heating Capacity (MBH)	N/A	N/A	N/A
Approx Age	28	28	28
ASHRAE Service Life	15	15	15
Remaining Life	(13)	(13)	(13)
Comments	* Heater Accessory	* Heater Accessory	* Heater Accessory

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Woodmont Elementary School

RTU / AC Units

Tag			
Unit Type	Split System Condensing Unit		
Qty	6		
Location	Roof		
Area Served	-		
Manufacturer	Trane		
Model #	TTP042C100A4		
Serial #	P074PK12F		
Cooling Type	R22, DX		
Cooling Capacity (Tons)	3.5		
Cooling Efficiency (SEER/EER)	9.9		
Heating Type	Hot Water Coil in the Unit Ventilator		
Heating Capacity (MBH)	Hot Water		
Approx Age	12		
ASHRAE Service Life	15		
Remaining Life	3		
Comments	Direct Expansion Cooling for Unit Ventilators		

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Woodmont Elementary School

Boilers

Tag	Boiler - #1 & 2		
Unit Type	Modular Condensing Boiler		
Qty	2		
Location	Boiler Room		
Area Served	Heating Hot Water Loop		
Manufacturer	Aerco		
Model #	Benchmark 2.0		
Serial #			
Input Capacity (Btu/Hr)	2,000		
Rated Output Capacity (Btu/Hr)	1,800		
Approx. Efficiency %	90.0%		
Fuel	Natural Gas		
Approx Age	7		
ASHRAE Service Life	25		
Remaining Life	18		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Woodmont Elementary School

Domestic Water Heaters

Tag	DHW - 1	DHW - 2	
Unit Type	Domestic Gas Hot Water Heater	Domestic Gas Hot Water Heater	
Qty	1	1	
Location	Boiler Room	Boiler Room	
Area Served	Domestic Hot Water	Domestic Hot Water	
Manufacturer	Rheem	Vanguard	
Model #	42V50-65F	3WA71	
Serial #	RHLN0710403232	VG 0309B19418	
Size (Gallons)	48	50	
Input Capacity (MBH/KW)	65 MBH	4,500 Watt	
Recovery (Gal/Hr)	-	-	
Efficiency %	80%	-	
Fuel	Natural Gas	Electricity	
Approx Age	1	2	
ASHRAE Service Life	12	12	
Remaining Life	11	10	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Woodmont Elementary School

Pumps

Tag	P - 1/2	P - 3/4	P - 5/6
Unit Type	Base Mounted	In - Line	In - Line
Qty	2	2	2
Location	Boiler Room	Boiler Room	Boiler Room
Area Served	Zone 1	Zone 2	Zone 3
Manufacturer	Armstrong	B&G	Taco
Model #	-	25K95B	12008E2NAB696D
Serial #	-	CT117502K40	-
Horse Power	1.5	5.0	2.0
Flow	-	88 GPM @ 80 ft	-
Motor Info	Marathon	U.S. Electric Motors	Baldor
Electrical Power	208-230 / 460	208-230 / 460	208-230 / 460
RPM	1750	1725	1725
Motor Efficiency %	84.0%	81.5%	82.5%
Approx Age	20 (est)	3	13
ASHRAE Service Life	20	10	10
Remaining Life	0	7	(3)
Comments	*Flow data missing from tag		*Flow data missing from tag

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

Investment Grade Lighting Audit

CEG Job #: 9C11046

Project: Montville Twp BOE **Woodmont Elementary** **KWH COST: $0.178**

Address: 39 Woodmont Road

Pine Brook, New Jersey

Bldg. Sq. Ft. 44,000

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.11	Classroom 6	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 7	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 8	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 9	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 10	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 11	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 12	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 13	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 5	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 2	2000	16	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.99	1,984.0	$353.15	16	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.80	1600	$284.80	$14.00	$224.00	0.19	384	$68.35	3.28
221.11	Classroom 3	2000	24	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.49	2,976.0	$529.73	24	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	1.20	2400	$427.20	$14.00	$336.00	0.29	576	$102.53	3.28
242.21	Boy's Restroom	2000	4	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.44	872.0	$155.22	4	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	0.40	800	$142.40	$28.00	$112.00	0.04	72	$12.82	8.74
242.21	Girl's Restroom	2000	4	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.44	872.0	$155.22	4	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	0.40	800	$142.40	$28.00	$112.00	0.04	72	$12.82	8.74
221.11	Elec. Closet 1	1200	4	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.25	297.6	$52.97	4	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.20	240	$42.72	$14.00	$56.00	0.05	57.6	$10.25	5.46
221.21	Cust. Office	2000	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	248.0	$44.14	2	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.10	200	$35.60	$14.00	$28.00	0.02	48	$8.54	3.28
221.11	Classroom 14	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 15	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
221.11	Classroom 16	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.11	Classroom 17	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.74	1,488.0	$264.86	12	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.60	1200	$213.60	$14.00	$168.00	0.14	288	$51.26	3.28
242.22	Boy's Restroom	2000	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	0.33	654.0	$116.41	3	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	0.30	600	$106.80	$28.00	$84.00	0.03	54	$9.61	8.74
242.22	Girl's Restroom	2000	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	0.33	654.0	$116.41	3	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	0.30	600	$106.80	$28.00	$84.00	0.03	54	$9.61	8.74
242.21	Cust. Closet 4	2000	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.11	218.0	$38.80	1	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	0.10	200	$35.60	$28.00	$28.00	0.01	18	$3.20	8.74
612		2000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	200.0	$35.60	1	1	(1) 26w CFL Lamp	26	0.03	52	$9.26	$20.00	$20.00	0.07	148	$26.34	0.76
221.11	Faculty Room 19	2000	4	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.25	496.0	$88.29	4	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.20	400	$71.20	$14.00	$56.00	0.05	96	$17.09	3.28
221.11	Room 18	2000	8	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.50	992.0	$176.58	8	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.40	800	$142.40	$14.00	$112.00	0.10	192	$34.18	3.28
221.11	Room 21	2000	3	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.19	372.0	$66.22	3	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.15	300	$53.40	$14.00	$42.00	0.04	72	$12.82	3.28
221.11	Classroom 20	2000	18	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.12	2,232.0	$397.30	18	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.90	1800	$320.40	$14.00	$252.00	0.22	432	$76.90	3.28
221.37	Media Center	2000	44	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	2.73	5,456.0	$971.17	44	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	2.20	4400	$783.20	$14.00	$616.00	0.53	1056	$187.97	3.28
221.11	Classroom 22	2000	16	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.99	1,984.0	$353.15	16	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.80	1600	$284.80	$14.00	$224.00	0.19	384	$68.35	3.28
242.22	Classroom 25	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.31	2,616.0	$465.65	12	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	1.20	2400	$427.20	$28.00	$336.00	0.11	216	$38.45	8.74
242.22	Classroom 26	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.31	2,616.0	$465.65	12	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	1.20	2400	$427.20	$28.00	$336.00	0.11	216	$38.45	8.74
242.22	Classroom 29	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.31	2,616.0	$465.65	12	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	1.20	2400	$427.20	$28.00	$336.00	0.11	216	$38.45	8.74
242.22	Classroom 30	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.31	2,616.0	$465.65	12	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	1.20	2400	$427.20	$28.00	$336.00	0.11	216	$38.45	8.74
232.22	Room 27	2000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.26	516.0	$91.85	3	3	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	75	0.23	450	$80.10	$21.00	$63.00	0.03	66	$11.75	5.36
232.22	Room 28	2000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.26	516.0	$91.85	3	3	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	75	0.23	450	$80.10	$21.00	$63.00	0.03	66	$11.75	5.36
242.21	Nurse's Office	2000	6	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.65	1,308.0	$232.82	6	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	0.60	1200	$213.60	$28.00	$168.00	0.05	108	$19.22	8.74
242.21	Main Office	2000	6	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.65	1,308.0	$232.82	6	4	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	100	0.60	1200	$213.60	$28.00	$168.00	0.05	108	$19.22	8.74
227.21	Lobby	3000	22	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.36	4,092.0	$728.38	22	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	1.10	3300	$587.40	$14.00	$308.00	0.26	792	$140.98	2.18
221.11	Principal's Office	2000	8	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.50	992.0	$176.58	8	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.40	800	$142.40	$14.00	$112.00	0.10	192	$34.18	3.28

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.11	Classroom LL1	2000	14	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.87	1,736.0	$309.01	14	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.70	1400	$249.20	$14.00	$196.00	0.17	336	$59.81	3.28
221.11	Classroom LL2	2000	14	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.87	1,736.0	$309.01	14	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.70	1400	$249.20	$14.00	$196.00	0.17	336	$59.81	3.28
612	Boiler Room	3000	8	1	Pendant Mnt., 100w A19 Lamp	100	0.80	2,400.0	$427.20	8	1	(1) 26w CFL Lamp	26	0.21	624	$111.07	$20.00	$160.00	0.59	1776	$316.13	0.51
222.21	Lower Level Corridor	3000	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	0.25	744.0	$132.43	4	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.20	600	$106.80	$14.00	$56.00	0.05	144	$25.63	2.18
222.21	Corridors	3000	58	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	3.60	10,788.0	$1,920.26	58	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	2.90	8700	$1,548.60	$14.00	$812.00	0.70	2088	$371.66	2.18
222.21	Connecting Corridor	3000	5	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	0.31	930.0	$165.54	5	2	28w 800 Series - Relamp; Sylvania Lamp FO28/841/SS/ECO	50	0.25	750	$133.50	$14.00	$70.00	0.06	180	$32.04	2.18
766	Gym	2000	8	1	400w MH Lobay, Prismatic Lens	465	3.72	7,440.0	$1,324.32	8	6	2x4 54w T5HO 6 Lamp w/Prismatic Lens	360	2.88	5760	$1,025.28	$370.00	$2,960.00	0.84	1680	$299.04	9.90
612	Elec. Closet 2	500	2	1	Pendant Mnt., 100w A19 Lamp	100	0.20	100.0	$17.80	2	1	(1) 26w CFL Lamp	26	0.05	26	$4.63	$20.00	$40.00	0.15	74	$13.17	3.04
713	Front Overhang	3000	5	1	100w A Lamp, 1x1 w/Prismatic Lens	100	0.50	1,500.0	$267.00	5	1	26w CFL	26	0.13	390	$69.42	$30.00	$150.00	0.37	1110	$197.58	0.76
725	Exterior	3000	6	1	150w HPS Wallpack	188	1.13	3,384.0	$602.35	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
705		3000	2	1	500w Quartz Flood Light	500	1.00	3,000.0	$534.00	2	1	100w Pulse Start MH Flood	110	0.22	660	$117.48	$180.00	$360.00	0.78	2340	$416.52	0.86
	Totals		533	117				92,806	$16,519	533	121			32.5	69,702	$12,407		$11,796	8.6	19,720	$3,510	3.36

Investment Grade Lighting Audit

CEG Job #: 9C11046
Project: Montville Twp BOE
Address: 39 Woodmont Road
Pine Brook, New Jersey
Building SF: 44,000

Woodmont Elementary

KWH COST: $0.178

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS											SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.11	Classroom 6	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 7	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 8	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 9	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 10	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 11	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 12	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 13	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 5	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 2	2000	16	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.992	1984	353.152	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.79	20%	1587.2	$282.52	$300.00	$300.00	0.20	396.8	$70.63	4.25
221.11	Classroom 3	2000	24	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.488	2976	529.728	24	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	1.19	20%	2380.8	$423.78	$300.00	$300.00	0.30	595.2	$105.95	2.83
242.21	Boy's Restroom	2000	4	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.436	872	155.216	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.35	20%	697.6	$124.17	$300.00	$300.00	0.09	174.4	$31.04	9.66
242.21	Girl's Restroom	2000	4	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.436	872	155.216	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.35	20%	697.6	$124.17	$300.00	$300.00	0.09	174.4	$31.04	9.66
221.11	Elec. Closet 1	1200	4	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.248	297.6	52.9728	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.20	20%	238.08	$42.38	$300.00	$300.00	0.05	59.52	$10.59	28.32

Investment Grade Lighting Audit

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.21	Cust. Office	2000	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	248	44.144	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.10	20%	198.4	$35.32	$300.00	$300.00	0.02	49.6	$8.83	33.98
221.11	Classroom 14	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 15	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 16	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
221.11	Classroom 17	2000	12	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.744	1488	264.864	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.60	20%	1190.4	$211.89	$300.00	$300.00	0.15	297.6	$52.97	5.66
242.22	Boy's Restroom	2000	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	0.327	654	116.412	3	0	no change	109	0.33	0%	654	$116.41	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Girl's Restroom	2000	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	0.327	654	116.412	3	0	no change	109	0.33	0%	654	$116.41	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Cust. Closet 4	2000	1	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.109	218	38.804	1	0	no change	109	0.11	0%	218	$38.80	$0.00	$0.00	0.00	0	$0.00	0.00
612		2000	1	1	Pendant Mnt., 100w A19 Lamp	100	0.1	200	35.6	1	0	no change	100	0.10	0%	200	$35.60	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Faculty Room 19	2000	4	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.248	496	88.288	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.20	20%	396.8	$70.63	$150.00	$150.00	0.05	99.2	$17.66	8.49
221.11	Room 18	2000	8	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.496	992	176.576	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.40	20%	793.6	$141.26	$150.00	$150.00	0.10	198.4	$35.32	4.25
221.11	Room 21	2000	3	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.186	372	66.216	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.15	20%	297.6	$52.97	$150.00	$150.00	0.04	74.4	$13.24	11.33
221.11	Classroom 20	2000	18	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	1.116	2232	397.296	18	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.89	20%	1785.6	$317.84	$300.00	$300.00	0.22	446.4	$79.46	3.78
221.37	Media Center	2000	44	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	2.728	5456	971.168	44	2	Dual Technology Occupancy Sensor - Remote Mnt.	62	2.18	20%	4364.8	$776.93	$300.00	$600.00	0.55	1091.2	$194.23	3.09
221.11	Classroom 22	2000	16	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.992	1984	353.152	16	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.79	20%	1587.2	$282.52	$300.00	$300.00	0.20	396.8	$70.63	4.25

Investment Grade Lighting Audit

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 25	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.308	2616	465.648	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	1.05	20%	2092.8	$372.52	$300.00	$300.00	0.26	523.2	$93.13	3.22
242.22	Classroom 26	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.308	2616	465.648	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	1.05	20%	2092.8	$372.52	$300.00	$300.00	0.26	523.2	$93.13	3.22
242.22	Classroom 29	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.308	2616	465.648	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	1.05	20%	2092.8	$372.52	$300.00	$300.00	0.26	523.2	$93.13	3.22
242.22	Classroom 30	2000	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	109	1.308	2616	465.648	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	1.05	20%	2092.8	$372.52	$300.00	$300.00	0.26	523.2	$93.13	3.22
232.22	Room 27	2000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.258	516	91.848	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.21	20%	412.8	$73.48	$150.00	$150.00	0.05	103.2	$18.37	8.17
232.22	Room 28	2000	3	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.258	516	91.848	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	86	0.21	20%	412.8	$73.48	$150.00	$150.00	0.05	103.2	$18.37	8.17
242.21	Nurse's Office	2000	6	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.654	1308	232.824	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	109	0.52	20%	1046.4	$186.26	$150.00	$150.00	0.13	261.6	$46.56	3.22
242.21	Main Office	2000	6	4	2x4, 4 Lamp, 32w 800 Series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	109	0.654	1308	232.824	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	109	0.52	20%	1046.4	$186.26	$300.00	$300.00	0.13	261.6	$46.56	6.44
227.21	Lobby	3000	22	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.364	4092	728.376	22	0	no change	62	1.36	0%	4092	$728.38	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Principal's Office	2000	8	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.496	992	176.576	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.40	20%	793.6	$141.26	$300.00	$300.00	0.10	198.4	$35.32	8.49
221.11	Classroom LL1	2000	14	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.868	1736	309.008	14	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.69	20%	1388.8	$247.21	$300.00	$300.00	0.17	347.2	$61.80	4.85
221.11	Classroom LL2	2000	14	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.868	1736	309.008	14	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.69	20%	1388.8	$247.21	$300.00	$300.00	0.17	347.2	$61.80	4.85
612	Boiler Room	3000	8	1	Pendant Mnt., 100w A19 Lamp	100	0.8	2400	427.2	8	0	no change	100	0.80	0%	2400	$427.20	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Lower Level Corridor	3000	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	0.248	744	132.432	4	0	no change	62	0.25	0%	744	$132.43	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridors	3000	58	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	3.596	10788	1920.264	58	0	no change	62	3.60	0%	10788	$1,920.26	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
222.21	Connecting Corridor	3000	5	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Indirect	62	0.31	930	165.54	5	1	Daylight Sensor (Sensorswitch PP-20 & CM-PC or equal)	62	0.25	20%	744	$132.43	$300.00	$300.00	0.06	186	$33.11	9.06
766	Gym	2000	8	1	400w MH Lobay, Prismatic Lens	465	3.72	7440	1324.32	8	2	Dual Technology Occupancy Sensor - Remote Mnt.	465	2.98	20%	5952	$1,059.46	$300.00	$600.00	0.74	1488	$264.86	2.27
612	Elec. Closet 2	500	2	1	Pendant Mnt., 100w A19 Lamp	100	0.2	100	17.8	2	0	no change	100	0.20	0%	100	$17.80	$0.00	$0.00	0.00	0	$0.00	0.00
713	Front Overhang	3000	5	1	100w A Lamp, 1x1 w/Prismatic Lens	100	0.5	1500	267	5	0	no change	100	0.50	0%	1500	$267.00	$0.00	$0.00	0.00	0	$0.00	0.00
725	Exterior	3000	6	1	150w HPS Wallpack	188	1.128	3384	602.352	6	0	no change	188	1.13	0%	3384	$602.35	$0.00	$0.00	0.00	0	$0.00	0.00
705		3000	2	1	500w Quartz Flood Light	500	1	3000	534	2	0	no change	500	1.00	0%	3000	$534.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		533	117			42.2	92,805.6	$16,519	533	40			35.7		79,791.3	$14,202.85		$11,100	6.50	13,014	$2,317	4.79

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Woodmont School	11,500	SHARP NU-U235F2	469	17.5	8,227	110.22	127,365	89.0	19,651	13.40

.= Proposed PV Layout

Notes:

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

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	110.2 kW
DC to AC Derate Factor:	0.810
AC Rating:	89.3 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.0 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	2.39	6613	991.95
2	3.17	8017	1202.55
3	4.07	11220	1683.00
4	4.83	12431	1864.65
5	5.70	14790	2218.50
6	5.94	14452	2167.80
7	5.77	14340	2151.00
8	5.38	13282	1992.30
9	4.65	11428	1714.20
10	3.61	9407	1411.05
11	2.35	6000	900.00
12	2.01	5383	807.45
Year	4.16	127365	19104.75

Project Name: **Montville BOE**
Location: **Woodmont School**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$673,405
Annual kWh Production	127,365
Annual Energy Cost Reduction	$22,671
Average Annual SREC Revenue	$26,026

Simple Payback: **13.83** Years

Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.178**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.204

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$0	0	0	0	$0	0	0	0	0
1	$0	127,365	$22,671	$0	$38,210	$39,627	$28,564	($7,310)	($7,310)
2	$0	126,728	$23,351	$0	$38,018	$37,866	$30,325	($6,821)	($14,132)
3	$0	126,095	$24,052	$0	$31,524	$35,995	$32,196	($12,616)	($26,747)
4	$0	125,464	$24,773	$0	$31,366	$34,009	$34,182	($12,052)	($38,799)
5	$0	124,837	$25,516	$1,286	$24,967	$31,901	$36,290	($18,993)	($57,792)
6	$0	124,213	$26,282	$1,279	$24,843	$29,663	$38,528	($18,346)	($76,138)
7	$0	123,591	$27,070	$1,273	$24,718	$27,287	$40,904	($17,675)	($93,813)
8	$0	122,974	$27,882	$1,267	$24,595	$24,764	$43,427	($16,980)	($110,794)
9	$0	122,359	$28,719	$1,260	$24,472	$22,085	$46,106	($16,261)	($127,054)
10	$0	121,747	$29,580	$1,254	$24,349	$19,241	$48,949	($15,515)	($142,570)
11	$0	121,138	$30,468	$1,248	$18,171	$16,222	$51,969	($20,800)	($163,370)
12	$0	120,532	$31,382	$1,241	$18,080	$13,017	$55,174	($19,971)	($183,340)
13	$0	119,930	$32,323	$1,235	$17,989	$9,614	$58,577	($19,113)	($202,454)
14	$0	119,330	$33,293	$1,229	$17,900	$6,001	$62,190	($18,227)	($220,681)
15	$0	118,733	$34,292	$1,223	$17,810	$2,165	$66,025	($17,312)	($237,993)
Totals:		1,845,036	$421,655	$13,796	$377,011	$349,459	$673,405	($237,993)	($1,702,988)

Net Present Value (NPV) **($173,916)**

MONTVILLE TOWNSHIP
BOARD OF EDUCATION

HILLDALE ELEMENTARY SCHOOL

123 KONNER AVENUE
PINEBROOK, NJ 07058

FACILITY ENERGY REPORT

TABLE OF CONTENTS

I. HISTORIC ENERGY CONSUMPTION/COST 2

II. FACILITY DESCRIPTION 7

III. MAJOR EQUIPMENT LIST 10

IV. ENERGY CONSERVATION MEASURES 11

V. ADDITIONAL RECOMMENDATIONS 50

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start® Program Incentives

Appendix C – Portfolio Manager "Statement of Energy Performance"

Appendix D – Major Equipment List

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

I. HISTORIC ENERGY CONSUMPTION/COST

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.

Electric Utility Provider:	Jersey Central Power and Light (JCP&L)
Electric Utility Rate Structure:	General Service Secondary Three-Phase
Third Party Supplier:	None

Natural Gas Utility Provider:	New Jersey Natural Gas
Utility Rate Structure:	General Service Large (GSL)
Third Party Supplier:	Amerada HESS

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

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

Description	Average
Electricity	16.8¢ / kWh
Natural Gas	$1.29 / Therm

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Jersey Central Power & Light
Rate: GSS Secondary 3 Phase
Meter No: G16598209
Account # 100029305313
Third Party Utility Provider: N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Aug-10	18,800	101	$3,526
Sep-10	29,840	109	$5,098
Oct-10	28,080	109	$4,850
Nov-10	24,400	107	$4,281
Dec-10	32,800	102	$5,421
Jan-11	24,880	100	$4,258
Feb-11	27,760	99	$4,629
Mar-11	30,720	100	$4,772
Apr-11	28,160	100	$4,432
May-11	24,800	102	$4,162
Jun-11	20,720	94	$3,412
Jul-11	22,480	92	$3,684
Totals	**313,440**	**109 Max**	**$52,525**

AVERAGE DEMAND **101.3 KW average**
AVERAGE RATE **$0.168** **$/kWh**

Figure 1
Hilldale Elementary School
Electric Usage Profile
August - 10 through July - 11

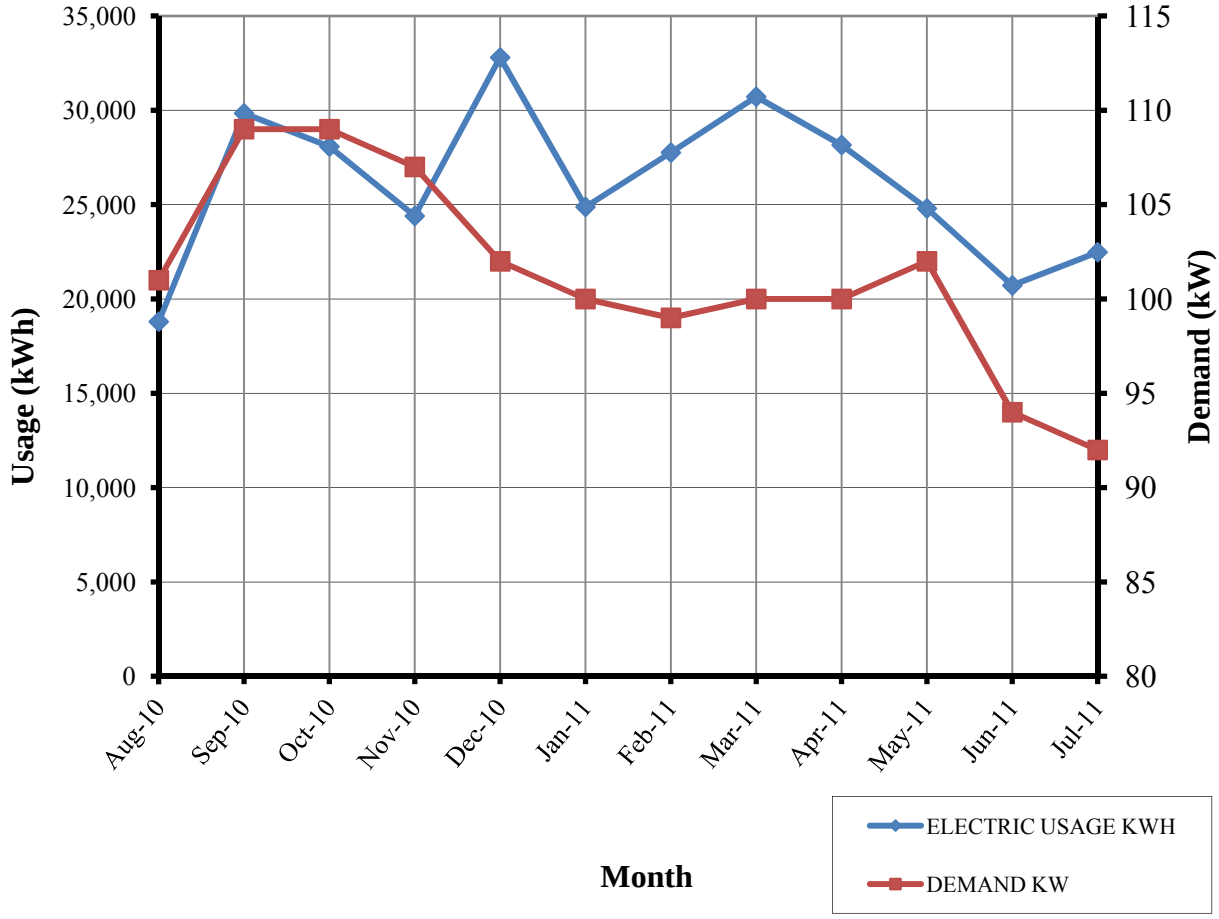
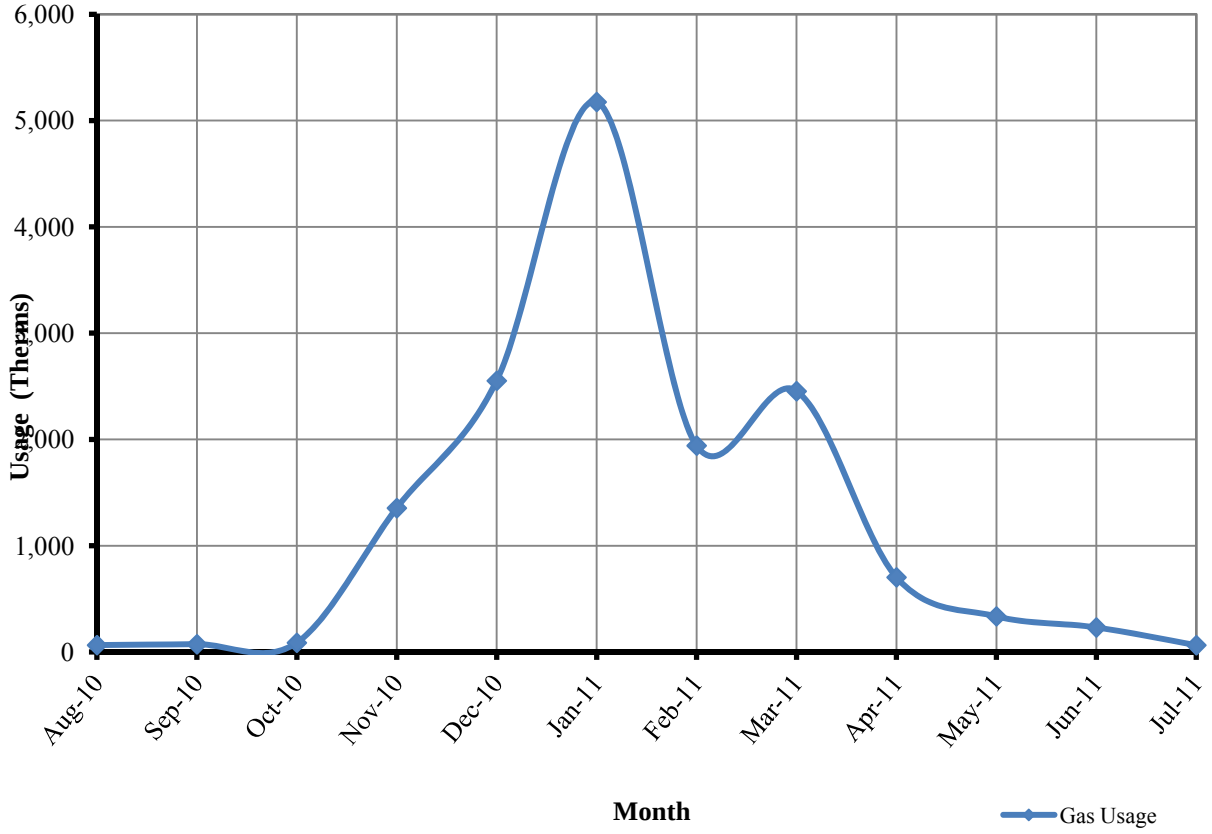


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: NJ Natural Gas		
Rate: GSL		
Meter No: 393696		
Point of Delivery ID: 04-1220-8788-13		
Third Party Utility Provider: Amerada Hess		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Aug-10	65	$414
Sep-10	73	$416
Oct-10	87	$434
Nov-10	1,354	$1,722
Dec-10	2,552	$2,970
Jan-11	5,175	$5,692
Feb-11	1,942	$2,350
Mar-11	2,454	$2,878
Apr-11	703	$1,072
May-11	335	$685
Jun-11	231	$364
Jul-11	64	$411
TOTALS	**15,035**	**$19,408**
AVERAGE RATE:	**$1.29**	**$/THERM**

Figure 2
Hilldale Elementary School
Gas Usage Profile
August - 10 through July - 11



II. FACILITY DESCRIPTION

The 38,000 SF Hilldale Elementary School is a single story facility comprised of classrooms, media center, cafeteria, kitchen, gymnasium, administration office, restrooms, boiler room, and storage spaces. The School was built in 1974 with several renovations and an addition in 2005. The addition consists primarily of classrooms.

Building Profile

The school hours are between 8:20 AM and 2:55 PM on the weekdays. The teachers start arriving several hours before the classes. The school remains open till 6:00 PM in the evening for after school activities. The gymnasium, cafeteria and library are used after hours for sports and other events during the weekdays and weekends.

The student enrollment at the Woodmont Elementary School is approximately 376. Estimated total number of staff is 60.

Building Envelope

The facility is made up of two main interconnected building structures. The exterior of the buildings consist of block construction with concrete façade. Insulation within the walls is not known. The original structure roof consists of a fairly new pitched roof with tar and gravel covering. The amount of insulation below the roof is not known. The roof of the 2005 addition is made up of flat roof with an estimated 1 inch rigid insulation below the rubber covering. There is one rooftop HVAC unit on the original building roof and several split condensing units on the new addition building roof. Windows throughout the facility consists of operable, double pane windows with aluminum frames. The windows are in good condition.

HVAC Systems

Heating is provided to the facility from a central hot water boiler room. Two (2) Superior fire tube hot water boilers with 2,423 MBH input capacity serves the entire facility. The boilers were installed in 1973 and appear to be in poor condition.

The boiler water is circulated throughout the facility by three (3) constant speed hot water pumps driven by 3 and 10 HP motors. The pumps are driven with standard efficiency motors. There are a total of two (2) hydronic zones in the facility. The boilers provide heating hot water to the hot water baseboard heaters, unit ventilators and heating and ventilation units throughout the school.

Terminal heating equipment for the classrooms and the perimeter offices consists of unit ventilators made by Trane in combination with hydronic baseboard heat. These units serve the classrooms throughout the original section of the school. The unit ventilators are original to the facility and appear to be in fair condition. The unit ventilators are controlled by the building pneumatic system. Majority of the unit ventilator controls are functioning with low accuracy due to older equipment, valves, dampers and actuators.

The newer classrooms in the 2005 addition utilize newer unit ventilators made by Trane. Each classroom has a dedicated unit ventilator with hot water heating coils and direct expansion

cooling coils. The unit ventilators are coupled with four (4) 2.5 ton and six (6) 3.5 ton Trane split condensing units. Heat is provided by hot water heating coils fed from the new boiler room. New Trane units are in good condition and appear to be maintained well.

In addition to the unit ventilators, several spaces utilize packaged rooftop heating and air conditioning units. A 6-ton Trane rooftop unit provides air conditioning to the main office. The unit is approximately 6 years old and appears to be in good condition. Similarly, a 4-ton Carrier split air conditioning unit provides cooling to the server room located in the media center. The unit is 9 years old and appears to be in good condition.

Finally, a rooftop heating and ventilation (H&V) unit provides heating and ventilation to the multi-purpose (gym) area. The rooftop H&V unit is made by Trane and it appears to be in fair condition. A separate heating and ventilation unit in the boiler room ceiling also serves the gym areas. However, operation of the H&V unit in the boiler room could not be verified due to accessibility issues.

Exhaust System

The air is exhausted from the hallways and corridors via dedicated exhaust fans located on the roof. The toilet rooms have a dedicated exhaust fan as well. It is reported that the exhaust fan operates based on the occupancy schedule. However, this could not be verified during the survey. It is recommended to ensure that the fans operate based on a time of day schedule.

HVAC System Controls

The HVAC systems in this facility are controlled via two separate control systems.

The unit ventilators in the original building are controlled via the original pneumatic control system. The old and outdated pneumatic controllers and actuators for the unit ventilators are deteriorated therefore do not function properly. It is recommended to upgrade the original pneumatic controls to a state of the art DDC control system to enhance comfort conditions in the classrooms and increase energy efficiency.

The new section unit ventilators, HVAC units for the media center and the office, gym heating and ventilation unit and the exhaust fans are controlled via a DDC Building Management System (BMS) made by Honeywell. The BMS provides control over the equipment and consists of time of day scheduling and temperature set-points for the spaces. Each classroom is equipped with a thermostat with limited override capability. The digital control system appears to be providing adequate control for conditioning of the building and occupant comfort. The BMS currently does not have optimal start/stop controls. The boilers are controlled via a separate boiler controllers.

Domestic Hot Water

Domestic hot water for the facility is provided with two (2) domestic hot water heaters in two separate locations. The unit #1 is an 89 gallon gas fired domestic hot water heater with 154 MBH input capacity. The gas fired hot water heater is made by AO Smith and it was installed in early 1991. The unit is old and inefficient compared to current industry standards and it is

recommended to be replaced with a high efficiency unit. The second unit is a 30 gallon electric hot water heater with 5.5 kW heating element. The electric hot water heater is made by the State Industries. It was installed in 1999 and appears to be in fair condition.

Domestic hot water is circulated throughout the spaces via two (2) separate circulators. Each circulator is connected to an aqua-stat.

Lighting

Typical lighting throughout the building is fluorescent tube fixtures with T-8 lamps and electronic ballasts. There are a number of spaces with older T12 fixtures with magnetic ballasts and incandescent lamps. A space by space breakdown of the lighting throughout the facility is provided in the **Investment Grade Lighting Appendix**.

III. 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.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 3
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Equipment Upgrade	$19,830	$4,326	4.6	227%
ECM #2	Lighting Controls Upgrade	$7,460	$2,353	3.2	373%
ECM #3	Gymnasium Lighting Equipment and Controls	$5,650	$738	7.7	96%
ECM #4	Boiler Systems Upgrade	$144,500	$2,459	59	-49%
ECM #5	AC Unit Upgrades	$92,218	$1,583	58	-74%
ECM #6	Water Efficiency	$34,345	$1,400	25	-39%
ECM #7	Nema Premium Efficiency Motors	$6,858	$243	28	-47%
ECM #8	High Efficiency Domestic Hot Water	$20,150	$2,543	7.9	89%
ECM #9	DDC System Expansion	$90,000	$5,542	16	-7.6%
ECM #10	CRT Monitor Upgrades	$2,520	$326	7.7	29%
ECM #11	Automatic Computer Stand-by / Hibernate	$175	$545	0.3	3012%
ECM #12	Unit Ventilators with Energy Recovery	$196,000	$4,638	42	-65%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	110 KW Solar System	$661,838	$50,019	13.2	13%

Table 4
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Equipment Upgrade	10.7	28,843	-
ECM #2	Lighting Controls Upgrade	-	18,111	-
ECM #3	Gymnasium Lighting Equipment and Controls	1.0	4,917	-
ECM #4	Boiler Systems Upgrade	-	-	2,364
ECM #5	AC Unit Upgrades	10.6	9,423	-
ECM #6	Water Efficiency	-	-	282
ECM #7	Nema Premium Efficiency Motors	0.8	1,449	-
ECM #8	High Efficiency Domestic Hot Water	-	16,379	-162
ECM #9	DDC System Expansion	-	15,672	2,255
ECM #10	CRT Monitor Upgrades	-	1,940	-
ECM #11	Automatic Computer Stand-by / Hibernate	-	3,241	-
ECM #12	Unit Ventilators with Energy Recovery	-	1,810	3,359
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	110 KW Solar System	90	134,338	-

Table 5
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Equipment Upgrade	$4,326	$21,630	$1,800	$19,830	4.6
Lighting Controls Upgrade	$2,353	$8,400	$940	$7,460	3.2
Gymnasium Lighting Equipment and Controls	$738	$6,520	$870	$5,650	~~7.7~~
~~Boiler Systems Upgrade~~	~~$2,459~~	~~$147,500~~	~~$3,000~~	~~$144,500~~	~~58.8~~
~~AC Unit Upgrades~~	~~$1,583~~	~~$96,500~~	~~$4,282~~	~~$92,218~~	~~58.3~~
~~Water Efficiency~~	~~$1,400~~	~~$34,345~~	~~$0~~	~~$34,345~~	~~24.5~~
Nema Premium Efficiency Motors	$243	$7,218	$360	$6,858	28.2
High Efficiency Domestic Hot Water	$2,543	$20,500	$350	$20,150	7.9
DDC System Expansion	$5,542	$90,000	$0	$90,000	16.2
CRT Monitor Upgrades	$326	$2,520	$0	$2,520	7.7
Automatic Computer Stand-by / Hibernate	$545	$175	$0	$175	0.3
~~Unit Ventilators with Energy Recovery~~	~~$4,638~~	~~$196,000~~	~~$0~~	~~$196,000~~	~~42.3~~
Design / Construction Extras (15%)	*$0*	*$20,065*	*$0*	*$20,065*	
Total Project	**$16,616**	**$177,028**	**$4,320**	**$172,708**	**10.4**

ECMs marked with strikethrough font are not included in total.

Design / Construction Extras are shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Lighting Upgrade - General

Description: General

The lighting in the Hilldale Elementary School is primarily made up of fluorescent fixtures with T-8 lamps and electronic ballasts and only select locations still have T12 lamps with magnetic ballasts.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. Typically converting T12s to T8s provide maintenance savings through the reduced number of lamps replaced per year. However, majority of the old fixtures at this facility have two (2) 8-ft T12 lamps, which are replaced with four (4) 4-ft T8 lamps, offsetting the benefit of longer lamp life. Therefore, this ECM doesn't produce any significant maintenance savings.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

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

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

$$\text{SmartStart® Incentive} = (\#\text{ of } 1-4 \text{ lamp fixtures retrofitted} \times \$10)$$
$$\text{SmartStart® Incentive} = (180 \times \$10) = \underline{\$1800}$$

From the Smart Start Incentive appendix, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Replacement and Maintenance Savings:

Replacement and Maintenance Savings are minimal for this ECM.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$21,630
NJ Smart Start Equipment Incentive ($):	$1,800
Net Installation Cost ($):	$19,830
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,326
Total Yearly Savings ($/Yr):	$4,326
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.6
Simple Lifetime ROI	227.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$64,896
Internal Rate of Return (IRR)	20%
Net Present Value (NPV)	$31,818.52

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

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

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

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

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

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

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

Energy Savings Calculations:

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

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

Total number of rooms to be retrofitted is 32. Remote mounted sensors are to be used in 24 rooms and switch mounted sensors are to be used in 8 rooms. The total cost to install sensors is $8,400.

Incentives:

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

Occupancy Sensor Fixture Mounted (existing facility only) = $20 per sensor
Occupancy Sensor Remote Mounted (existing facility only) = $35 per sensor

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,400
NJ Smart Start Equipment Incentive ($):	$940
Net Installation Cost ($):	$7,460
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,353
Total Yearly Savings ($/Yr):	$2,353
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.2
Simple Lifetime ROI	373.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$35,301
Internal Rate of Return (IRR)	31%
Net Present Value (NPV)	$20,634.93

ECM #3: Gymnasium Lighting Equipment and Controls Upgrade

Description:

The Gymnasium at the Hilldale Elementary School utilizes 250W metal halide fixtures for its lighting. Metal halide bulbs provide a reasonably efficient option for bay lighting however a few draw-backs that are common. Metal halide fixtures often have poor overall efficacy which limits the amount of light actually leaving the fixture. Also metal halide bulbs require a significant warm-up period and even longer cool down period eliminating the potential for occupancy sensors frequent switching. This symptom encourages the gymnasium lighting to be left on continuously during the day. Another drawback is the reduced lumen output (Lumen Maintenance) of the metal halide bulb over its life time. Average bulb output or "mean lumens," is approximately 25% less than the bulb's initial lumens for typical metal halide lamps. In addition the most rapid rate of light output decline is during the beginning of its life, approximately 15-20% light loss within the first 20% of its rated life. It is important to note that the light loss has no savings in energy used; therefore the overall light efficiency is continuously decreasing with age. The final drawback is the light quality or Color Rendering Index (CRI). Typical values for metal halide bulbs is 65, which is a measure of how close the light is to true "full spectrum" light produced by sunlight or incandescent lighting. Metal halide bulbs also show noticeable color shifting when the bulb is reaching the end of its life. Utilizing fluorescent fixtures in low and high bay spaces is a superior option over metal halide fixtures in all areas described above. Although metal halide fixtures provide light very efficiently at the start of the bulb life, the average efficiency over the life is below that of fluorescent fixtures.

This ECM includes replacement of each of the existing gymnasium high bay metal halide light fixtures with T5HO fixtures with reflective lenses. The retrofit for the metal halide fixtures includes a one for one fixture replacement. The fluorescent fixtures selected will provide equivalent light compared to the average light output of the existing metal halide fixtures. The bulb replacement cost for T-5 HO lamps compared to the existing metal halide lamps were found to be approximately equal and therefore not included in the savings calculations.

This ECM also includes installation of occupancy sensors for the proposed fluorescent gymnasium light fixtures. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives

Metal Halide Fixtures

From the **Smart Start Incentive Appendix**, the following incentives are warranted:
For replacement of HID (250-399W) with new T-5 or T-8 fixtures = $50/Fixture

$$\text{Smart Start ® Incentive} = (\#\text{ of Metal Halide Fixture Replaced} \times \$50)$$

$$\text{Smart Start ® Incentive} = (16 \times \$50) = \$800$$

Occupancy Sensors

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

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

$$\text{Smart Start ® Incentive} = (2 \times \$35) = \$70$$

There is no significant replacement or maintenance savings generated with this ECM.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,520
NJ Smart Start Equipment Incentive ($):	$870
Net Installation Cost ($):	$5,650
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$738
Total Yearly Savings ($/Yr):	$738
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.7
Simple Lifetime ROI	95.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$11,064
Internal Rate of Return (IRR)	10%
Net Present Value (NPV)	$3,155.04

ECM #4: Boiler Systems Upgrade – Condensing Boilers

Description:

Space heating for Hilldale Elementary School is provided by a heating hot water loop. The source of hot water for this equipment is two (2) hot water boilers located in the boiler room.

The boilers are made by Superior with 2,432 MBH heating capacity each. The boilers were installed with the original construction and are 38 years old, which brings them significantly past their ASHRAE service life. The boilers are in poor condition and should be replaced with newer high efficiency units. This ECM provides insight into the energy efficiency benefit of condensing boiler technology compared to standard cast iron and firetube boilers.

Standard (non-condensing) boilers provide lower than nominal efficiency compared to condensing boilers. Standard boilers suffer further efficiency losses at part load operating conditions mainly due to limitations in the reduction of the flue gas temperature. Current average combustion efficiency of each boiler is estimated to be 70% due to standard non-condensing boiler technology, limited turn down ratio, cycling losses and outdated design and controls. A new condensing boiler could substantially improve the operating efficiency of the heating system of the building. Condensing boiler's peak efficiency tops out at 99% depending on return water temperature.

Currently only one boiler can satisfy the building heat load and the second boiler serves as a backup. This ECM is based on the replacement of one (1) of the existing hot water boilers with two (2) Aerco BMK 1.5 modular condensing boilers. The remaining boiler shall be utilized as a backup.

The annual average operating efficiency of the proposed boiler set is expected to be 90%, which gives the heating system a 20% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature. The owner is recommended to retain a professional engineer to confirm equipment sizing and finalize design.

BOILER REPLACEMENT SUMMARY		
EXISTING UNIT	**LOCATION**	**PROPOSED UNITS**
(2) Firetube Boilers	Boiler Room	(2) Aerco BMK 1.5 (1) Firetube Boiler remains as backup

First, domestic hot water usage is estimated and subtracted from the total usage in order to estimate the net natural gas usage for space heating. Additional gas usage by the other boiler room was also estimated then subtracted from total gas usage.

Current total hot water usage can be found in the table below:

ANNUAL GAS USAGE				
MONTH	TOTAL USAGE THERMS	DOMESTIC HW USAGE	HEATING ONLY	COST
Jul-10	65	65	0	$0
Aug-10	73	72	1	$1
Sep-10	87	72	11	$12
Oct-10	1,354	72	962	$1,000
Nov-10	2,552	72	1,860	$1,934
Dec-10	5,175	72	3,827	$3,980
Jan-11	1,942	72	1,403	$1,459
Feb-11	2,454	72	1,787	$1,858
Mar-11	703	72	473	$492
Apr-11	335	72	197	$205
May-11	231	72	119	$124
Jun-11	64	64	0	$0
TOTAL	**15,035**	**849**	**10,640**	**$11,065**

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

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

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

Energy savings calculations are summarized in the table below:

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	(2) Existing Hot Water Boiler	(2) New Condensing Boilers	-
Boiler Input Capacity (MBH)	4,864	3,000	-
Boiler Output Capacity (MBH)	3,404	2,700	-
Existing Nat Gas (Therms)	10,640	-	-
Boiler Efficiency (%)	70%	90%	20%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	-
Building Heating Energy Usage (MMBTUs)	745	745	-
Ave. Gas Cost ($/Therm)	1.04	1.04	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	10,640	8,275	2,364
Energy Cost ($)	$11,065	$8,606	$2,459
COMMENTS:			

Project Cost, Incentives and Maintenance Savings

Estimated cost for removing one of the existing boilers and installing (2) Aerco BMK 1.5 condensing boilers plus labor is estimated to be $147,500.

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

GAS FIRED BOILER REBATE SUMMARY					
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/MBH**	**PROPOSED CAPACITY,**	**NUMBER OF UNITS**	**TOTAL REBATE, $**
≥ 300 MBH - 1500 MBH	84% AFUE for Hot Water boilers	$1.75	0	0	$0
>1500 - ≤ 4000 MBH	84% AFUE for Hot Water boilers	$1	1,500	2	$3,000
> 4000 MBH	84% AFUE for Hot Water boilers	$1	0	0	$0
TOTAL					**$3,000**

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$147,500
NJ Smart Start Equipment Incentive ($):	$3,000
Net Installation Cost ($):	$144,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,459
Total Yearly Savings ($/Yr):	$2,459
Estimated ECM Lifetime (Yr):	30
Simple Payback	58.8
Simple Lifetime ROI	-49%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$73,767
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	($96,304)

ECM #5: AC Unit Upgrades

Description:

Sections of Hilldale Elementary School are conditioned by rooftop units and split system condensing units. Units are currently installed to serve the main office, server room, and addition classrooms. The remainder of the building does not have air conditioning units of any type. The units currently installed are less efficient compared to modern equipment and can be replaced with new high efficiency units. New air conditioners provide higher full load and part load efficiencies due to advances in inverter motor technologies, heat exchangers and refrigerants.

This ECM includes one-for-one replacement of the older air conditioning units with new higher efficiency systems. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. A summary of the unit replacements for this ECM can be found in the table below:

IMPLEMENTATION SUMMARY					
ECM INPUTS	**SERVING**	**NUMBER OF UNITS**	**COOLING CAPACITY, BTU/HR**	**TOTAL CAPACITY, TONS**	**REPLACE UNIT WITH**
RTU	Various	1	48,000	4.0	Carrier Infinity Series
SS	Various	4	72,000	24.0	Carrier Gemini Series
SS	RTU - 1/2	6	42,000	21.0	Carrier Infinity Series
SS	Various	1	30,000	2.5	Carrier Infinity Series
Total		**12**	**192,000**	**51.5**	

The manufacturers used as the basis for this calculation is Carrier. All units are one for one style replacements with matching capacity of the new units to the old units. The unit pricing and install cost were estimated based on current rates. The payback may change based on actual unit pricing and install costs if the ECM is implemented. Due to the payback over 15 years CE recommends that Montville BOE review the replacement of rooftop and condensing units as they reach the end of their service life in the coming years.

Energy Savings Calculations:

Cooling Energy Savings:

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

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

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

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

ENERGY SAVINGS CALCULATIONS							
ECM INPUTS	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**EXISTING UNITS (S)EER**	**SPLIT UNITS (S)EER**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
RTU	48,000	1,600	10.5 EER	14.1 EER	1	1,867	1.2
SS	72,000	800	11.5 EER	12 EER	4	835	1.0
SS	42,000	800	10 EER	14.2 EER	6	5,963	7.5
SS	30,000	800	9.9 EER	14.4 EER	1	758	0.9
Total					**12**	**9,423**	**10.6**

Project Cost, Incentives and Maintenance Savings

From the NJ Smart Start® Program appendix, the replacement of split system AC units and unitary systems with high efficiency AC systems falls under the category "Unitary HVAC Split System" and warrants an incentive based on efficiency (EER/SEER). The program incentives are calculated as follows:

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

AC UNITS REBATE SUMMARY				
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/TON**	**PROPOSED CAPACITY TONS**	**TOTAL REBATE $**
≥20 to 30 tons	10.5 EER	$79	0	$0
≥ 11.25 to < 20 tons	11.5 EER	$79	0	$0
≥ 5.4 to < 11.25 tons	11.5 EER	$73	24	$1,752
5.4 tons or less Unitary AC and Split System	≥14 SEER	$92	27.5	$2,530
TOTAL			**51.5**	**$4,282**

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**
RTU	$11,000	1	$11,000	$368	$10,632	$314	33.9
SS	$9,000	4	$36,000	$1,752	$34,248	$140	244.2
SS	$7,250	6	$43,500	$1,932	$41,568	$1,002	41.5
SS	$6,000	1	$6,000	$230	$5,770	$127	45.3
Total	**$33,250**	**12**	**$96,500**	**$4,282**	**$92,218**	**$1,583**	**58.3**

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

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$96,500
NJ Smart Start Equipment Incentive ($):	$4,282
Net Installation Cost ($):	$92,218
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,583
Total Yearly Savings ($/Yr):	$1,583
Estimated ECM Lifetime (Yr):	15
Simple Payback	58.3
Simple Lifetime ROI	-74.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$23,745
Internal Rate of Return (IRR)	-14%
Net Present Value (NPV)	($73,320.25)

ECM #6: Water Efficiency & Conservation

Description:

The facility utilizes standard plumbing fixtures. The typical water closet and urinal water consumption only meet the minimum federally required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the replacement of the existing sink faucets, water closets and urinals within the bathrooms the facility. The estimated usage of the plumbing fixtures is based on the total population of the facility.

The proposed retrofit includes installation of auto flow sink faucets, low flow aerators, low flow flushometer style water closets that utilize 1.28 gallons per flush and ultra-low flushometer style urinals that utilize 1/8 gallons per flush. For the basis of this calculation the LEED rating system was used to estimate the occupancy usage for students within the school. When water consumption information was not available, the GPF values were estimated for the existing fixtures.

Energy Savings Calculations:

Urinals and Toilets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Flush}}{\text{Person per Day}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Flush}}\right)$$

Faucets:

$$\text{Water Consumption} = \text{Occupancy}\left(\frac{\text{Days}}{\text{Yr}}\right) \times \text{Use}\left(\frac{\text{Use}}{\text{Person per Day}}\right) \times \text{Use Time}\left(\frac{\text{Sec}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Water Cost} = \frac{\text{Water Consumption (Gallons)} \times \text{Ave Cost}\left(\frac{\$}{1000\ \text{Gal}}\right)}{1000(\text{Gal})}$$

$$\text{Gas Cost (Therms)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.34\ \text{BTU}}{\text{Gal}} \times \frac{\text{Therm}}{100{,}000\ \text{BTU}}$$

WATER CONSERVATION CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Fixtures	Low Flow / Auto Flow Fixtures	-
Total Number of Students	420	420	-
% Male to Female	50%	50%	-
Estimated % Floor Area Served by Older Bathrooms	100%	100%	-
Occupied Days Per Year	195	195	-
Lavatory Uses per Day per Person	3	3	-
Sink flow time per use, sec	15	12	-
Sink Aerator Flow, GPM	1.5	0.5	-
WC Uses per Day per Person	2.0	2.0	-
Urinal Uses per Day per Person	1.0	1.0	-
Total Urinal Flushes Per Day	210	210	-
Total WC Flushes Per Day	420	420	-
Urinal Gallons Per Flush (GPF)	1.0	0.125	0.875
WC Gallons Per Flush (GPF)	1.6	1.28	0.32
**** Water Cost ($/1000 Gal)**	$8.00	$8.00	-
Gas Cost ($/Therm)	$1.29	$1.29	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Water Consumption, Urinal and WC (Gal)	171,990	109,951	62,039
Water Consumption, Faucets (Gal)	92,138	24,570	67,568
Total Water Consumption, (Gal)	264,128	134,521	129,607
Water Cost ($)	$2,113	$1,076	$1,037
Gas Consumption (Therms)	384	102	282
Gas Cost ($/Year)	$496	$132	$363
Total Savings ($/Year)	-	-	$1,400
COMMENTS:	*Savings are based on LEED Reference Guide for Green Building Design and Construction - 2009 Edition for WC and Urinal water usage. ** Cost of Water estimated.		

The cost for installation and materials of water closets, low flow urinals and new auto flow sink faucets throughout the facility is estimated to be $34,345.

There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$34,345
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$34,345
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,400
Total Yearly Savings ($/Yr):	$1,400
Estimated ECM Lifetime (Yr):	15
Simple Payback	24.5
Simple Lifetime ROI	-38.9%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$21,000
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	($17,631.89)

ECM #7: Install NEMA Premium® Efficiency Motors

Description:

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

The school has a number of motors that are candidates to be replaced with NEMA Premium® efficiency motors. The motors are located in the boiler room which serves the hot water zone pumps and circulation pumps. Boiler operating hours were estimated based on hours of operation obtained from the school based on daily usage and after school activities or weekend use.

This energy conservation measure replaces the existing lower efficiency electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today. The energy savings and payback are subject to change based on the pool filtration usage during the year. An implementation summary of the motor is provided below.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
P - 1	Zone Pump	10	1,750	88.5%	92.4%
P - 2	Circulation Pump	3	1,750	86.0%	89.5%
P - 3	Circulation Pump	3	1,750	86.0%	89.5%
P - 4	Zone Pump	10	1,750	88.5%	92.4%

Energy Savings Calculations:

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

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

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

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

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

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	**MOTOR HP**	**LOAD FACTOR**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**POWER SAVINGS kW**	**ENERGY SAVINGS kWH**	**COST SAVINGS**
P - 1	10	90%	88.5%	92.4%	0.32	563	$95
P - 2	3	90%	86.0%	89.5%	0.09	161	$27
P - 3	3	90%	86.0%	89.5%	0.09	161	$27
P - 4	10	90%	88.5%	92.4%	0.32	563	$95
TOTAL					**0.8**	**1,449**	**$243**

Equipment Cost and Incentives

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

INCENTIVES	
HORSE POWER	**NJ SMART START INCENTIVE**
1	$45
1.5	$45
2	$54
3	$54
5	$54
7.5	$81
10	$90
15	$104
20	$113
25	$117
30	$135
40	$162

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

MOTOR REPLACEMENT SUMMARY						
EQMT ID	MOTOR POWER HP	INSTALLED COST	SMART START INCENTIVE	NET COST	TOTAL SAVINGS	SIMPLE PAYBACK
P - 1	10	$2,560	$90	$2,470	$95	26.1
P - 2	3	$1,049	$90	$959	$27	35.4
P - 3	3	$1,049	$90	$959	$27	35.4
P - 4	10	$2,560	$90	$2,470	$95	26.1
TOTAL		**$7,218**	**$360**	**$6,858**	**$243**	**28.2**

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,218
NJ Smart Start Equipment Incentive ($):	$360
Net Installation Cost ($):	$6,858
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$243
Total Yearly Savings ($/Yr):	$243
Estimated ECM Lifetime (Yr):	15
Simple Payback	28.2
Simple Lifetime ROI	-46.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,645
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($3,957.08)

ECM #8: High Efficiency Domestic Hot Water Heater

Description:
Domestic hot water for Hilldale Elementary School kitchen and bathrooms is provided by an Electric Hot Water Heater and a Gas Fired Hot Water Heater. This ECM calculates the cost and savings associated with replacement of both of these units.

Gas Fired Hot Water Heater Replacement:

The current gas fired hot water heater operates at an estimated efficiency of 70%, and is approximately eight years beyond its useful life. Montville Township BOE should replace the unit with a similar efficiency to the one used for the calculation below. The basis for this ECM is AO Smith Cyclone Xi BTH-150 gas fired condensing domestic hot water heater. The usage of the gas domestic hot water heater was based on a site survey and provided utility bill information. The utility information was used to determine the site usage during months when the hot water boilers are in not in operation. By averaging this amount a usage of gas for each month was estimated for the gas hot water heater.

Energy Savings Calculations:

HIGH EFFICIENCY DOMESTIC WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing HWH	High Efficiency Hot Water Heater	-
Building Type	Education	Education	-
Area Served	Domestic Hot Water	Domestic Hot Water	-
DHW Heating Fuel Type	Gas	Gas	-
Heating Efficiency	70%	95%	25%
Nat Gas Cost ($/Therm)	$1.29	$1.29	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Nat Gas Consumption (Therms)	1,704	1,278	426
Energy Cost ($)	$2,198	$1,649	$550
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003		

Electric Hot water Heater Replacement:

The current electric hot water heater has reached the end of its service life. It is recommended that this unit be replaced with a more cost effective gas fired hot water heater. The basis for this calculation is AO Smith GCV-30 ProMax gas fired hot water heater.

Energy Savings Calculations:

CONDENSING DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Hot Water Heater	Bradford White High Efficiency	
Building Type	Education		
Building Square-foot	10,750	10,750	
Domestic Water Usage, kBtu	55,900.00	55,900.00	
DHW Heating Fuel Type	Electric	Gas	
Heating Efficiency	100%	95%	-5%
Total Usage (kBTU)	55,900	58,842	-2,942
Electric Cost ($/kWh)	$ 0.168	$ 0.168	
Nat Gas Cost ($/Therm)	$ 1.290	$ 1.290	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	16,379	0	16,379
Natural Gas Usage (Therms)	0	588	-588
Energy Cost ($)	$2,752	$759	$1,993
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Cost, Rebates and Incentives:

The total installed cost for the gas fired hot water heater replacement with gas piping is estimated to be $**9,000.**

The total installed cost for replacing the electric hot water heater with new gas fired heater including gas piping is estimated to be **$11,500.**

From the NJ Smart Start® Program appendix, the hot water heater installation falls under the category "Gas Water Heating" and warrants an incentive as follows:

Smart Start ® Incentive: $2/MBH × Unit Capacity, MBH
(Water Heaters > 50 Gallons, up to 300 MBH)
$2/MBH × 150 MBH = **$300**

Smart Start ® Incentive: $50 per water heater
(Water Heaters < 50 Gallons, 0.67 of better energy factor)

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$20,500
NJ Smart Start Equipment Incentive ($):	$350
Net Installation Cost ($):	$20,150
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,543
Total Yearly Savings ($/Yr):	$2,543
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.9
Simple Lifetime ROI	89.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$38,145
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	$10,208.17

ECM #9: DDC System Upgrades

Description:

Hilldale Elementary School is currently controlled primarily through the use of pneumatic control systems. CE recommends expanding the DDC system to control remaining HVAC systems in the school including the air handling units, unit ventilators, wall thermostats, air conditioning units, rooftop units, and boilers. In addition the existing control systems will be unified under one system allowing easier operation for building facility management personnel.

This ECM includes expansion of the existing Building Automation system to include control of the rest of the HVAC equipment in the facility. The system will include new temperature sensors and new local thermostats with limited over-ride capability, a front end computer and main controller. The system will also include central controls for lighting. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the building may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. 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 referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 5% of the electricity and 15% for the gas utility in this building.

The basis for the DDC system expansion is the Automated Logic Energy Management System or similar.

Energy Savings Calculations:

Since some of the key utility consumption and cost information was not available, estimated values are used for the unit cost of natural gas, total electricity usage and unit cost of electricity.

Energy savings for each utility is calculated with the equation below.

$$\text{Energy Savings (Utility)} = \text{Current Energy Consumption} \times \text{Estimated Savings, \%}$$

Following table summarizes energy savings for this facility via implementation of an Energy Management System:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Controls w/ Local Thermostats	DDC Controls	
Existing Nat Gas Usage (Therms)	15,035	-	
Existing Electricity Usage (kWh)	313,440	-	
Energy Savings, Nat. Gas	-	15%	
Energy Savings, Electricity	-	5%	
Gas Cost ($/Therm)	*$1.29*	$1.29	
Electricity Cost ($/kWh)	*$0.168*	$0.168	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	15,035	12,780	2,255
Electricity Usage (kWh)	313,440	297,768	15,672
Natural Gas Cost ($)	$19,395	$16,486	$2,909
Electricity Cost ($)	$52,658	$50,025	$2,633
Energy Cost ($)	$72,053	$66,511	$5,542
COMMENTS:			

Demand savings due to implementation of this ECM is minimal.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $2.00 to $2.50 per SF in accordance with recent Contractor pricing for systems of this magnitude. Savings from the implementation of this ECM will be from the reduced energy consumption currently used by the HVAC system by proper control of schedule and temperatures via the DDC system.

Cost of complete DDC System = $90,000

Currently, there are no prequalified NJ SmartSmart Incentives for installation of the DDC system.

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$90,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$90,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$5,542
Total Yearly Savings ($/Yr):	$5,542
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.2
Simple Lifetime ROI	-7.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$83,130
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($23,839.96)

ECM #10: Computer Monitor Replacement

Description:

The computers throughout the facility utilize a mixture of CRT computer monitors and LCD computer monitors. The CRT computer monitors within the offices and classrooms are outdated and have several disadvantages such as; significantly increased energy consumption, uses large amount of desk space, poor picture quality, distortions and flickering image, secular glare problems, high weight, and electromagnetic emissions. Many of these 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.

By choosing LCD monitors with an LED backlighting system the resulting energy consumption can be reduced even further. LED based LCD monitor's use less energy than conventional LCD monitor, and due to recent advancements have a comparable cost to conventional LCD monitors. For example a typical LCD with LED technology will use an estimated 2 watts when in sleep mode, and 20 watts while in operation (Based on 18.5 inch display).

Based on the site survey it was noted that there are 21 CRT monitors. Some of the monitors were left in screen saver mode, which 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 is based on averages for power usage of various computer monitors.

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

Energy Savings Calculations:

No. of CRT Monitors:	21
Operating Weeks per Yr:	42
Hrs per Week:	40 (8 hrs per day estimated average)

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

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

Installation cost of new monitors is estimated based on current pricing for an 18.5" 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 $120.

Installation Costs: # Monitors X Cost per Monitor
21 Monitors X $120 per Monitor
$2,520

COMPUTER MONITOR CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CRT Monitors	LCD Monitor	-
# of Computers	21	21	-
Monitor Power Cons. (W)	75	20	-
Operating Hrs per Week	40	40	-
Operating Weeks per Yr	42	42	-
Elec Cost ($/kWh)	0.168	0.168	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	2,646	706	1,940
Energy Cost ($)	$445	$119	$326
COMMENTS:	CRT Monitor consumption based on Dell CRT monitor M/N: CRT-E771MM. LCD Monitor based on Dell IN1930 LCD LED. Operating hours estimated.		

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,520
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$2,520
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$326
Total Yearly Savings ($/Yr):	$326
Estimated ECM Lifetime (Yr):	10
Simple Payback	7.7
Simple Lifetime ROI	29.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,260
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	$260.85

ECM #11: Set Computers to Automatic Stand-by or Hibernate

Description:

During the survey, it was noticed that the majority of the computers were left at ON position with the monitors at Screen Saver or OFF positions. According to interviews with some of the personnel, the computers require significant amount of time to boot up therefore they are typically left ON.

Many personal computers (PC) came equipped with automatic Stand-by or Hibernate (power down) features. Normally computers boot up from Stand-by or Hibernate modes much faster than powering up from Shut Down position.

Based on an independent study by the U.S. Department of Energy, Energy star® rated computers use approximately 70% less power during Stand-by Mode. It is recommended to set up the PCs at this facility to switch into Stand-by Mode after a short period of inactivity and Hibernate mode after a long period of inactivity.

This ECM includes configuring the computers in the classrooms and the library such that they automatically:

- Stand-by after 15 minutes of inactivity
- Hibernate after 60 minutes of inactivity

The inactivity times above can be adjusted based on experience or preference. Even though this ECM can be implemented easily in house, the calculations assume an independent computer technician performing the task at a typical market rate.

Energy Savings Calculations:

No. of CRT Monitors:	21
Operating Weeks per Yr:	42
Estimated percentage of computers left ON over night:	75%

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

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

The cost of configuring the computers to automatically sleep or hibernate is based on 10 minutes per computer per technician at an hourly rate indicated below.

Implementation Costs: = # Computers X Configuration Time X Cost per Hour
= 21Computers X 10 Minutes/Computer X $100 per Hour

= $175

AUTOMATIC SLEEP OR HIBERNATE MODES FOR COMPUTERS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Manual Operation	Auto Power Save	-
# of Computers	21	21	-
% Computers left ON	75%	75%	-
Power when left ON (Watt)	50	50	-
Power at Stand-by (Watt)	5	5	-
Power at Hibernate (Watt)	4	4	-
Power when OFF (Watt)	0	0	-
Operating Weeks per Yr	42	42	-
Operating Hours per Week	168	168	-
Hours/Wk Computers ON	120	20	-
Hours/Wk at Sleep Mode	0	20	-
Hours/Wk at Hibernate Mode	0	80	-
Hours/Wk at Power Down	48	48	-
Elec Cost ($/kWh)	0.168	0.168	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	3,969	728	3,241
Energy Cost ($)	$667	$122	$545
COMMENTS:	Calculation assumes computers currently run throughout work week and get shut down over the weekend.		

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$175
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$175
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$545
Total Yearly Savings ($/Yr):	$545
Estimated ECM Lifetime (Yr):	10
Simple Payback	0.3
Simple Lifetime ROI	3011.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,445
Internal Rate of Return (IRR)	311%
Net Present Value (NPV)	$4,470.09

ECM #12: Install Unit Ventilators with Energy Recovery

Description:

The heating for the classrooms in the original section of the School are provided by TRANE unit ventilators, which are original to the building. The unit ventilators are over 30 years old and far beyond the end of expected useful service life, which is fifteen (15) years per ASHRAE.

The estimated total number of older unit ventilators in this facility is 14. The units are heating only and controlled with pneumatic controllers and actuators. It is recommended to replace older unit ventilators with modern unit ventilators with energy recovery wheels. The advantage of this setup is the utilization of the energy recovery system to recover the energy in the exhaust air in order to reduce the heating and cooling demand of the classrooms.

This ECM replaces existing older unit ventilators with new unit ventilators with hot water heating coils and built-in energy recovery wheels. The basis for this ECM is Trane HUVC series unit ventilator with matching Energy Recovery ventilators. The ECM also includes attaching the unit ventilator controls to the Building Energy Management System to achieve superior scheduling and controls.

Energy Savings Calculations:

The energy savings calculations are based reduction of the outside air heating, reduction of the overheating and infiltration due to opening of the windows and temperature setback during nights and weekends.

Nominal recovery capacity of the proposed unit is calculated based on typical outside air percentage, heating degree days and design day temperature difference. Total energy recovery of each unit at heating modes is calculated using heating degree days:

$$\text{Heating Energy Recovered}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Recovery Rate}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}(\text{Day }^{\circ}\text{F})\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times(0.60)}{65(^{\circ}\text{F})\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\,(\%)}$$

Amount of addition infiltration at each classroom due to open windows:

$$\text{Infiltration}\,(\text{BTU}/\text{Hr})=\frac{\text{Ave Classroom Size (SF)}\times 10'\,\text{Ceiling}\times\frac{\#\,\text{Air Changes}}{\text{Hr}}}{\frac{60\,\text{Minutes}}{\text{Hr}}}\times 1.08\times 65^{\circ}\text{F}$$

$$\text{Infiltration Energy}\left(\frac{\text{Therms}}{\text{Yr}\times\text{Unit}}\right)=\frac{\text{Infiltration}\left(\frac{\text{Btu}}{\text{Hr.}}\right)\times\text{HDD}(\text{Day }^{\circ}\text{F})\times\#\left(\frac{\text{Hr.}}{\text{Day}}\right)\times(0.60)}{65(^{\circ}\text{F})\times\text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right)\times\text{Heating Efficiency}\,(\%)}$$

Fan Energy Cost:

$$\text{Fan Energy, kWh}=\frac{\text{Fan Power (HP)}\times\frac{0.746\text{kW}}{\text{HP}}\times 0.8\,(\text{Load Factor})\times\text{Annual Hrs}}{0.9\,(\text{Power Factor})}$$

Results of the calculations can be found in the table below:

UNIT VENTILATOR CALCULATIONS			
ECM INPUTS	**EXISTING UNITS**	**PROPOSED UNITS**	**SAVINGS**
ECM INPUTS	Existing Unit Ventilators UVs	New UVs with ERVs	
Number of Units	14	14	-
Ave. Unit Flow Capacity (CFM)	1250	1250	
Outside Air %	30%	30%	
Outside Air Flow (CFM)	375	375	
Heating Design Day Temp. Diff (°F)	65	65	
Average Classroom Size (SF)	1000	1000	
Additional Air Changes per Hour*	2	0	
Infiltration (CFM)	333	0	
Windows Open Hours/Day	3	0	
Infiltration Energy Loss (MBH/Unit)	23.4	0	
Heating Energy Recovery, MBH/Unit	-	26.3	26.3
ERV Operation Hours / Day	-	12	-
Supply Fan Motor HP	1/4	1/4	0
Fan Annual Hours of Operation	1560	780	780
Heating Degree Days	4713	4713	-
Net Heating System Efficiency	70%	70%	-
Electric Cost ($/KWH)	$0.168	$0.168	0.168
Natural Gas Cost ($/Therm)	$1.29	$1.29	$1.29
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED UNITS**	**SAVINGS**
Fan Energy (kWh)	3,621	1,810	1,810
Heating Energy Infiltration (Therms)	611	0	611
Heating Energy Recovery (Therms)	0	-2,749	2,749
Fan Energy Cost ($)	$608	$304	$304
Infiltration Energy Cost ($)	$788	$0	$788
Heating Energy Recovered ($)	$0	-$3,546	$3,546
Total ($)	$1,396	-$3,242	$4,638
COMMENTS:	* Due to open windows and overheating		

Project cost, incentives and maintenance savings:
Total installed cost for 14 unit ventilators with hot water coils, energy recovery ventilators (ERV) and controls upgrade is $196,000

The selected equipment does not qualify for any of the NJ Smart Start rebates.

There is no significant maintenance savings associated to this ECM.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$196,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$196,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,638
Total Yearly Savings ($/Yr):	$4,638
Estimated ECM Lifetime (Yr):	15
Simple Payback	42.3
Simple Lifetime ROI	-64.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$69,567
Internal Rate of Return (IRR)	-11%
Net Present Value (NPV)	($140,634.37)

REM #1: 110 KW Solar System

Description:

Hilldale Elementary School has available roof and parking space that could accommodate a solar system. Based on the available area a 110 kilowatt solar array could be installed, assuming the existing roof structure is capable of supporting an array. The array will produce approximately 134,338 kilowatt-hours annually that will reduce the overall electric usage of the facility by 42%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period. This model has been adjusted based on current SREC market values as of December 2011.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
System Size (KW_{DC}):	110.92
Electric Generation (KWH/Yr):	134,338
Installation Cost ($):	$661,838
SREC Revenue ($/Yr):	$27,450
Energy Savings ($/Yr):	$22,569
Total Yearly Savings ($/Yr):	$50,019
ECM Analysis Period (Yr):	15
Simple Payback (Yrs):	13.2
Analysis Period Electric Savings ($):	$419,755
Analysis Period SREC Revenue ($):	$397,652
Net Present Value (NPV)	($146,688.00)

V. 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. Turn off computers when not in use. Ensure computers are not running in screen saver mode which saves the monitor screen not energy.

F. Ensure outside air dampers are functioning properly and only open during occupied mode.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Hilldale Elementary School

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum \frac{C_n}{(1+IRR)^n}$	$\sum \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Equipment Upgrade	$21,630	$0	$1,800	$19,830	$4,326	$0	$4,326	15	$64,896	$0	227.3%	4.6	20.48%	$31,818.52
ECM #2	Lighting Controls Upgrade	$8,400	$0	$940	$7,460	$2,353	$0	$2,353	15	$35,301	$0	373.2%	3.2	31.00%	$20,634.93
ECM #3	Gymnasium Lighting Equipment and Controls Upgrade	$6,520	$0	$870	$5,650	$738	$0	$738	15	$11,064	$0	95.8%	7.7	9.88%	$3,155.04
ECM #4	Boiler Systems Upgrade	$147,500	$0	$3,000	$144,500	$2,459	$0	$2,459	30	$73,767	$0	-49.0%	58.8	-3.89%	($96,304.34)
ECM #5	AC Unit Upgrades	$96,500	$0	$4,282	$92,218	$1,583	$0	$1,583	15	$23,745	$0	-74.3%	58.3	-13.56%	($73,320.25)
ECM #6	Water Efficiency	$34,345	$0	$0	$34,345	$1,400	$0	$1,400	15	$21,000	$0	-38.9%	24.5	-5.60%	($17,631.89)
ECM #7	Nema Premium Efficiency Motors	$7,218	$0	$360	$6,858	$243	$0	$243	15	$3,645	$0	-46.9%	28.2	-7.03%	($3,957.08)
ECM #8	High Efficiency Domestic Hot Water	$20,500	$0	$350	$20,150	$2,543	$0	$2,543	15	$38,145	$0	89.3%	7.9	9.29%	$10,208.17
ECM #9	DDC System Expansion	$90,000	$0	$0	$90,000	$5,542	$0	$5,542	15	$83,130	$0	-7.6%	16.2	-0.98%	($23,839.96)
ECM #10	CRT Monitor Upgrades	$2,520	$0	$0	$2,520	$326	$0	$326	10	$3,260	$0	29.4%	7.7	4.98%	$260.85
ECM #11	Automatic Computer Stand-by / Hibernate	$175	$0	$0	$175	$545	$0	$545	10	$5,445	$0	3011.7%	0.3	311.17%	$4,470.09
ECM #12	Unit Ventilators with Energy Recovery	$196,000	$0	$0	$196,000	$4,638	$0	$4,638	15	$69,567	$0	-64.5%	42.3	-10.82%	($140,634.37)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	110 KW Solar System	$661,838	$0	$0	$661,838	$22,569	$27,450	$50,019	15	$750,287	$411,756	13.4%	13.2	1.61%	($64,712.43)

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

Concord Engineering Group, Inc.

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

SmartStart Building Incentives

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

Electric Chillers

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Cooling

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

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-2 lamps) $30 per fixture (3-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Premium Motors

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Hilldale School

Building ID: 2957226
For 12-month Period Ending: July 31, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: January 12, 2012

Facility
Hilldale School
123 Konner Ave.
Pine Brook, NJ 07058

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

Year Built: 1973
Gross Floor Area (ft²): 38,000

Energy Performance Rating[2] (1-100) 22

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,069,457
Natural Gas (kBtu)[4]	1,503,500
Total Energy (kBtu)	2,572,957

Energy Intensity[4]

Site (kBtu/ft²/yr)	68
Source (kBtu/ft²/yr)	135

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	231

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

National Median Comparison

National Median Site EUI	52
National Median Source EUI	105
% Difference from National Median Source EUI	29%
Building Type	K-12 School

Stamp of Certifying Professional

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

Meets Industry Standards[5] **for Indoor Environmental Conditions:**

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

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) 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	Hilldale School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	123 Konner Ave., Pine Brook, NJ 07058	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 a hospital (general medical and surgical)) nor can they be submitted as representing only a portion of a building		☐
Hilldale School (K-12 School)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	38,000 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.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	30	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	0	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	No	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	50 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	N/A(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Jersey Central Power & Light Co [FirstEnergy Corp]

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2011	07/31/2011	22,480.00
06/01/2011	06/30/2011	20,720.00
05/01/2011	05/31/2011	24,800.00
04/01/2011	04/30/2011	28,160.00
03/01/2011	03/31/2011	30,720.00
02/01/2011	02/28/2011	27,760.00
01/01/2011	01/31/2011	24,880.00
12/01/2010	12/31/2010	32,800.00
11/01/2010	11/30/2010	24,400.00
10/01/2010	10/31/2010	28,080.00
09/01/2010	09/30/2010	29,840.00
08/01/2010	08/31/2010	18,800.00
Electric Consumption (kWh (thousand Watt-hours))		**313,440.00**
Electric Consumption (kBtu (thousand Btu))		**1,069,457.28**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,069,457.28**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

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

Start Date	End Date	Energy Use (therms)
07/01/2011	07/31/2011	64.00
06/01/2011	06/30/2011	231.00
05/01/2011	05/31/2011	335.00
04/01/2011	04/30/2011	703.00
03/01/2011	03/31/2011	2,454.00
02/01/2011	02/28/2011	1,942.00
01/01/2011	01/31/2011	5,175.00
12/01/2010	12/31/2010	2,552.00
11/01/2010	11/30/2010	1,354.00
10/01/2010	10/31/2010	87.00

09/01/2010	09/30/2010	73.00
08/01/2010	08/31/2010	65.00
Gas Consumption (therms)		**15,035.00**
Gas Consumption (kBtu (thousand Btu))		**1,503,500.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**1,503,500.00**
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.

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
Hilldale School
123 Konner Ave.
Pine Brook, NJ 07058

Facility Owner
Montville Township Board of Education
86 River Road
Montville, NJ 07045

Primary Contact for this Facility
James Tevis
86 River Road
Montville, NJ 07045

General Information

Hilldale School	
Gross Floor Area Excluding Parking: (ft^2)	38,000
Year Built	1973
For 12-month Evaluation Period Ending Date:	July 31, 2011

Facility Space Use Summary

Hilldale School	
Space Type	K-12 School
Gross Floor Area(ft^2)	38,000
Open Weekends?	No
Number of PCs	30
Number of walk-in refrigeration/freezer units	0
Presence of cooking facilities	No
Percent Cooled	50
Percent Heated	100
Months[o]	N/A
High School?	No
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 07/31/2011)	**Baseline** (Ending Date 07/31/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	22	22	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	68	68	41	N/A	52
Source (kBtu/ft^2)	135	135	82	N/A	105
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					
$MtCO_2e$/year	231	231	140	N/A	179
$kgCO_2e/ft^2$/year	6	6	4	N/A	5

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Median column presents energy performance data your building would have if your building had a median rating of 50.

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

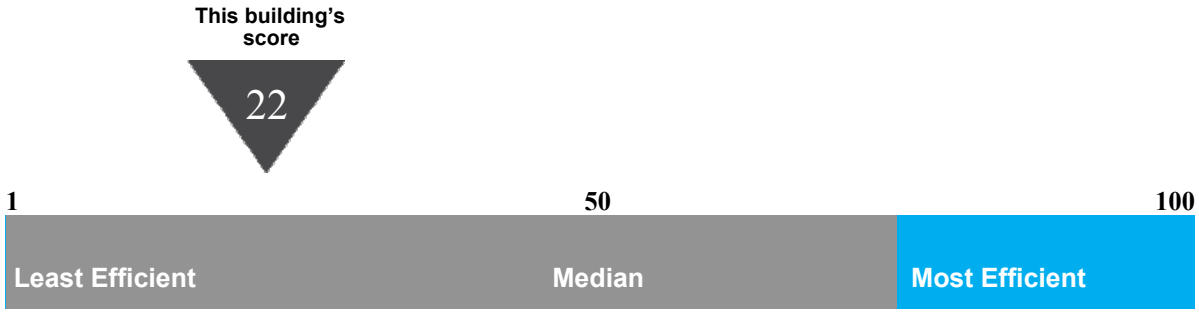
Statement of Energy Performance

2011

Hilldale School
123 Konner Ave.
Pine Brook, NJ 07058

Portfolio Manager Building ID: 2957226

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 135 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending July 2011

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

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

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 01/12/2012

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hilldale Elementary School

AC Units

Tag			
Unit Type	Split System Condensing Unit	Rooftop Unit	Split System Condensing Unit
Qty	1	1	6
Location	Roof	Roof	Roof
Area Served	Server Room	Main Office	Addition Classrooms
Manufacturer	Carrier	Trane	Trane
Model #	HABA - F048SE	THC072A3R0A1VG0C	TTP042C100A4
Serial #	WBNM017119	724103043L	P2240592F
Cooling Type	R22, DX	R22, DX	R22, DX
Cooling Capacity (Tons)	4.0	6.0	3.5
Cooling Efficiency (SEER/EER)	10.5 EER	11.5 EER	10 EER
Approx Age	9	4	12
ASHRAE Service Life	15	15	15
Remaining Life	4	11	3
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hilldale Elementary School

AC Units

Tag			
Unit Type	Split System Condensing Unit		
Qty	4		
Location	Roof		
Area Served	Addition Classrooms		
Manufacturer	Trane		
Model #	TTP030D100A0		
Serial #	P2127LX2F		
Cooling Type	R22, DX		
Cooling Capacity (Tons)	2.5		
Cooling Efficiency (SEER/EER)	9.9 EER		
Approx Age	12		
ASHRAE Service Life	15		
Remaining Life	3		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hilldale Elementary School

Air Handling Units

Tag	HV-3	HV-3	
Unit Type	Indoor Heating and Ventilation Unit	Rooftop Heating and Ventilation Unit	
Qty	1	1	
Location	Boiler room	Roof	
Area Served	Gym	Gym Area	
Manufacturer	Nesbitt	Trane	
Model # / Serial #	-	-	
Cooling Type	N/A	N/A	
CFM	-	-	
Heating Type	Hot water	Hot water	
Heating Input (MBH)	-	-	
Fuel	-	-	
Approx Age	37	12	
ASHRAE Service Life	15	15	
Remaining Life	(22)	3	
Comments	10 HP (Est) supply fan motor		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hilldale Elementary School

Boilers

Tag	Boiler - 1	Boiler - 2	
Unit Type	Firetube Boiler	Firetube Boiler	
Qty	1	1	
Location	Boiler Room	Boiler Room	
Area Served	Heating Hot Water Loop	Heating Hot Water Loop	
Manufacturer	Superior Boiler Works	Superior Boiler Works	
Model #	M528000	M528000	
Serial #	7343-12588	7343-12587	
Input Capacity (Btu/Hr)	2,432 MBH	2,432 MBH	
Rated Output Capacity (Btu/Hr)	1,702 MBH	1,702 MBH	
Approx. Efficiency %	70% (est)	70% (est)	
Fuel	Natural Gas	Natural Gas	
Approx Age	38	38	
ASHRAE Service Life	25	25	
Remaining Life	(13)	(13)	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hilldale Elementary School

Domestic Water Heaters

Tag	DHW - 1	DHW - 2	
Unit Type	Domestic Hot Water Heater	Domestic Hot Water Heater	
Qty	1	1	
Location	Addition Janitor Room	Boiler Room	
Area Served	Addition Restrooms	Original Section Restrooms	
Manufacturer	State Industries	A.O. Smith	
Model #	PEX302PRTV	BTC 154 920	
Serial #	J99343245	MF93-0277521	
Size (Gallons)	30	89	
Input Capacity (MBH/KW)	5.5 KW	154 MBH	
Recovery (Gal/Hr)	-	140	
Efficiency %	100%	70% (Est)	
Fuel	Electric	Natural Gas	
Approx Age	12	20	
ASHRAE Service Life	12	12	
Remaining Life	0	(8)	
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hilldale Elementary School

Pumps

Tag	P - 1 / 4	P - 2 / 3	
Unit Type	Base Mounted	In-Line	
Qty	1	2	
Location	Boiler Room	Boiler Room	
Area Served	Zone Pump	Circulation Pump	
Manufacturer	-	-	
Model #	-	-	
Serial #	-	-	
Horse Power	10.0	3.0	
Flow	-	-	
Motor Info	Dayton	Baldor	
Electrical Power	208-230/460	208-230/460	
RPM	1755	1725	
Motor Efficiency %	88.5%	86.0%	
Approx Age	15 (est)	10 (est)	
ASHRAE Service Life	20	10	
Remaining Life	5	0	
Comments	* Pump Tag Missing		

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hilldale Elementary School

Unit Ventilators

Tag	UV	UV	
Unit Type	Horizontal Floor Mount	Horizontal Floor Mount	
Qty	14	10	
Location	Original Section	New Section	
Manufacturer	Trane	Trane	
Model #	FSSN10H1	-	
Serial #	S3G 233 254	-	
Flow (CFM)	1200 (Est)	1500	
Cooling Capacity (Tons)	N/A	2.5 & 3.5	
Estimated Cooling Efficiency (EER)	N/A	10 (Est)	
Heating Type	Hot Water Coil	Hot Water Coil	
Heating Input (MBH)	-	-	
Approx Age	30	10 (Est)	
Ashrae Service Life	15.00	15	
Remaining Life	-15	5	
Comments	Poor condition	Coupled with Split Condensers. Good condition	

Note:
N/A = Not Applicable.
"-" = Info Not Available

Investment Grade Lighting Audit

CEG Job #: 9C11044

Project: Montville Twp BOE — **Hilldale Elementary School** — **KWH COST: $0.150**

123 Konner Avenue

Pine Brook, NJ

Bldg. Sq. Ft. 38,000

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.22	Class room 122	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.69	1,788.8	$268.32	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Class room 123	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.69	1,788.8	$268.32	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Class room 124	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.69	1,788.8	$268.32	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Classroom 121	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.69	1,788.8	$268.32	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Classroom 117	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.03	2,683.2	$402.48	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Classroom 118	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.95	2,459.6	$368.94	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 118	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$22.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 118 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$22.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Classroom 119	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.95	2,459.6	$368.94	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 119	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$22.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 119 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$22.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Classroom 120	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.95	2,459.6	$368.94	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 120	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$22.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 120 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.06	150.8	$22.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 116	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$486.72	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 115	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.25	3,244.8	$486.72	12	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Corridor - 122 - 115	3000	17	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.05	3,162.0	$474.30	17	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Corridor - 122 - 115	3000	15	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.98	2,925.0	$438.75	15	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Toilet Room #1	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$25.35	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Toilet Room #2	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	169.0	$25.35	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Boy's Room	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	161.2	$24.18	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Boy's Room	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.13	338.0	$50.70	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Girl's Room	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.06	161.2	$24.18	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Girl's Room	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.13	338.0	$50.70	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Custodian Room	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.25	644.8	$96.72	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Main Lobby Corridor	3000	26	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	4.11	12,324.0	$1,848.60	26	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	2.70	8112	$1,216.80	$120.00	$3,120.00	1.40	4212	$631.80	4.94
555	Main Lobby	3000	14	1	Recessed Down Light, 65w BR30 Lamp	65	0.91	2,730.0	$409.50	14	1	26w CFL Flood Lamp	26	0.36	1092	$163.80	$20.00	$280.00	0.55	1638	$245.70	1.14
745	MPR	2600	16	1	250w MH LoBay w/Prismatic Lens	291	4.66	12,105.6	$1,815.84	16	4	2x4, 4 Lamp, 54w T5HO, Elect. Ballast, Lo Bay	231	3.70	9609.6	$1,441.44	$370.00	$5,920.00	0.96	2496	$374.40	15.81
3520	Boiler Room	2600	6	1	Ceiling Mount White Globe, (1) 26w CFL Lamp	125	0.75	1,950.0	$292.50	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
3520	MPR Closet	1000	1	1	Ceiling Mount White Globe, (1) 26w CFL Lamp	125	0.13	125.0	$18.75	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 107	2600	18	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	2.84	7,394.4	$1,109.16	18	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	1.87	4867.2	$730.08	$120.00	$2,160.00	0.97	2527.2	$379.08	5.70

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.34	Classroom 107	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.35	904.8	$135.72	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 109	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 109	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	603.2	$90.48	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 110	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 110	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	603.2	$90.48	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 106	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 106	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	603.2	$90.48	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 105	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 105	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	603.2	$90.48	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 104	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 104	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	603.2	$90.48	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 103	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 103	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.23	603.2	$90.48	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Boy's Room	2600	3	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.19	483.6	$72.54	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Girl's Room	2600	2	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	322.4	$48.36	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 102	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.11	Classroom 102	2600	6	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.37	967.2	$145.08	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 101	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.11	Classroom 101	2600	6	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.37	967.2	$145.08	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Corridor - 102 - 104	3000	7	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.46	1,365.0	$204.75	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Corridor 107 - Main Lobby	3000	11	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.74	5,214.0	$782.10	11	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	1.14	3432	$514.80	$120.00	$1,320.00	0.59	1782	$267.30	4.94
242.21	Nurse's Office 159	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.43	1,112.8	$166.92	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
610	Nurse's Office 159 Toilet Room	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312.0	$46.80	1	2	13w CFL Lamps	26	0.03	67.6	$10.14	$25.00	$25.00	0.09	244.4	$36.66	0.68
128.11	Classroom 113	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 113	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.35	904.8	$135.72	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Girl's Room	2600	2	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.12	322.4	$48.36	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Boy's Room	2600	3	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.19	483.6	$72.54	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 112	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 112	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.35	904.8	$135.72	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 111	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 111	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.35	904.8	$135.72	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
128.11	Classroom 114	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.26	3,286.4	$492.96	8	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.83	2163.2	$324.48	$120.00	$960.00	0.43	1123.2	$168.48	5.70
221.34	Classroom 114	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.35	904.8	$135.72	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
200	Corridor - 109 - Main Lobby	3000	11	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.37	1,122.0	$168.30	11	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Staff 161	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.43	1,112.8	$166.92	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Media Center	2600	24	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	3.79	9,859.2	$1,478.88	24	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	2.50	6489.6	$973.44	$120.00	$2,880.00	1.30	3369.6	$505.44	5.70
221.34	Media Center	2600	8	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.46	1,206.4	$180.96	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Office 155	2600	8	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.86	2,225.6	$333.84	8	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Office 155 Closet	2600	1	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	0.16	410.8	$61.62	1	4	(2) 8' Lamps to (4) 4' Lamps - 32w T8, Elect Ballast; retrofit	104	0.10	270.4	$40.56	$120.00	$120.00	0.05	140.4	$21.06	5.70
221.34	Office 155 Closet	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.06	150.8	$22.62	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Main Office	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.64	1,669.2	$250.38	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Principal	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.43	1,112.8	$166.92	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Main Office Closet	1000	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.21	214.0	$32.10	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
31	Main Office	2600	4	1	Recessed Down Light, 90w R40 Lamp	90	0.36	936.0	$140.40	4	1	26w CFL Lamp	26	0.10	270.4	$40.56	$20.00	$80.00	0.26	665.6	$99.84	0.80
227.21	Main Office Corridor	3000	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.07	195.0	$29.25	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
610	Main Office Toilet Room #1	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312.0	$46.80	1	2	13w CFL Lamps	26	0.03	67.6	$10.14	$25.00	$25.00	0.09	244.4	$36.66	0.68
640	Main Office Toilet Room #2	2600	1	8	Strip Light, (8) 40w G40 Lamp	320	0.32	832.0	$124.80	1	8	14w G40 CFL Lamp	112	0.11	291.2	$43.68	$100.00	$100.00	0.21	540.8	$81.12	1.23

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
710	Exterior	4000	7	1	100w HPS Wallpack	125	0.88	3,500.0	$525.00	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		510	182				153,298	$22,995	510	86			22.6	60,528	$9,079		$27,550	11.7	31,339	$4,701	5.86

CEG Job #:
Project: Montville Twp BOE
Address: 123 Konner Avenue
Pine Brook, NJ
Building SF: 38,000

Hilldale Elementary School

KWH COST: $0.150

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
232.22	Class room 122	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.688	1788.8	268.32	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.55	20%	1431.04	$214.66	$300.00	$300.00	0.14	357.76	$53.66	5.59
232.22	Class room 123	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.688	1788.8	268.32	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.55	20%	1431.04	$214.66	$300.00	$300.00	0.14	357.76	$53.66	5.59
232.22	Class room 124	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.688	1788.8	268.32	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.55	20%	1431.04	$214.66	$300.00	$300.00	0.14	357.76	$53.66	5.59
232.22	Classroom 121	2600	8	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.688	1788.8	268.32	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.55	20%	1431.04	$214.66	$300.00	$300.00	0.14	357.76	$53.66	5.59
232.22	Classroom 117	2600	12	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	1.032	2683.2	402.48	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.83	20%	2146.56	$321.98	$300.00	$300.00	0.21	536.64	$80.50	3.73
232.22	Classroom 118	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.946	2459.6	368.94	11	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.76	20%	1967.68	$295.15	$300.00	$300.00	0.19	491.92	$73.79	4.07
227.22	Classroom 118	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	22.62	1	0	no change	58	0.06	0%	150.8	$22.62	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 118 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	22.62	1	0	no change	58	0.06	0%	150.8	$22.62	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Classroom 119	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.946	2459.6	368.94	11	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.76	20%	1967.68	$295.15	$300.00	$300.00	0.19	491.92	$73.79	4.07
227.22	Classroom 119	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	22.62	1	0	no change	58	0.06	0%	150.8	$22.62	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 119 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	22.62	1	0	no change	58	0.06	0%	150.8	$22.62	$0.00	$0.00	0.00	0	$0.00	0.00
232.22	Classroom 120	2600	11	3	2x4, 3 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	86	0.946	2459.6	368.94	11	1	Dual Technology Occupancy Sensor - Remote Mnt.	86	0.76	20%	1967.68	$295.15	$300.00	$300.00	0.19	491.92	$73.79	4.07
227.22	Classroom 120	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	22.62	1	0	no change	58	0.06	0%	150.8	$22.62	$0.00	$0.00	0.00	0	$0.00	0.00
227.22	Classroom 120 Toilet	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	58	0.058	150.8	22.62	1	0	no change	58	0.06	0%	150.8	$22.62	$0.00	$0.00	0.00	0	$0.00	0.00
242.22	Classroom 116	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	486.72	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$389.38	$300.00	$300.00	0.25	648.96	$97.34	3.08

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.22	Classroom 115	2600	12	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	104	1.248	3244.8	486.72	12	1	Dual Technology Occupancy Sensor - Remote Mnt.	104	1.00	20%	2595.84	$389.38	$300.00	$300.00	0.25	648.96	$97.34	3.08
222.21	Corridor - 122 - 115	3000	17	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	1.054	3162	474.3	17	0	no change	62	1.05	0%	3162	$474.30	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Corridor - 122 - 115	3000	15	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.975	2925	438.75	15	0	no change	65	0.98	0%	2925	$438.75	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Toilet Room #1	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	25.35	1	0	no change	65	0.07	0%	169	$25.35	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Toilet Room #2	2600	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	169	25.35	1	0	no change	65	0.07	0%	169	$25.35	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Boy's Room	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	161.2	24.18	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.05	20%	128.96	$19.34	$150.00	$150.00	0.01	32.24	$4.84	31.02
227.21	Boy's Room	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.13	338	50.7	2	0	no change	65	0.13	0%	338	$50.70	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Girl's Room	2600	1	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.062	161.2	24.18	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.05	20%	128.96	$19.34	$150.00	$150.00	0.01	32.24	$4.84	31.02
227.21	Girl's Room	2600	2	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.13	338	50.7	2	0	no change	65	0.13	0%	338	$50.70	$0.00	$0.00	0.00	0	$0.00	0.00
222.21	Custodian Room	2600	4	2	2x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	62	0.248	644.8	96.72	4	0	no change	62	0.25	0%	644.8	$96.72	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Main Lobby Corridor	3000	26	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	4.108	12324	1848.6	26	0	no change	158	4.11	0%	12324	$1,848.60	$0.00	$0.00	0.00	0	$0.00	0.00
555	Main Lobby	3000	14	1	Recessed Down Light, 65w BR30 Lamp	65	0.91	2730	409.5	14	0	no change	65	0.91	0%	2730	$409.50	$0.00	$0.00	0.00	0	$0.00	0.00
745	MPR	2600	16	1	250w MH LoBay w/Prismatic Lens	291	4.656	12105.6	1815.84	16	2	Dual Technology Occupancy Sensor - Remote Mnt.	291	3.72	20%	9684.48	$1,452.67	$300.00	$600.00	0.93	2421.12	$363.17	1.65
3520	Boiler Room	2600	6	1	Ceiling Mount White Globe, (1) 26w CFL Lamp	125	0.75	1950	292.5	6	0	no change	125	0.75	0%	1950	$292.50	$0.00	$0.00	0.00	0	$0.00	0.00
3520	MPR Closet	1000	1	1	Ceiling Mount White Globe, (1) 26w CFL Lamp	125	0.125	125	18.75	1	0	no change	125	0.13	0%	125	$18.75	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 107	2600	18	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	2.844	7394.4	1109.16	18	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	2.28	20%	5915.52	$887.33	$300.00	$300.00	0.57	1478.88	$221.83	1.35

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.34	Classroom 107	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.348	904.8	135.72	6	0	no change	58	0.35	0%	904.8	$135.72	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 109	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 109	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	603.2	90.48	4	0	no change	58	0.23	0%	603.2	$90.48	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 110	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 110	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	603.2	90.48	4	0	no change	58	0.23	0%	603.2	$90.48	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 106	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 106	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	603.2	90.48	4	0	no change	58	0.23	0%	603.2	$90.48	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 105	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 105	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	603.2	90.48	4	0	no change	58	0.23	0%	603.2	$90.48	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 104	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 104	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	603.2	90.48	4	0	no change	58	0.23	0%	603.2	$90.48	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 103	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 103	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.232	603.2	90.48	4	0	no change	58	0.23	0%	603.2	$90.48	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Boy's Room	2600	3	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.186	483.6	72.54	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.15	20%	386.88	$58.03	$150.00	$150.00	0.04	96.72	$14.51	10.34
221.11	Girl's Room	2600	2	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	322.4	48.36	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$38.69	$150.00	$150.00	0.02	64.48	$9.67	15.51
128.11	Classroom 102	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS											SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.11	Classroom 102	2600	6	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.372	967.2	145.08	6	0	no change	62	0.37	0%	967.2	$145.08	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 101	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$0.00	$0.00	0.25	657.28	$98.59	0.00
221.11	Classroom 101	2600	6	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.372	967.2	145.08	6	0	no change	62	0.37	0%	967.2	$145.08	$300.00	$0.00	0.00	0	$0.00	0.00
227.21	Corridor - 102 - 104	3000	7	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.455	1365	204.75	7	0	no change	65	0.46	0%	1365	$204.75	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Corridor 107 - Main Lobby	3000	11	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.738	5214	782.1	11	0	no change	158	1.74	0%	5214	$782.10	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Nurse's Office 159	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.428	1112.8	166.92	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	0.34	20%	890.24	$133.54	$300.00	$300.00	0.09	222.56	$33.38	8.99
610	Nurse's Office 159 Toilet Room	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312	46.8	1	0	no change	120	0.12	0%	312	$46.80	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 113	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 113	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.348	904.8	135.72	6	0	no change	58	0.35	0%	904.8	$135.72	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Girl's Room	2600	2	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	322.4	48.36	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	257.92	$38.69	$150.00	$150.00	0.02	64.48	$9.67	15.51
221.11	Boy's Room	2600	3	2	1x4, 2 Lamp, 32wT8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.186	483.6	72.54	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.15	20%	386.88	$58.03	$150.00	$150.00	0.04	96.72	$14.51	10.34
128.11	Classroom 112	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04
221.34	Classroom 112	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.348	904.8	135.72	6	0	no change	58	0.35	0%	904.8	$135.72	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 111	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	158	1.01	20%	2629.12	$394.37	$150.00	$150.00	0.25	657.28	$98.59	1.52
221.34	Classroom 111	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.348	904.8	135.72	6	0	no change	58	0.35	0%	904.8	$135.72	$0.00	$0.00	0.00	0	$0.00	0.00
128.11	Classroom 114	2600	8	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	1.264	3286.4	492.96	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	158	1.01	20%	2629.12	$394.37	$300.00	$300.00	0.25	657.28	$98.59	3.04

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
221.34	Classroom 114	2600	6	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.348	904.8	135.72	6	0	no change	58	0.35	0%	904.8	$135.72	$0.00	$0.00	0.00	0	$0.00	0.00
200	Corridor - 109 - Main Lobby	3000	11	2	1x2, 2 Lamp, 17w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	34	0.374	1122	168.3	11	0	no change	34	0.37	0%	1122	$168.30	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Staff 161	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.428	1112.8	166.92	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.34	20%	890.24	$133.54	$150.00	$150.00	0.09	222.56	$33.38	4.49
128.11	Media Center	2600	24	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	3.792	9859.2	1478.88	24	0	no change	158	3.79	0%	9859.2	$1,478.88	$0.00	$0.00	0.00	0	$0.00	0.00
221.34	Media Center	2600	8	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.464	1206.4	180.96	8	0	no change	58	0.46	0%	1206.4	$180.96	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Office 155	2600	8	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.856	2225.6	333.84	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	107	0.68	20%	1780.48	$267.07	$300.00	$300.00	0.17	445.12	$66.77	4.49
128.11	Office 155 Closet	2600	1	2	8' Channel, 2 Lamp, 85w T12, Elect. Ballast, Pendant Mnt., No Lens	158	0.158	410.8	61.62	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	158	0.13	20%	328.64	$49.30	$150.00	$150.00	0.03	82.16	$12.32	12.17
221.34	Office 155 Closet	2600	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.058	150.8	22.62	1	0	no change	58	0.06	0%	150.8	$22.62	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Main Office	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.642	1669.2	250.38	6	0	no change	107	0.64	0%	1669.2	$250.38	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Principal	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.428	1112.8	166.92	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.34	20%	890.24	$133.54	$150.00	$150.00	0.09	222.56	$33.38	4.49
242.21	Main Office Closet	1000	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	107	0.214	214	32.1	2	0	no change	107	0.21	0%	214	$32.10	$0.00	$0.00	0.00	0	$0.00	0.00
31	Main Office	2600	4	1	Recessed Down Light, 90w R40 Lamp	90	0.36	936	140.4	4	0	no change	90	0.36	0%	936	$140.40	$0.00	$0.00	0.00	0	$0.00	0.00
227.21	Main Office Corridor	3000	1	2	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.065	195	29.25	1	0	no change	65	0.07	0%	195	$29.25	$0.00	$0.00	0.00	0	$0.00	0.00
610	Main Office Toilet Room #1	2600	1	2	1x1 Surface Mount, Prismatic Lens, (2) 60w A Lamp	120	0.12	312	46.8	1	0	no change	120	0.12	0%	312	$46.80	$0.00	$0.00	0.00	0	$0.00	0.00
640	Main Office Toilet Room #2	2600	1	8	Strip Light, (8) 40w G40 Lamp	320	0.32	832	124.8	1	0	no change	320	0.32	0%	832	$124.80	$0.00	$0.00	0.00	0	$0.00	0.00
710	Exterior	4000	7	1	100w HPS Wallpack	125	0.875	3500	525	7	0	no change	125	0.88	0%	3500	$525.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		510	182			57.2	153,297.6	$22,995	510	36			50.2		135,187.0	$20,278.06		$9,000	6.97	18,111	$2,717	3.31

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Hilldale Elementary School	11,700	SHARP NU-U235F2	472	17.5	8,279	110.92	134,338	90	19,777	13.40

.= Proposed PV Layout

Notes:

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

Parking Canopy Output

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	35.2 kW
DC to AC Derate Factor:	0.810
AC Rating:	28.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.39	2115	317.25
2	3.17	2564	384.60
3	4.07	3588	538.20
4	4.83	3976	596.40
5	5.70	4730	709.50
6	5.94	4622	693.30
7	5.77	4586	687.90
8	5.38	4248	637.20
9	4.65	3655	548.25
10	3.61	3008	451.20
11	2.35	1919	287.85
12	2.01	1722	258.30
Year	4.16	40733	6109.95

Pitched Roof Output

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	75.7 kW
DC to AC Derate Factor:	0.810
AC Rating:	61.3 kW
Array Type:	Fixed Tilt
Array Tilt:	25.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.95	5747	862.05
2	3.70	6497	974.55
3	4.44	8405	1260.75
4	4.97	8729	1309.35
5	5.65	10011	1501.65
6	5.78	9640	1446.00
7	5.67	9654	1448.10
8	5.46	9199	1379.85
9	4.99	8407	1261.05
10	4.15	7452	1117.80
11	2.82	5096	764.40
12	2.50	4768	715.20
Year	4.43	93605	14040.75

Project Name: **Montville BOE**
Location: **Hilldale Elementary School**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$661,838
Annual kWh Production	134,338
Annual Energy Cost Reduction	$22,569
Average Annual SREC Revenue	$27,450

Simple Payback: **13.23** Years

Life Cycle Cost Analysis

Analysis Period (years): 15
Discount Rate: 3%
Average Energy Cost ($/kWh) **$0.168**
Financing Rate: 6.00%
Financing %: 100%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
Average SREC Value ($/kWh) $0.204

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$0	0	0	0	$0	0	0	0	0
1	$0	134,338	$22,569	$0	$40,301	$38,947	$28,073	($4,149)	($4,149)
2	$0	133,666	$23,246	$0	$40,100	$37,215	$29,804	($3,674)	($7,823)
3	$0	132,998	$23,943	$0	$33,249	$35,377	$31,643	($9,827)	($17,650)
4	$0	132,333	$24,662	$0	$33,083	$33,425	$33,594	($9,275)	($26,925)
5	$0	131,671	$25,401	$1,356	$26,334	$31,353	$35,666	($16,640)	($43,565)
6	$0	131,013	$26,163	$1,349	$26,203	$29,153	$37,866	($16,003)	($59,568)
7	$0	130,358	$26,948	$1,343	$26,072	$26,818	$40,202	($15,342)	($74,910)
8	$0	129,706	$27,757	$1,336	$25,941	$24,338	$42,681	($14,658)	($89,568)
9	$0	129,058	$28,589	$1,329	$25,812	$21,706	$45,314	($13,948)	($103,516)
10	$0	128,412	$29,447	$1,323	$25,682	$18,911	$48,109	($13,213)	($116,729)
11	$0	127,770	$30,331	$1,316	$19,166	$15,944	$51,076	($18,840)	($135,568)
12	$0	127,131	$31,240	$1,309	$19,070	$12,793	$54,226	($18,019)	($153,587)
13	$0	126,496	$32,178	$1,303	$18,974	$9,449	$57,571	($17,170)	($170,757)
14	$0	125,863	$33,143	$1,296	$18,879	$5,898	$61,121	($16,293)	($187,051)
15	$0	125,234	$34,137	$1,290	$18,785	$2,128	$64,891	($15,387)	($202,438)
	Totals:	1,946,048	$419,755	$14,551	$397,652	$343,456	$661,838	($202,438)	($1,393,804)

Net Present Value (NPV) **($146,688)**