LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

ESTELL MANOR SCHOOL DISTRICT
128 CAPE MAY AVENUE
ESTELL MANOR, NJ 08319
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REPORT ISSUANCE: **FINAL, FEBRUARY 25, 2014**

PROJECT NO: **1C13529**

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I. EXECUTIVE SUMMARY

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

Estell Manor School Disitrct
128 Cape May Avenue
Estell Manor New Jersey 08319

District Contact Person: Rose Millar, Business Administrator
Facility Contract Person: James Pettit, Building & Grounds Supervisor

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program for the Estell Manor School District. The purpose of this analysis is to provide the owner insight into the energy savings potential that exists within the facility. Energy Efficiency changes and upgrades requires support from the building occupants, operations personnel and the administrators of the building in order to maximize the savings and overall benefit. The efficiency improvement of public buildings provides a benefit for the environment and the residents of New Jersey.

The Energy Conservation Measures (ECMs) identified within the report represent the potential annual savings at the facility. It is recommended to consider all ECMs as part of the District's initiative to save energy, reduce emissions, and lower operating costs. The District should review and be familiar with all measures presented in the report prior to making a decision on which projects to move forward with.

The annual energy costs at this facility are as follows:

Electricity	$ 89,580
Fuel Oil #2	$ 10,085
Propane	$ 2,147
Total	$ 101,812

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

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - Interior	$825	$550	1.5	900.0%
ECM #2	Lighting Upgrade - T8 to LED	$103,250	$5,008	20.6	-27.2%
ECM #3	Lighting Upgrade - Exterior	$8,025	$1,392	5.8	160.2%
ECM #4	Lighting Controls	$17,865	$2,386	7.5	100.3%
ECM #5	Refrigerator Replacement	$780	$62	12.6	19.2%
ECM #6	CRT Monitor Replacement	$375	$44	8.5	76.0%
ECM #7	Computer Power Optimization	$10,000	$1,665	6.0	149.8%
ECM #8	De-stratification Fans	$5,000	$412	12.1	23.6%
ECM #9	High Efficiency XFMR	$26,000	$2,218	11.7	28.0%
ECM #10	Fuel Conversion to Natural Gas	$9,000	$7,156	1.3	1092.7%
ECM #11	Electric to HW Conversion	$190,000	$4,188	45.4	-55.9%
ECM #12	Rooftop HP Replacement	$68,000	$1,030	66.0	-77.3%
ECM #13	Rooftop HP to Natural Gas	$73,826	$1,332	55.4	-72.9%
ECM #14	Air to Air HP to Geothermal	$194,900	$3,964	49.2	-59.3%
ECM #15	Energy Star Kitchen Equipment	$14,000	$833	16.8	-10.8%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	95 kW Solar Array	$425,787	$40,089	10.6	41.2%

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

Table 2
Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)						
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION				
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	FUEL OIL #2 (GALLONS)	PROPANE (GALLONS)	NATURAL GAS (THERMS)
ECM #1	Lighting Upgrade - Interior	1.0	3,549	0	0	0
ECM #2	Lighting Upgrade - T8 to LED	12.0	25,860	0	0	0
ECM #3	Lighting Upgrade - Exterior	2.0	8,982	0	0	0
ECM #4	Lighting Controls	0.0	10,546	0	0	0
ECM #5	Refrigerator Replacement	0.0	399	0	0	0
ECM #6	CRT Monitor Replacement	0.2	287	0	0	0
ECM #7	Computer Power Optimization	0.0	10,744	0	0	0
ECM #8	De-stratification Fans	0.0	2,656	0	0	0
ECM #9	High Efficiency XFMR	2.8	14,312	0	0	0
ECM #10	Fuel Conversion to Natural Gas	0.0	0	3,290	567	-5,092
ECM #11	Electric to HW Conversion	0.0	67,282	-2,033	0	0
ECM #12	Rooftop HP Replacement	2.9	6,645	0	0	0
ECM #13	Rooftop HP to Natural Gas	3.7	25,069	0	0	-2,553
ECM #14	Air to Air HP to Geothermal	8.7	25,574	0	0	0
ECM #15	Energy Star Kitchen Equipment	0.0	0	0	220	0
RENEWABLE ENERGY MEASURES (REM's)						
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION				
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	FUEL OIL #2 (GALLONS)	PROPANE (GALLONS)	NATURAL GAS (THERMS)
REM #1	95 kW Solar Array	77.2	115,836	0	0	0

Notes: Utility reductions denoted with a "0" mean there are no associated savings for that measure.

Table 3
Emissions Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**GREENHOUSE GAS EMISSIONS REDUCTION**		
		CO_2 EMISSIONS (LBS)	**NO_X EMISSIONS (LBS)**	**SO_2 EMISSIONS (LBS)**
ECM #1	Lighting Upgrade - Interior	5,394	10	23
ECM #2	Lighting Upgrade - T8 to LED	39,307	72	168
ECM #3	Lighting Upgrade - Exterior	13,653	25	58
ECM #4	Lighting Controls	16,030	30	69
ECM #5	Refrigerator Replacement	606	1	3
ECM #6	CRT Monitor Replacement	436	1	2
ECM #7	Computer Power Optimization	16,331	30	70
ECM #8	De-stratification Fans	4,037	7	17
ECM #9	High Efficiency XFMR	21,754	40	93
ECM #10	Fuel Conversion to Natural Gas	21,321	(47)	0
ECM #11	Electric to HW Conversion	56,729	188	437
ECM #12	Rooftop HP Replacement	10,100	19	43
ECM #13	Rooftop HP to Natural Gas	8,235	47	163
ECM #14	Air to Air HP to Geothermal	38,872	72	166
ECM #15	Energy Star Kitchen Equipment	0	0	0

Notes: A. Emissions Reduction based on NJCEP published factors for electric & gas.

Table 4
Facility Project Summary Table

FACILITY PROJECT SUMMARY TABLE					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Upgrade - Interior	$550	$1,025	$200	$825	1.5
~~Lighting Upgrade - T8 to LED~~	~~$5,008~~	~~$128,000~~	~~$24,750~~	~~$103,250~~	~~20.6~~
Lighting Upgrade - Exterior	$1,392	$10,000	$1,975	$8,025	5.8
Lighting Controls	$2,386	$18,000	$135	$17,865	7.5
Refrigerator Replacement	$62	$780	$0	$780	12.6
CRT Monitor Replacement	$44	$375	$0	$375	8.5
Computer Power Optimization	$1,665	$10,000	$0	$10,000	6.0
De-stratification Fans	$412	$5,000	$0	$5,000	12.1
High Efficiency XFMR	$2,218	$26,000	$0	$26,000	11.7
~~Fuel Conversion to Natural Gas~~	~~$7,156~~	~~$9,000~~	~~$0~~	~~$9,000~~	~~1.3~~
~~Electric to HW Conversion~~	~~$4,188~~	~~$190,000~~	~~$0~~	~~$190,000~~	~~45.4~~
Rooftop HP Replacement	$1,030	$68,000	$0	$68,000	66.0
~~Rooftop HP to Natural Gas~~	~~$1,332~~	~~$75,000~~	~~$1,174~~	~~$73,826~~	~~55.4~~
~~Air to Air HP to Geothermal~~	~~$3,964~~	~~$203,000~~	~~$8,100~~	~~$194,900~~	~~49.2~~
~~Energy Star Kitchen Equipment~~	~~$833~~	~~$14,500~~	~~$500~~	~~$14,000~~	~~16.8~~
Total Project	**$9,759**	**$139,180**	**$2,310**	**$136,870**	**14.0**

If natural gas becomes available to the facility additional cost savings could be realized altering the project scope and funding capability. Measures with a strike through represent projects not able to be funded in a potential ESIP Program; however this should not discourage consideration by the district with use of alternative funding mechanisms.

Overall Assessment:

Overall, the Estell Manor School is operating inefficiently for K-12 type buildings based on the national average. The District is also paying an average cost of energy at $2.35 per square-foot above the typical average costs of $2.00 per square-foot.

On the whole, Concord Engineering recommends the District review and be familiar with all measures presented in the report prior to making a decision on which projects to move forward with. This will enable the District to effectively align report recommendations with those outlined in their mid/long range facility plans and financial plans, as well as the current referendum. The District should also review all conventional and unconventional funding, along with all NJCEP funding opportunities for these projects and determine which options fit the District's budget most positively in the short and long term. The combination of this information will enable the District to put together an effective Energy Savings Improvement Strategy that maximizes the received benefits of the selected projects.

Other Considerations:

Renewable Energy Conservation Measures:

Renewable Energy Measures (REMs) were also reviewed for implementation at the Estell Manor School. Concord Engineering utilized a roof mounted array to house a PV system. There is a total estimated solar system potential of 95 kW DC that could generate 115,836 kilowatt-hours annually offsetting 20% of the total energy purchased from the grid. The system's calculated simple payback of 10.6 years is above 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.

Energy Procurement Recommendations:

The District is currently contracted with a third party supplier for the school for electric. It is recommended the District continue utilizing a 3rd party purchasing approach to energy. The District should consider trying to change the main electric account rate tariff from Monthly to Annual General Service to realize delivery cost savings. Further recommendations are outlined in the Energy Procurement Section.

Maintenance and Operational Recommendations:

In addition to the ECMs and REMs, 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 are typically achievable with onsite staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The recommendations outlined in Section XI should be considered a priority in achieving an energy efficient building.

II. INTRODUCTION

The comprehensive energy audit covers the 43,366 square foot Estell Manor School at 128 Cape May Avenue, owned by the Estell Manor School District.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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 based on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

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

ECM Calculation Equations:

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

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

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

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

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

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

Net Present Value calculations are based on Discount Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

The electric usage profile represents the actual electrical usage for the facility. The facility receives electric distribution service through Atlantic City Electric (ACE) under their Monthly General Service (MGS) rate structure. The District has contracted Amerada Hess, and most recently First Energy, a Third Party Supplier (TPS), to provide electric commodity supply (generation) service. 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 oil usage profile shows the actual oil consumption for the facility normalized over an entire year. Oil is provided by Pedroni and Riggins to the facility. The oil provider measures consumption in gallons. One Gallon of #2 oil is equivalent to 140,000 BTUs of energy.

The propane usage profile shows the actual propane consumption for the facility normalized over an entire year. Propane is provided by Suburban Propane and Modern Gas to the facility. The propane provider measures consumption in gallons. One Gallon of propane is equivalent to 91,600 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	15.5¢ / kWh
Fuel Oil #2	$3.07 / gallon
Propane	$3.79 / gallon

Table 5
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Atlantic City Electric
Rate: Monthly General Service
Meter No: 7635099; 58696530
Account No: 0219 4119 9990; 0219 4129 9998
Third Party Utility Provider: Amerada Hess, First Energy
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Jan-13	63,444	48.2	$8,725
Feb-13	66,438	49.1	$9,148
Mar-13	60,925	50.1	$8,387
Apr-13	36,137	49.6	$5,005
May-13	32,230	56.3	$5,919
Jun-13	32,764	116.3	$6,204
Jul-13	44,473	115.5	$8,101
Aug-13	36,301	115.6	$6,999
Sep-13	38,221	58.8	$7,534
Oct-13	33,758	57.7	$2,872
Nov-13	47,231	47.6	$7,397
Dec-13	85,351	49.7	$13,289
Totals	**577,273**	**116.3 Max**	**$89,580**

AVERAGE DEMAND **69.5 KW average**
AVERAGE RATE **$0.155** **$/kWh**

Figure 1
Electricity Usage Profile

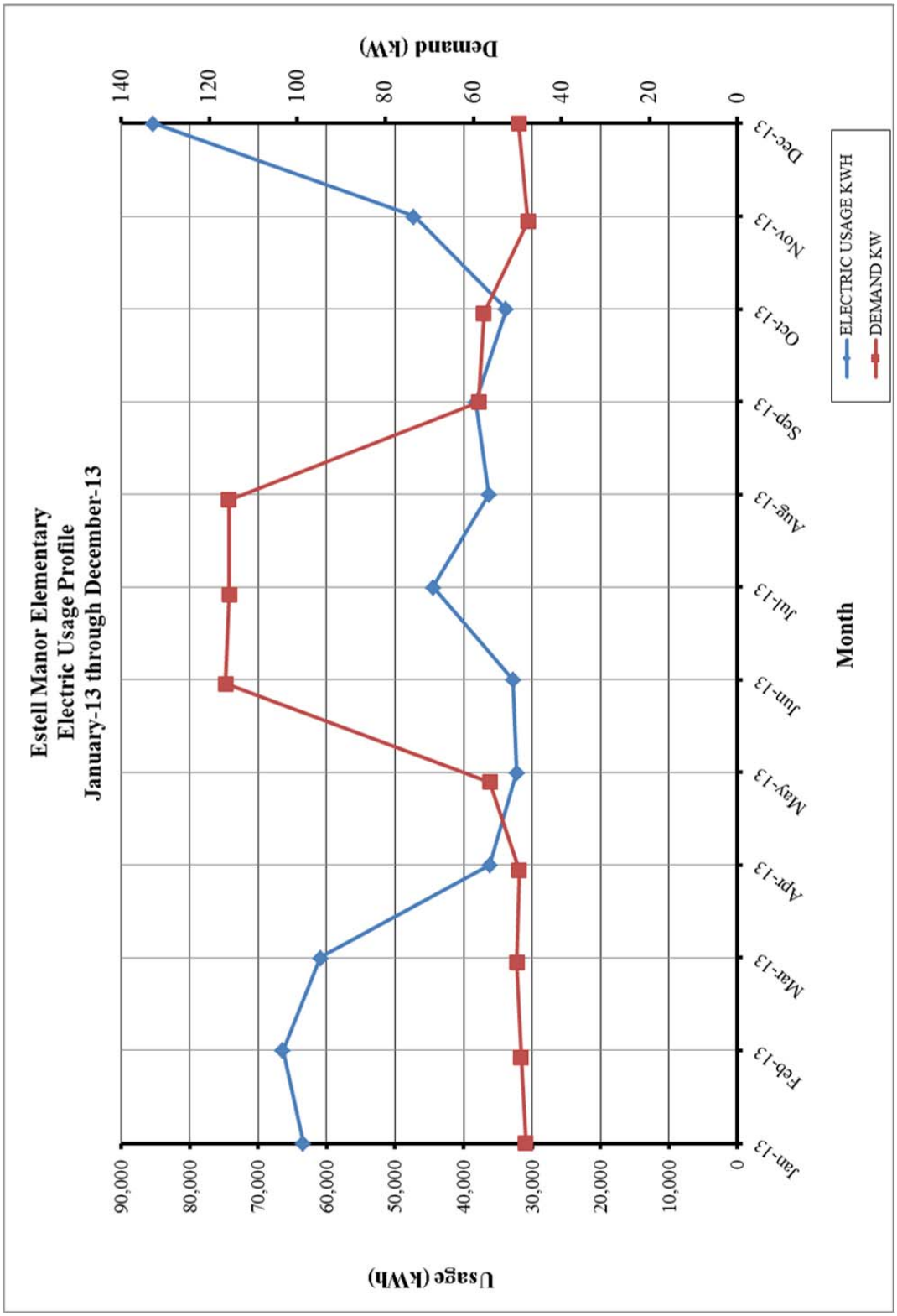


Table 6
Fuel Oil #2 Billing Data

FUEL OIL USAGE SUMMARY		
Utility Provider: Pedroni, Riggins Account No: 1263J; 18660032 Rate: Based on Time of Delivery Price		
MONTH OF USE	**CONSUMPTION (GALLONS)**	**TOTAL BILL**
Jan-13	485.71	$1,536.80
Feb-13	514.29	$1,627.20
Mar-13	500.00	$1,405.00
Apr-13	500.00	$1,405.00
May-13	0.00	$0.00
Jun-13	0.00	$0.00
Jul-13	0.00	$0.00
Aug-13	0.00	$0.00
Sep-13	0.00	$0.00
Oct-13	349.40	$1,123.31
Nov-13	349.40	$1,123.31
Dec-13	591.17	$1,864.31
TOTALS	**3,289.96**	**$10,084.94**
AVERAGE RATE:	**$3.07**	**$/Gallon**

Figure 2
Fuel Oil #2 Usage Profile

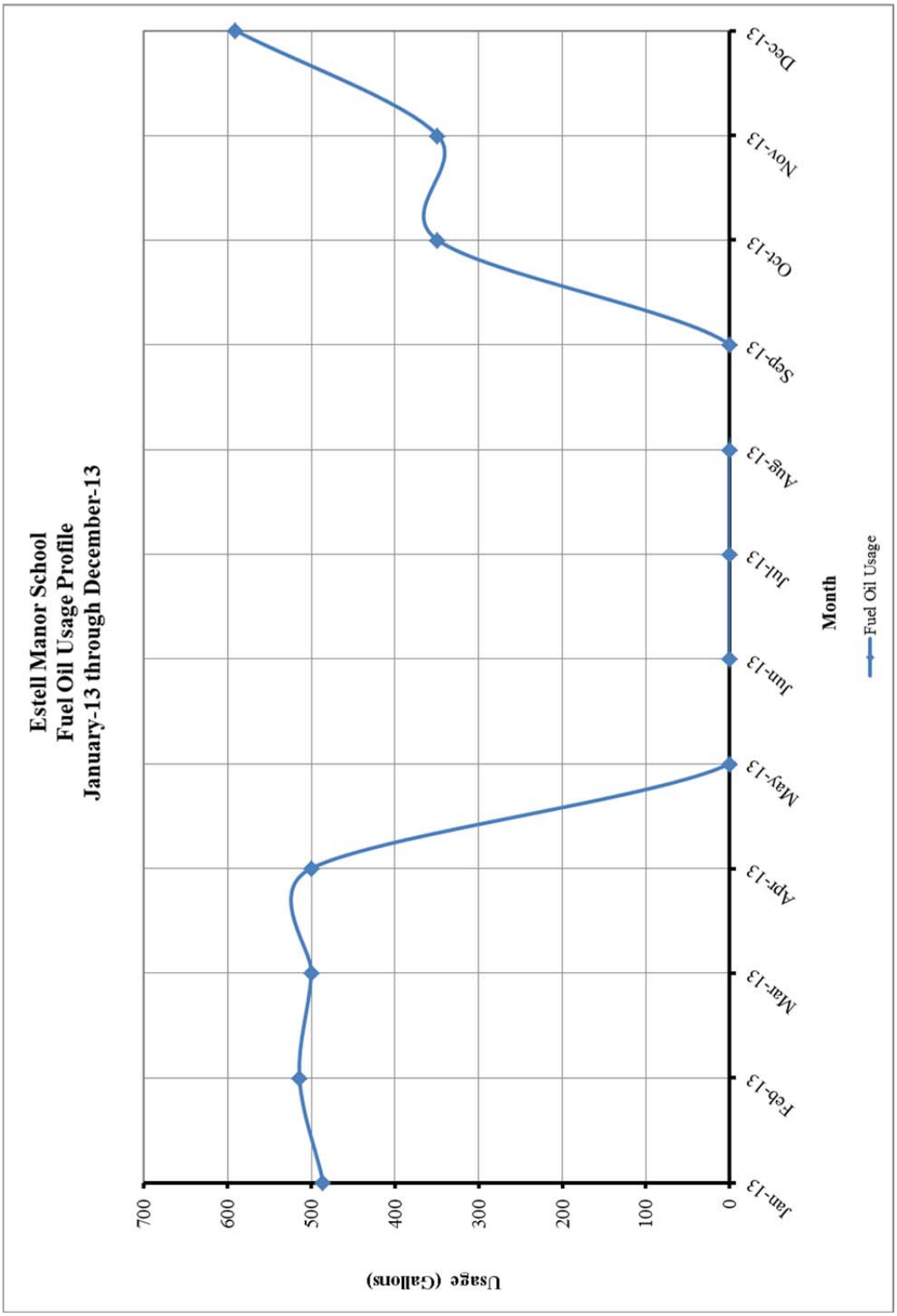
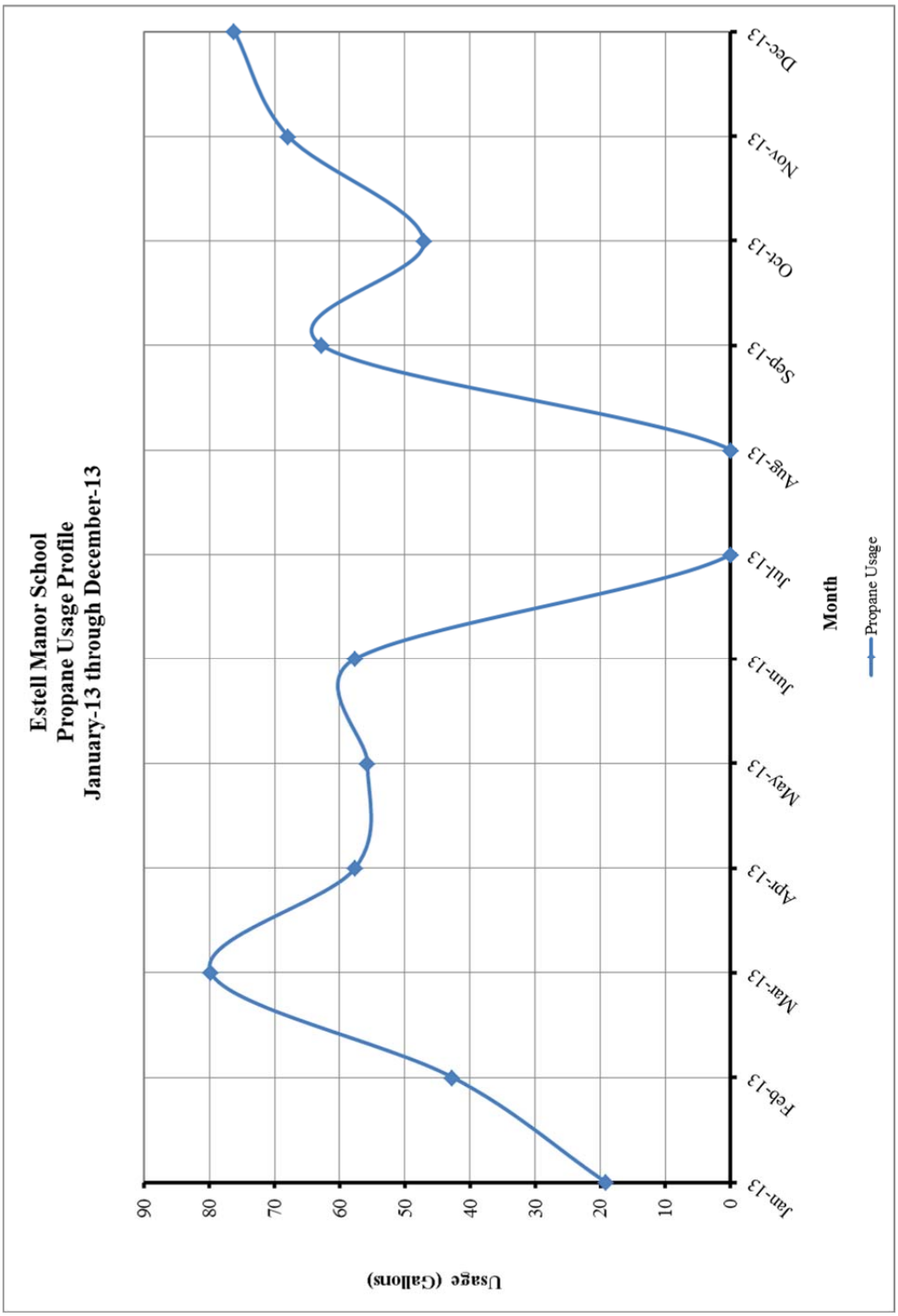


Table 7
Propane Billing Data

PROPANE USAGE SUMMARY		
Utility Provider: Suburban Propane, Modern Gas Account No: 2115-000233057-001 Rate: Based on Time of Delivery Price		
MONTH OF USE	**CONSUMPTION (GALLONS)**	**TOTAL BILL**
Jan-13	19.21	$64.66
Feb-13	42.70	$142.90
Mar-13	79.80	$256.43
Apr-13	57.62	$185.10
May-13	55.76	$179.13
Jun-13	57.62	$185.10
Jul-13	0.00	$0.00
Aug-13	0.00	$0.00
Sep-13	62.80	$274.40
Oct-13	47.10	$205.80
Nov-13	67.94	$308.24
Dec-13	76.17	$345.60
TOTALS	**566.73**	**$2,147.37**
AVERAGE RATE:	**$3.79**	**$/Gallon**

Figure 3
Propane Usage Profile



B. Energy Use Index (EUI)

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

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

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

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

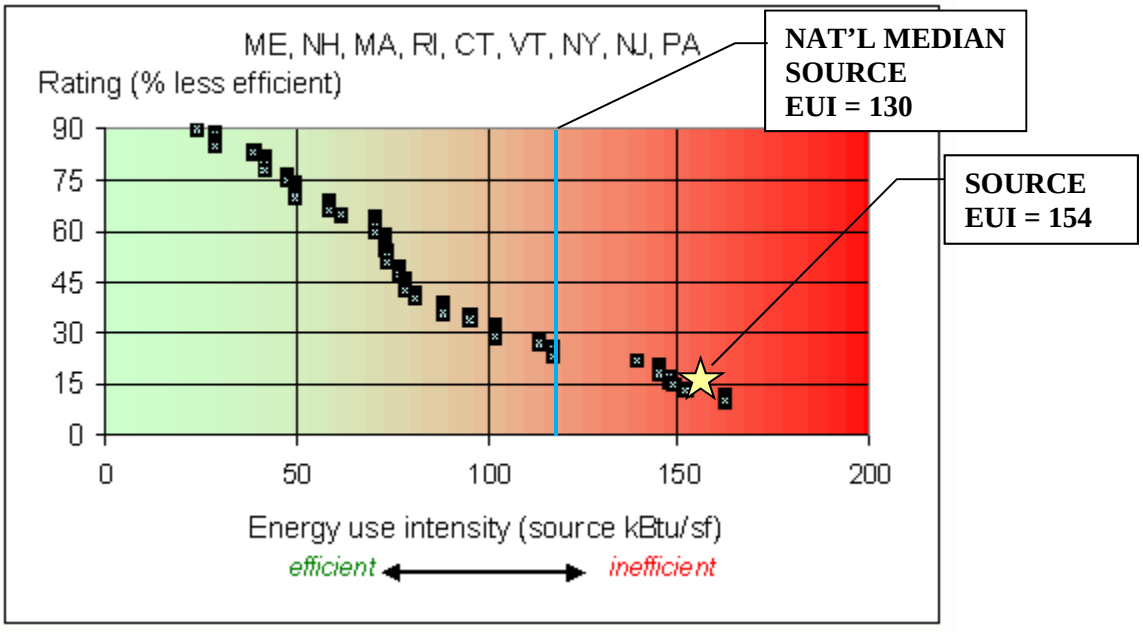
$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

Table 8
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	577,273.0			1,970,810	3.140	6,188,343
FUEL OIL			3,290.0	457,305	1.010	461,878
PROPANE			566.7	51,759	1.010	52,277
TOTAL				2,479,874		6,702,498
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA			43,366	SQUARE FEET		
BUILDING SITE EUI			*57.18*	kBtu/SF/YR		
BUILDING SOURCE EUI			*154.56*	kBtu/SF/YR		

Figure 3 below depicts a national EUI grading for the source use of Elementary Schools.

Figure 4
Source Energy Use Intensity Distributions: Elementary Schools



Based on the above source energy comparison the Estell Manor School is operating inefficiently, compared to buildings of similar type.

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, Concord 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

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 8
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Estell Manor School	32	50

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

V. FACILITY DESCRIPTION

The 43,366 square-foot Estell Manor School is a one story building located at 128 Cape May Avenue, Estell Manor, New Jersey. The building was built in 1955 with three additions one in 1975 that added classrooms and a cafeteria, another in 1995 that added classrooms and the main office, and the more recent in 2004 that added the gymnasium and two classrooms. The school serves students grades kindergarten through 8th. The space types in the facility consist of classrooms, offices, a cafeteria, a gymnasium, restrooms, a library, a boiler room, and utility/storage rooms.

Occupancy Profile

The building is occupied from approximately 6:00 am till 9:00 pm Monday through Friday, with limited occupancy hours on the weekend. However the school is beginning to see increased use through community activities. Students occupy the facility for approximately 10 months out of the year, and the Offices located in the facility are occupied year round. There are approximately 200 students and 40 staff in the building.

Building Envelope

The exterior of the building is masonry brick throughout the building with concrete block interior walls, with insulation ranging from 1 to 2 inches. Windows through the building are double pane glass with aluminum frames. The roof is a flat built up rubber roof with insulation ranging from 2 to 5 inches.

HVAC Systems

The school consists of multiple system types including steam, electric heating, air to air heat pump, and geothermal that were installed during each addition made to the building.

The 1955 wing is conditioned by a steam unit ventilators and radiators located in each classroom. These units are manufactured by Nesbitt and provide limited control. Each classroom and office in this wing also has a window air conditioning unit to provide cooling, each with a rated capacity of 12,000 Btu/hour and an efficiency rating of 9.8 EER or less. Steam is provided by a single oil fired Weil McLain boiler cast iron sectional boiler with an input rating of 1080 MBH and efficiency of 81%. The boiler is fitted with outside air controls to modulate the boiler on and off.

The 1975 wing is conditioned by heating on unit ventilators with electric heating coils. The units have electric coils with an estimated size of 10 to 15 kilowatts. Along with the unit ventilator each classroom has a window air conditioning unit with a rated capacity of 12,000 Btu/hour and an efficiency rating of 9.8 EER.

The 1995 wing is conditioned by air to air heat pump unit ventilators in the classrooms and rooftop heat pump units that serve the main office and a single classroom. The unit ventilators are manufactured by Trane with a cooling capacity of 3.5 tons and an electric backup heating coil of 13.2 kilowatts. These units have a cooling efficiency of 9.5 SEER and a heating

performance of 3.2 COP. The main office and classroom 109 are conditioned by Trane rooftop heat pumps ranging in cooling capacity from 3 to 6.5 tons with electric heating coils from 6 to 18 kilowatts. The units have a cooling efficiency of 9 EER and heating efficiency of 3 COP.

The 2004 wing is conditioned by geothermal heat pump units. The classroom, restrooms, corridors, and gym office are conditioned by three horizontal ceiling units and one vertical unit. These units are manufactured by Florida Heat pump with capacities ranging from 1 ton to 6 tons and cooling efficiencies of 14 EER and above. The heating capacities in these units range from 12,000 to 50,000 Btu/hour with an efficiency of 3.4 COP and above. The gymnasium is conditioned by a single rooftop geothermal unit coupled with a SEMCO energy recovery wheel unit. The rooftop is rated for 20 tons of cooling and 180,000 Btu/hour of heating with efficiencies of 14 EER and 3.4 COP. The SEMCO unit provides pre-conditioned air to the rooftop unit by recovering energy from treated air that is exhausted from the space. Geothermal loop water is circulated via a single pair of constant volume distribution pumps rated at 10 horsepower each with a flow rate of 150 gallons per minute at 125 foot of head pressure.

Exhaust System

General and toilet exhaust air is removed through roof mounted exhaust fans manufactured by Penn Ventilator. These units are switch controlled located in the Building and Grounds Office. Some of the personal bathrooms contain in room exhaust fans that are light switch controlled. The kitchen hood has a single large up blast exhaust fan that is controlled by the disconnect switch. The kitchen hood has no make-up system and the fan only operates when cooking is occurring.

HVAC System Controls

The school consists of two control systems, one being an antiquated pneumatic system with occupied and unoccupied mode based on a Honeywell time-clock panel, and newer Siemens Apogee direct digital control system. The pneumatic system operates the HVAC equipment located in the 1955 and 1975 wings of the building. Each classroom unit ventilator has a pneumatic control valve and room thermostat; however the thermostat provided limited control. The 1995 and 2004 wing HVAC systems are controlled by the Siemens Apogee DDC system. The control system has a graphical user interface that allows global control of the units from a single networked computer. The system has occupied and unoccupied scheduling capability for each wing.

The steam boiler fires based on outside air temperature and modulates based on the steam pressure reading in the system. The boiler will generate steam at 7 PSI and once system pressure reduces to 3 PSI the boiler will fire again until the pressure rises back to 7 PSI.

Domestic Hot Water

Domestic hot water is supplied to the 1955 wing with a single Bock oil-fired hot water heater with a 32 gallon storage tank. The 1975 and 1995 wing is supplied domestic hot water with a Bradford and White Hydrojet electric heater rated at 18 kilowatts and 119 gallons of storage. The 2004 wing is supplied domestic hot from an Addyson water to water geothermal heat pump

coupled with an A.O. Smith 80 gallon storage tank. Each storage tank maintains a domestic water temperature of 120 degrees Fahrenheit.

Kitchen Equipment

The kitchen is equipped with a cooking hood that has propane-fired cooking equipment underneath which includes a Vulcan ten burner combination dual oven, electric warmer, and Blodgett convection oven. There also one propane fired warming station in the food line. The kitchen also has five reach in style commercial refrigerators and freezers. There is a single Hobart Dishwasher door type coupled with an electric booster heater both of these pieces of equipment are no longer in service.

Lighting

A space by space breakdown of the lighting throughout the facility is provided in the **Investment Grade Lighting Appendix**.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – Interior

Description:

The lighting throughout the Estell Manor School is comprised of fluorescent fixtures with standard T8 lamps and electronic ballasts, and some T12 lamps with magnetic ballasts. Fixtures within the building vary from 2 to 4 lamps in most instances and are a mix of recessed and surface mounted style fixtures. There are also many incandescent and compact fluorescent (CFL) medium base style lamps used for general lighting.

This ECM includes fixture retrofits for replacement of CFL lamps and incandescent screw in lamps to equivalent LED fixtures and lamps.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	1.0
Electric Usage Savings (kWh)	3,549
Electric Cost Savings ($)	$550

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,025
NJ Smart Start Equipment Incentive ($):	$200
Net Installation Cost ($):	$825
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$550
Total Yearly Savings ($/Yr):	$550
Estimated ECM Lifetime (Yr):	10
Simple Payback	1.5
Simple Lifetime ROI	566.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,500
Internal Rate of Return (IRR)	66%
Net Present Value (NPV)	$3,866.61

ECM #2: Lighting Upgrade – T8 to LED

Description:

The lighting throughout the Estell Manor School is comprised of fluorescent fixtures with standard T8 lamps and electronic ballasts, and some T12 lamps with magnetic ballasts. Fixtures within the building vary from 2 to 4 lamps in most instances and are a mix of recessed and surface mounted style fixtures.

This ECM recommends replacing the existing fluorescent fixtures with new LED 1x4, 2x4, and 2x2 style recessed and or surface mounted fixtures through the hallways, offices, classrooms, and restrooms. Currently this measure recommends a one for one replacement strategy in each space; however the school should consult a professional engineer to perform light level calculations in each space as part of the replacement strategy. This may result in a reduction in fixture quantities that could further increase energy savings.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix** that outlines the proposed retrofits, costs, savings, and payback periods. Maintenance savings for this ECM have been estimated based on the cost to replace lamps and ballasts over time on an annual basis compared to the LED fixtures. Note when selecting LED fixtures they must be Design Lights Consortium (DLC) qualified in order to receive a NJ Smart Start incentive.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	12.0
Electric Usage Savings (kWh)	25,860
Electric Cost Savings ($)	$4,008

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$128,000
NJ Smart Start Equipment Incentive ($):	$24,750
Net Installation Cost ($):	$103,250
Maintenance Savings ($/Yr):	$1,000
Energy Savings ($/Yr):	$4,008
Total Yearly Savings ($/Yr):	$5,008
Estimated ECM Lifetime (Yr):	10
Simple Payback	20.6
Simple Lifetime ROI	-51.5%
Simple Lifetime Maintenance Savings	$10,000
Simple Lifetime Savings	$50,080
Internal Rate of Return (IRR)	-11%
Net Present Value (NPV)	($60,530.74)

ECM #3: Lighting Upgrade – Exterior Lighting

Description:

The exterior lighting at the Estell Manor School is currently lit by various high pressure sodium and metal halide fixtures. The exterior would be better served with more efficient LED lighting system. Concord Engineering recommends upgrading the lighting to an energy-efficient LED lighting system that includes LED lamps for the existing high pressure sodium and metal halide fixtures on the exterior.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	2.0
Electric Usage Savings (kWh)	8,982
Electric Cost Savings ($)	$1,392

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,000
NJ Smart Start Equipment Incentive ($):	$1,975
Net Installation Cost ($):	$8,025
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,392
Total Yearly Savings ($/Yr):	$1,392
Estimated ECM Lifetime (Yr):	10
Simple Payback	5.8
Simple Lifetime ROI	73.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$13,920
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	$3,849.04

ECM #4: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Estell Manor 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.

This ECM includes installation of ceiling or switch mount sensors for classrooms, restrooms, hallways, and offices. 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:

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

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

LIGHTING CONTROLS SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	0.0
Electric Usage Savings (kWh)	10,546
Electric Cost Savings ($)	$2,386

Rebates and Incentives:

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

Smart Start Incentive
$= (\#\ \text{Wall mount sensors} \times \$20\ \text{per sensor})$
$+ (\#\ \text{Ceiling mount sensors} \times \$35\ \text{per sensor})$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$18,000
NJ Smart Start Equipment Incentive ($):	$135
Net Installation Cost ($):	$17,865
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,386
Total Yearly Savings ($/Yr):	$2,386
Estimated ECM Lifetime (Yr):	10
Simple Payback	7.5
Simple Lifetime ROI	33.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$23,860
Internal Rate of Return (IRR)	6%
Net Present Value (NPV)	$2,488.06

ECM #5: Refrigerator Replacement

Description:

There are residential style refrigerators located in the Conference Room, Nurses Office, and Building and Grounds Office. These units are older models that are not nearly as energy efficient as one manufactured today.

The proposed replacements are one-for-one with a unit of similar size and dimensions that has the most up-to-date Energy Star Rating. The models selected are manufactured by Frigidaire.

Energy Savings Calculations:

ENERGY STAR REFRIGERATOR CALCULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity	3	3	
Manufacturer	Summit	Frigidaire	
Type	Single Door	Single Door	
Model	Varies	FFPH44M4LB	
Size (Cu-Ft)	4; 6	4.4	
Per Unit Electric Usage (kWh)	422	289	133
Electric Rate ($/kWh)	$0.155	$0.155	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	1,266	867	399
Energy Cost ($)	$196	$134	$62
COMMENTS:	Calculations based Energy Star Website http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator		

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$780
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$780
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$62
Total Yearly Savings ($/Yr):	$62
Estimated ECM Lifetime (Yr):	10
Simple Payback	12.6
Simple Lifetime ROI	-20.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$620
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	($251.13)

ECM #6: CRT Monitor Replacement

Description:

The Estell Manor School still utilizes CRT Monitors for use by its students. Typical CRT monitors throughout the building consist of 15 inch displays. These computer monitors are outdated and have several disadvantages such as; significantly higher energy consumption in operating and idle mode, use a large amount of desk space, poor picture quality, distortions and flickering image, secular glare problems, and high weight, and electromagnetic emissions. Many of the drawbacks are difficult to quantify except for the energy use. CRT monitors use considerably more energy than an alternative flat panel LCD/LED monitor. Replacement of the existing CRT monitors with LCD/LED monitors saves considerable energy as well as provides other ergonomic benefits as well.

This ECM will replace all remaining three (3) existing CRT monitors with new 17" Dell LCD/LED. It is expected District IT Staff will purchase and install new monitors, therefore no labor costs were taken into account for this measure.

Energy Savings Calculations:

Savings calculations were based on operating occupied hours per week of operating staff and students, and estimated idle time of monitors per week outside occupied hours. Power consumption data is based on actual monitor characteristics for a Dell CRT, and Dell LCD/LED.

$$\text{Energy Savings} = \text{Quantity} \times \text{Operating Hours} \times P_o \times + \text{Quantity} \times \text{Idle Hours} \times P_I$$

Qty = Quantity

Op Hrs = Operating Hours per Year

Idle Hrs = Idle Hours per Year

P_O = Operating Power Consumption Watts

P_I = Idle Power Consumption Watts

CRT MONITOR REPLACEMENT CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	15" CRT	17" LCD	
# of Monitors	3	3	
Power Cons. (W)	71	18	53
Idle Power Cons. (W)	5	0.5	4.5
Operating Hrs per Week	33	33	
Operating Weeks per Yr	41	41	
Idle Hrs per Week	136	136	
Idle Weeks per Yr	41	41	
Elec Cost ($/kWh)	0.155	0.155	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	0.213	0.054	0.159
Electric Usage (kWh)	367	80	287
Energy Cost ($)	$57	$12	$44
COMMENTS:	Savings Based on Dell 15: CRT Monitor Compared with Dell 17" LCD/LED		

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$375
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$375
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$44
Total Yearly Savings ($/Yr):	$44
Estimated ECM Lifetime (Yr):	10
Simple Payback	8.5
Simple Lifetime ROI	17.3%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$440
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$0.33

ECM #7: Computer Power Management

Description:

The School currently has approximately 70 desktop computers throughout the classrooms, offices, and computer labs. Currently these computers are on all day during the week and shut down on weekends, during summer recess, and on long holidays. While the current operating procedure has its merits, by implementing a management program with power management and maintenance management while the buildings are unoccupied as well as designating on periods for software upgrades, and wake on LAN capability to boot computers up prior to student arrival significant energy savings could be achieved.

This ECM recommends installing a computer maintenance management program with a power management option to turn computer on and off without the need for manual shutdowns by staff. The system being considered should be equivalent to a Dell KACE K1000. This will not only save the School on energy costs, but also benefit IT maintenance.

Energy Savings Calculations:

Savings calculations were based on existing operating conditions observed in the field, in addition to the quantity, make, and model of desktop. Idle and off power information was obtained from Energy Star's version 5.0 Program Requirements for Computers.

$$\text{Energy Usage} = \text{Idle Power Watts} \times \text{On Hours} + \text{Off Power Watts} \times \text{Off Hours}$$

COMPUTER POWER MANAGEMENT CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Estell Manor School	Estell Manor School	
Quantity of Desktops	70	70	
Idle Power Cons. (W)	80	80	
Off Power Cons. (W)	2	2	
Normal Operating ON Hours	4,032	2,160	
Holiday Operating ON Hours	96	0	
Summer Operating ON Hours	0	0	
Normal Operating OFF Hours	2,033	3,905	
Holiday Operating OFF Hours	544	640	
Summer Operating OFF Hours	2,055	2,055	
Elec Cost ($/kWh)	0.155	0.155	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	23,764	13,020	10,744
Energy Cost ($)	$3,683	$2,018	$1,665
COMMENTS:	Idle and Off Power Draws based on Energy Star Rating for Desktop Computers		

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$10,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,665
Total Yearly Savings ($/Yr):	$1,665
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.0
Simple Lifetime ROI	149.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$24,975
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$9,876.66

ECM #8: De-stratification Fans

Description:

The Gymnasium at the Estell Manor School is heated and cooled through a single geothermal rooftop unit coupled with a heat recovery unit. In rooms with high ceilings typically stratification of heated air occurs, resulting in air at ceiling level being warmer than the floor. Since temperature at the floor level dictates the comfort of occupants and is typically the location of the thermostat controlling the system, this results in additional operating hours to satisfy space conditions.

This ECM would install two Airius Model A25 de-stratification fans in the gymnasium to be suspended from the ceiling, with all require electrical wiring and supports. These fans should only operate during heating season to help maintain a higher floor temperature and reduce cycling time.

Energy Savings Calculations:

The calculations are based on the manufacturer's percent savings utilizing the height of the ceiling and associated temperature differential between floor and ceiling. The temperature differential in this case was estimated at 12.6 degrees Fahrenheit.

$$\text{Heating Energy (kBtu)} = 80\%\ \text{Oversize Factor} \times \text{Space Heating Capacity} \times \text{HDD} \times$$

$$\text{Adj. Factor} \times 24\,\frac{\text{hr}}{\text{day}} \times \frac{1}{\text{Design } \Delta\text{T}} \times \frac{1}{\text{Efficiency}}$$

$$\text{Savings (kBtu)} = \text{Heating Energy} \times \text{Percent Savings}$$

$$\text{Fan Power Penalty (kWh)} = \text{Fan Power (W)} \times \text{Winter Operating Hours} \times \frac{1\ \text{kWh}}{1{,}000\ \text{W}}$$

DESTRATIFICATION FAN ANALYSIS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description	Existing Gym Conditions	Proposed Gym w/ Fans	
Space Heating Type	Geothermal	Geothermal	
Space Heating Capacity (MBH)	180	180	
Heating Efficiency (COP)	3.4	3.4	
Heating Degree Days (65 F)	4025	4025	
Degree Day Adjustment Factor	0.55	0.55	
Space Ceiling Height (ft)	25	25	
Ceiling-Floor ΔT (^{o}F)	13	13	
Percent Energy Savings	-	22%	
Destrat Fan Power (kWh)	-	134	
Heating Energy (kBtu)	43,273	33,753	
Electric Rate ($/kWh)	$0.155	$0.155	
Fuel Oil #2 ($/Gallon)	$3.070	$3.070	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	12,683	10,026	2,656
Energy Cost ($)	$1,966	$1,554	$412
COMMENTS:	Ceiling-Floor Temperature Differential Based on 0.5 F per Foot		

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$5,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$412
Total Yearly Savings ($/Yr):	$412
Estimated ECM Lifetime (Yr):	15
Simple Payback	12.1
Simple Lifetime ROI	23.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$6,180
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	($81.57)

ECM #9: High Efficiency Transformers

Description:

Electrical distribution transformers play a key role in delivering electrical power to buildings as all the electrical power supplied to the building flows through them. Whether equipment is plugged in and turned on or not transformers continue to operate. Consider their impact on electricity consumption. Some transformers waste as much as 20% of billed electricity.

Older transformers in existing buildings may not have been built to meet the load requirements of today. Over the years electrical distribution has changed very little, however the connected equipment has changed dramatically. This dramatic change is derived from both the type of equipment (mostly electronic in nature) and the density of installed equipment. The impact of this change has had a direct impact on power quality and transformer efficiency.

When newer electronic equipment is introduced into buildings with older electrical systems power quality and transformer efficiency can suffer. According to a Department of Energy study performed in 1996 electronic equipment can increase losses by as much as 2.7 times. In real terms this would mean that a transformer that has a name- plate efficiency of 97% in reality is operating closer to 90% or lower. The difference represents additional costs to operate the transformer. Replacing your older transformers with Power smiths energy efficient E-Saver-C3 or T1000-C3 transformers can improve the reliability of your electronic equipment and significantly reduce electricity waste.

Power smith's energy efficient transformers have substantially lower losses (higher efficiency) than other transformers. These energy savings mean less kilowatt-hours (kWh) consumed and lower energy bills. Electricity demand charges also decline, thanks to reduced energy losses. These savings pay for the transformer many times over its installed life.

The Estell Manor School has two GE 45 kVA, one GE 30 kVA, and one Sylvania 75 kVA rated dry type transformers located in electrical rooms. The GE transformers are nearly 10 years old and the Sylvania appears to be over 20 years old. This ECM would replace all four transformers with new Power Smith energy efficient units.

Energy Savings Calculations:

See **Appendix** for Manufacturers Transformer Calculation Spreadsheet.

TRANSFORMER SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	2.8
Electric Usage Savings (kWh)	14,312
Electric Cost Savings ($)	$2,218

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$26,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$26,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,218
Total Yearly Savings ($/Yr):	$2,218
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.7
Simple Lifetime ROI	28.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$33,270
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$478.34

ECM #10 – Fuel Conversion to Natural Gas

Description:

The Estell Manor School currently does not have natural gas service to the building. The gas company is currently investigating the potential for extension of natural gas utility services on Cape May Avenue. In the event gas utility service becomes available it is recommended the school convert to natural gas. While the conversion of existing equipment over to natural gas may not save energy, it will reduce energy costs.

This ECM would require extension of utility services to the building when gas is available on the street. (Note typically the utility company may cover the cost to bring gas from the street to the building depending on the length of pipe.) The school will need to switch the existing steam boiler over to natural gas from oil, and should convert the existing propane fired kitchen equipment over to natural gas fired equipment. This will require new gas distribution pipe to be installed from the utility meter to each converted appliance.

Energy Savings Calculations:

$$\text{Fuel Usage (kbtu)} = \text{Fuel Usage (Units)} \times \text{Fuel Conversion Factor } \left(\frac{\text{Btu}}{\text{Unit}}\right)$$

$$\text{Natural Gas Usage (therm)} = \text{Fuel Usage (kBtu)} \times \frac{1 \text{ therm}}{100 \text{ kBtu}}$$

FUEL CONVERSION ANALYSIS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description	Fuel Oil & Propane	Natural Gas Conversion	
Existing Fuel Oil Usage (Gallons)	3,290	0	
Existing Propane Usage (Gallons)	567	0	
Fuel Oil Conversion (Btu/Gal)	139,000	139,000	
Propane Conversion (Btu/Gal)	91,600	91,600	
Natural Gas (Btu/therm)	100,000	100,000	
Fuel Usage (kBtu)	509,220	509,220	
Fuel Oil #2 ($/Gallon)	$3.070	$3.070	
Propane ($/gal)	$3.790	$3.790	
Natural Gas ($/therm)	$1.000	$1.000	
ENERGY SAVINGS CALCULATIONS			
Fuel Oil #2 Usage (Gallons)	3,290	0	3,290
Propane Usage (Gallons)	567	0	567
Natural Gas Usage (Therm)	0	5,092	(5,092)
Energy Cost ($)	$12,248	$5,092	$7,156
COMMENTS:			

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$9,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$9,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$7,156
Total Yearly Savings ($/Yr):	$7,156
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.3
Simple Lifetime ROI	1092.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$107,340
Internal Rate of Return (IRR)	79%
Net Present Value (NPV)	$76,427.86

ECM #11 – Electric to Hot Water Heat

Description:

The 1975 wing has heating only unit ventilators with electric heating coils. There are a total of seven (7) unit ventilators in classrooms (#5, 6, 7, 8) and the cafeteria. While electric heating is efficient in terms of energy units converted to usable heat it is much more costly to operate on a $ per Btu of usable heat. By converting these units to hot water and utilizing the existing steam boiler and a new steam to hot water heat exchanger the units would be must more cost effective to operate compared to the electric.

This ECM would involve using the existing steam boiler and installing a heat exchanger to generate heating hot water from the steam. New unit ventilators would need to be installed with hot water heating coils along with all necessary controls and supply & return piping from the boiler room to each unit.

Energy Savings Calculations:

Heating Energy Usage

$$= \text{Capacity} \times 80\% \text{ Oversize Factor} \times \text{HDD (65F)}$$
$$\times \text{Adjustment Factor } (0.55) \times 24 \frac{\text{Hours}}{\text{day}} \times \frac{1}{\text{Design } \Delta T} \times \frac{1}{\text{Fuel Conversion}}$$
$$\times \frac{1}{\text{Efficiency}}$$

Pump Energy Penalty:

Estimated Pump Power required: ½ HP

Hours of Operation: 4,368

Pump Electric Usage (kWh): 1,379

ELECTRIC TO HOT WATER HEAT CONVERSION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Description	Unit Ventilator Electric Heat	Unit Ventilator Hot Water Heat	
Quantity of Units	7	7	
Electric Heat Element Size (kW)	12	-	
Hot Water Coil Size (MBH)	-	40	
Heating Degree Days (65 F)	4025	4025	
Degree Day Adjustment Factor	0.55	0.55	
System Efficiency	100%	81%	
Fuel Conversion (Btu/Unit)	3,412	139,000	
Electric Rate ($/kWh)	$0.155	$0.155	
Fuel Oil #2 ($/Gallon)	$3.070	$3.070	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	68,660	1,379	67,282
Fuel Oil #2 Usage (Gallons)	0	2,033	(2,033)
Energy Cost ($)	$10,642	$6,454	$4,188
COMMENTS:	Based on Converting 1975 Addition Electric Heat only UV's less Classroom #10 with the HP		

Note: If the District is able to convert to Natural Gas the adjusted Savings are as follows:
Natural Gas: 2,826 Therms (Additional Usage)
Energy Cost Savings: $7,603 (with Cost of Natural Gas at $1 / therm)

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$190,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$190,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$4,188
Total Yearly Savings ($/Yr):	$4,188
Estimated ECM Lifetime (Yr):	20
Simple Payback	45.4
Simple Lifetime ROI	-55.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$83,760
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($127,693.14)

ECM #12: Heat Pump Rooftop Units

Description:

The 1995 section three rooftop heat pump units are at the end of their useful life expectancy. In the installation of new rooftop units would not only yield energy savings based on one for one efficiency increases, but also reduce the demand on maintenance personnel compared to the existing equipment.

This ECM would replace the existing three (3) rooftop units with new heat pump roof top units with backup electric heat and economizer controls. The Trane WSC series were the basis of design for this ECM. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM.

Energy Savings Calculations:

Heating Usage

$$\text{Usage (kBtu)} = \text{Capacity} \times 0.8 \times 24 \text{ hrs} \times \text{HDD} \times \frac{1}{(65-15)\text{F}}$$

$$\text{Fuel Usage} = \text{Usage (kBtu)} \times \frac{1}{\text{Sys \% Eff}} \times \text{Fuel Conversion Factor}$$

$$\text{Heat Pump Usage (kWh)} = \text{Capacity} \left(\frac{\text{Btu}}{\text{h}}\right) \times 0.8 \times 24 \text{ hrs} \times \text{HDD} \times \frac{1}{(65-15)\text{F}} \times \frac{1}{COP} \times \frac{1}{3412}$$

HDD for Heat Pump Usage is calculation based on operation between 40 to 65 degrees Fahrenheit. Heating operation below 40 degrees Fahrenheit is performed by electric backup. Heating Degree Days were adjusted for use type.

Cooling Usage

$$Usage\ (kWh) = \frac{Capacity\ (\frac{Btu}{h})}{1000} \times EFLH \times \frac{1}{EER}$$

RHP-1

ROOFTOP HEATPUMP REPLACEMENT			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Unit Cooling Capacity (Btu/h)	75,000	75,000	
Unit Electric Heating Capacity (kW)	18.0	18.0	
HEATING SAVINGS CALCULATION			
Unit Capacity (Btu/h)	71,000	71,000	
Coefficient of Performance (COP)	3.00	3.50	
Heating Degree Days (65 F)	2,560	2,560	
Percent HDD less than 40 F	17%	17%	
Percent HDD between 40 F to 65 F	83%	83%	
Heating Stage 1 [Heat Pump] (kWh)	5,548	4,755	
Heating Stage 2 [Electric Backup] (kWh)	2,953	2,953	
Electric Usage (kWh)	8,501	7,708	793
COOLING SAVINGS CALCULATION			
Cooling Efficiency (EER)	9	11.4	
Cooling Equivalent Full Load Hours	1,131	1,131	
Electric Usage (kWh)	9,425	7,441	1,984
Electric Cost ($/kWh)	$0.1550	$0.1550	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	5.58	4.41	1.18
Electric Usage (kWh)	17,926	15,149	2,777
Energy Cost ($)	$2,778	$2,348	$430
COMMENTS:	HP Operation Above 40F for Heating, Below 40 F for Backup Electric Heat. HDD Adjusted for Use Type		

RHP-2

ROOFTOP HEATPUMP REPLACEMENT			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Unit Cooling Capacity (Btu/h)	36,000	36,000	
Unit Electric Heating Capacity (kW)	6.0	6.0	
HEATING SAVINGS CALCULATION			
Unit Capacity (Btu/h)	36,000	36,000	
Coefficient of Performance (COP)	3.00	3.40	
Heating Degree Days (65 F)	2,560	2,560	
Percent HDD less than 40 F	17%	17%	
Percent HDD between 40 F to 65 F	83%	83%	
Heating Stage 1 [Heat Pump] (kWh)	2,813	2,482	
Heating Stage 2 [Electric Backup] (kWh)	984	984	
Electric Usage (kWh)	3,797	3,466	331
COOLING SAVINGS CALCULATION			
Cooling Efficiency (EER)	9	11	
Cooling Equivalent Full Load Hours	1,131	1,131	
Electric Usage (kWh)	4,524	3,701	823
Electric Cost ($/kWh)	$0.1550	$0.1550	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	2.68	2.19	0.49
Electric Usage (kWh)	8,321	7,168	1,153
Energy Cost ($)	$1,290	$1,111	$179
COMMENTS:	HP Operation Above 40F for Heating, Below 40 F for Backup Electric Heat. HDD Adjusted for Use Type		

RHP-3

ROOFTOP HEATPUMP REPLACEMENT			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Unit Cooling Capacity (Btu/h)	60,000	60,000	
Unit Electric Heating Capacity (kW)	12.0	12.0	
HEATING SAVINGS CALCULATION			
Unit Capacity (Btu/h)	58,000	58,000	
Coefficient of Performance (COP)	3.00	3.50	
Heating Degree Days (65 F)	2,560	2,560	
Percent HDD less than 40 F	17%	17%	
Percent HDD between 40 F to 65 F	83%	83%	
Heating Stage 1 [Heat Pump] (kWh)	4,532	3,884	
Heating Stage 2 [Electric Backup] (kWh)	1,969	1,969	
Electric Usage (kWh)	6,501	5,853	647
COOLING SAVINGS CALCULATION			
Cooling Efficiency (EER)	9	12.4	
Cooling Equivalent Full Load Hours	1,131	1,131	
Electric Usage (kWh)	7,540	5,473	2,067
Electric Cost ($/kWh)	$0.1550	$0.1550	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	4.47	3.24	1.22
Electric Usage (kWh)	14,041	11,326	2,715
Energy Cost ($)	$2,176	$1,755	$421
COMMENTS:	HP Operation Above 40F for Heating, Below 40 F for Backup Electric Heat. HDD Adjusted for Use Type		

Energy Savings Summary:

ECM #12 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$68,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$68,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,030
Total Yearly Savings ($/Yr):	$1,030
Estimated ECM Lifetime (Yr):	15
Simple Payback	66.0
Simple Lifetime ROI	-77.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$15,450
Internal Rate of Return (IRR)	-15%
Net Present Value (NPV)	($55,704.17)

ECM #13: Heat Pump RTU to Natural Gas

Description:

The 1995 section three rooftop heat pump units are at the end of their useful life expectancy. By converting these units to natural gas the school will realize energy and cost savings. The school will also see improved heating performance of the Gas rooftop units during lower temperatures.

This ECM would replace the existing three (3) rooftop units with new gas-fired roof top units with DX cooling and economizer controls. The Trane YHC series were the basis of design for this ECM. It is recommended to fully evaluate the capacity needed for all new systems prior to moving forward with this ECM. This ECM is also predicated on natural gas being available to the building.

Energy Savings Calculations:

Heating Usage

$$\text{Usage (kBtu)} = \text{Capacity} \times 0.8 \times 24 \text{ hrs} \times \text{HDD} \times \frac{1}{(65-15)\text{F}}$$

$$\text{Fuel Usage} = \text{Usage (kBtu)} \times \frac{1}{\text{Sys \% Eff}} \times \text{Fuel Conversion Factor}$$

$$\text{Heat Pump Usage (kWh)} = \text{Capacity}\left(\frac{\text{Btu}}{\text{h}}\right) \times 0.8 \times 24 \text{ hrs} \times \text{HDD} \times \frac{1}{(65-15)\text{F}} \times \frac{1}{COP} \times \frac{1}{3412}$$

HDD for Heat Pump Usage is calculation based on operation between 40 to 65 degrees Fahrenheit. Heating operation below 40 degrees Fahrenheit is performed by electric backup. Heating Degree Days were adjusted for use type.

Cooling Usage

$$Usage\ (kWh) = \frac{Capacity\left(\frac{Btu}{h}\right)}{1000} \times EFLH \times \frac{1}{EER}$$

RHP-1

CONVERT ROOFTOP HEAT PUMP TO GAS UNIT			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Unit Cooling Capacity (Btu/h)	75,000	75,000	
Unit Electric Heating Capacity (kW)	18.0	0.0	
HEATING SAVINGS CALCULATION			
Unit Capacity (Btu/h)	71,000	150,000	
Coefficient of Performance (COP)	3.00	-	
Heating Degree Days (65 F)	2,560	2,560	
Percent HDD less than 40 F	17%	17%	
Percent HDD between 40 F to 65 F	83%	83%	
Heating Stage 1 [Heat Pump] (kWh)	5,548	-	
Heating Stage 2 [Electric Backup] (kWh)	2,953	-	
Electric Usage (kWh)	8,501	-	
COOLING SAVINGS CALCULATION			
Cooling Efficiency (EER)	9	12.6	
Cooling Equivalent Full Load Hours	1,131	1,131	
Electric Usage (kWh)	9,425	6,732	2,693
Electric Cost ($/kWh)	$0.1550	$0.1550	
Natural Gas Cost ($/therm)	$1.0000	$1.0000	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	5.58	3.99	1.60
Electric Usage (kWh)	17,926	6,732	11,194
Natural Gas Usage (themr)	0	1,130	-1,130
Energy Cost ($)	$2,778	$2,173	$605
COMMENTS:	HP Operation Above 40F for Heating, Below 40 F for Backup Electric Heat. HDD Adjusted for Use Type. Savings calculated based on equivalent capacity		

RHP-2

CONVERT ROOFTOP HEAT PUMP TO GAS UNIT			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Unit Cooling Capacity (Btu/h)	36,000	36,000	
Unit Electric Heating Capacity (kW)	6.0	0.0	
HEATING SAVINGS CALCULATION			
Unit Capacity (Btu/h)	36,000	120,000	
Coefficient of Performance (COP)	3.00	-	
Heating Degree Days (65 F)	2,560	2,560	
Percent HDD less than 40 F	17%	17%	
Percent HDD between 40 F to 65 F	83%	83%	
Heating Stage 1 [Heat Pump] (kWh)	2,813	-	
Heating Stage 2 [Electric Backup] (kWh)	984	-	
Electric Usage (kWh)	3,797	-	
COOLING SAVINGS CALCULATION			
Cooling Efficiency (EER)	9	12.7	
Cooling Equivalent Full Load Hours	1,131	1,131	
Electric Usage (kWh)	4,524	3,206	1,318
Electric Cost ($/kWh)	$0.1550	$0.1550	
Natural Gas Cost ($/therm)	$1.0000	$1.0000	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	2.68	1.90	0.78
Electric Usage (kWh)	8,321	3,206	5,115
Natural Gas Usage (themr)	0	542	-542
Energy Cost ($)	$1,290	$1,039	$251
COMMENTS:	HP Operation Above 40F for Heating, Below 40 F for Backup Electric Heat. HDD Adjusted for Use Type. Savings calculated based on equivalent capacity		

RHP-3

CONVERT ROOFTOP HEAT PUMP TO GAS UNIT			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Unit Cooling Capacity (Btu/h)	60,000	60,000	
Unit Electric Heating Capacity (kW)	12.0	0.0	
HEATING SAVINGS CALCULATION			
Unit Capacity (Btu/h)	58,000	130,000	
Coefficient of Performance (COP)	3.00	-	
Heating Degree Days (65 F)	2,560	2,560	
Percent HDD less than 40 F	17%	17%	
Percent HDD between 40 F to 65 F	83%	83%	
Heating Stage 1 [Heat Pump] (kWh)	4,532	-	
Heating Stage 2 [Electric Backup] (kWh)	1,969	-	
Electric Usage (kWh)	6,501	-	
COOLING SAVINGS CALCULATION			
Cooling Efficiency (EER)	9	12.85	
Cooling Equivalent Full Load Hours	1,131	1,131	
Electric Usage (kWh)	7,540	5,281	2,259
Electric Cost ($/kWh)	$0.1550	$0.1550	
Natural Gas Cost ($/therm)	$1.0000	$1.0000	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	4.47	3.13	1.34
Electric Usage (kWh)	14,041	5,281	8,760
Natural Gas Usage (themr)	0	881	-881
Energy Cost ($)	$2,176	$1,700	$477
COMMENTS:	HP Operation Above 40F for Heating, Below 40 F for Backup Electric Heat. HDD Adjusted for Use Type. Savings calculated based on equivalent capacity		

Energy Savings Summary:

ECM #13 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$75,000
NJ Smart Start Equipment Incentive ($):	$1,174
Net Installation Cost ($):	$73,826
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,332
Total Yearly Savings ($/Yr):	$1,332
Estimated ECM Lifetime (Yr):	15
Simple Payback	55.4
Simple Lifetime ROI	-72.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$19,980
Internal Rate of Return (IRR)	-13%
Net Present Value (NPV)	($57,924.67)

ECM #14 – Air to Air Heat Pump to Geothermal

Description:

The 1995 wing currently has heat pump unit ventilators that condition the five classrooms. The units are currently air to air heat pumps with 3.5 tons of cooling and 13 kilowatt electric back up heating coils. When the 2004 addition was constructed additional piping from the geothermal system was run down the main corridor for the future potential to feed these units. While the distribution piping is present the well field would need to be expanded to meet the capacity requirements of the added equipment.

This ECM would install new Daikin-McQuay geothermal unit ventilator style units in place of the existing heat pump unit ventilators. The condenser water piping would need to be extended from the hallway to the units in the classrooms. New geothermal wells will need to be added to the existing well field to supply enough capacity.

Energy Savings Calculations:

Heating Usage

$$\text{Usage (kBtu)} = \text{Capacity} \times 0.8 \times 24\ \text{hrs} \times \text{HDD} \times \frac{1}{(65-15)\text{F}}$$

$$\text{Fuel Usage} = \text{Usage (kBtu)} \times \frac{1}{\text{Sys \% Eff}} \times \text{Fuel Conversion Factor}$$

$$\text{Heat Pump Usage (kWh)} = \text{Capacity}\left(\frac{\text{Btu}}{\text{h}}\right) \times 0.8 \times 24\ \text{hrs} \times \text{HDD} \times \frac{1}{(65-15)\text{F}} \times \frac{1}{COP} \times \frac{1}{3412}$$

HDD for Heat Pump Usage is calculation based on operation between 40 to 65 degrees Fahrenheit. Heating operation below 40 degrees Fahrenheit is performed by electric backup. Heating Degree Days were adjusted for use type.

Cooling Usage

$$Usage\ (kWh) = \frac{Capacity\left(\frac{Btu}{h}\right)}{1000} \times EFLH \times \frac{1}{EER}$$

CONVERT AIR TO AIR HEAT PUMP TO GEOTHERMAL			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	5	5	
Unit Cooling Capacity (Btu/h)	42,000	42,000	
Unit Electric Heating Capacity (kW)	13.3	13.3	
HEATING SAVINGS CALCULATION			
Unit Capacity (Btu/h)	44,000	44,000	
Coefficient of Performance (COP)	2.80	3.36	
Heating Degree Days (65 F)	2,560	2,560	
Percent HDD less than 40 F	17%	-	
Percent HDD between 40 F to 65 F	83%	-	
Heating Stage 1 [Heat Pump] (kWh)	18,418	18,496	
Heating Stage 2 [Electric Backup] (kWh)	10,910		
Electric Usage (kWh)	29,328	18,496	10,831
COOLING SAVINGS CALCULATION			
Cooling Efficiency (EER)	8.2	16.7	
Cooling Equivalent Full Load Hours	1,131	1,131	
Electric Usage (kWh)	28,965	14,222	14,742
Electric Cost ($/kWh)	$0.1550	$0.1550	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	17.16	8.43	8.73
Electric Usage (kWh)	58,292	32,719	25,574
Energy Cost ($)	$9,035	$5,071	$3,964
COMMENTS:	HP Operation Above 40F for Heating, Below 40 F for Backup Electric Heat. HDD Adjusted for Use Type		

Energy Savings Summary:

ECM #14 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$203,000
NJ Smart Start Equipment Incentive ($):	$8,100
Net Installation Cost ($):	$194,900
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,964
Total Yearly Savings ($/Yr):	$3,964
Estimated ECM Lifetime (Yr):	20
Simple Payback	49.2
Simple Lifetime ROI	-59.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$79,280
Internal Rate of Return (IRR)	-
Net Present Value (NPV)	($135,925.69)

ECM #15: Kitchen Equipment Gas Conversion

Description:

The school is equipped with propane fired cooking equipment. In the kitchen are a ten burner range combination oven, and one half rack convection oven. By converting over to Energy Star Rated propane fired cooking equipment significant energy and cost savings could be realized.

This ECM would replace the existing equipment with new propane fired Energy Star rated kitchen equipment. This measure also recommends downsizing the range oven combination unit from a 10 burner to a smaller 6 burner unit as based on the bills appears to be oversized. It is recommended the school consult with a kitchen consultant prior to purchasing equipment to assist in specifying the most efficiency kitchen.

Energy Savings Calculations:

Energy savings were calculated based on NJ BPU Protocols to Measure Resource Savings with adjustments made based on operating assumptions for a school kitchen.

Fryer, Griddle, & Ovens Equation:

$$\text{Energy Usage} = \frac{\text{Days}}{\text{Year}} \times \left[\frac{\text{Energy}}{\text{Food}}\frac{\text{Btu}}{\text{lb}} \times \frac{1}{\text{Efficiency}} + \text{Idle Energy Rate}\left(\frac{\text{Btu}}{\text{hr}}\right) \times \left(\frac{\text{Hours}}{\text{day}} - \frac{\text{Production}}{\text{Capacity}}\right)\right] \times \frac{1}{\text{Fuel Conversion}}$$

Combination Oven & Range:

$$\text{Energy Usage} = \text{Qty of Units} \times \frac{\text{Days}}{\text{Year}} \times \left[(\text{Op. Hrs} - \text{Idle Hrs}) \times \text{Qty Burners} \times \text{Energy Rate} \times \text{Burner Use Rate \%} + \text{Idle Hours} \times \text{Qty Pilots} \times \text{Idle Energy Rate} + (\text{Op. Hrs} - \text{Idle Hrs}) \times \text{Oven Qty} \times \text{Energy Rate} \times \frac{1}{\text{Efficiency}}\right] \times \frac{1}{\text{Fuel Conversion}}$$

COMBINATION RANGE EQUIPMENT ANALYSIS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Operating Days per Year	180	180	
Operating Hours per Day	1	1	
Idle Operating Hours per Day	0	0	
Quantity of Burners	10	6	
Burner Energy Rate (Btu/h)	30,000.0	28,000.0	
Burner Idle Energy Rate (Btu/h)	600.0	560.0	
Underneath Oven Quantity	2.0	1.0	
Oven Energy Rate (Btu/h)	29,000.0	35,000.0	
Fuel Source	Propane	Propane	
Fuel Conversion Factor	91,600	91,600	
Burner Use Rate	20%	33%	
Oven Heavy Load Efficiency	35%	44%	
Propane Cost ($/gallon)	$3.790	$3.790	
ENERGY SAVINGS CALCULATIONS			
Propane Usage (Gallons)	444	265	178
Energy Cost ($)	$1,681	$1,005	$676
COMMENTS:	2% Pilot Light Energy Consumption, 1 Pilot Light per 2 Burners		

OVEN EQUIPMENT ANALYSIS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Units	1	1	
Type of Oven	Convection	Convection	
Operating Days per Year	180	180	
Operating Hours per Day	1	1	
Average Production per Day (lbs)	80	80	
Production Capacity (lb/hr)	70.0	70.0	
Fuel Source	Propane	Propane	
Fuel Conversion Factor	91,600	91,600	
Heavy Load Efficiency	30%	44%	
Idle Energy Rate (Btu/hr)	18,000.0	13,000.0	
Propane Cost ($/gallon)	$3.790	$3.790	
ENERGY SAVINGS CALCULATIONS			
Propane Usage (Gallons)	131	89	42
Energy Cost ($)	$495	$338	$158
COMMENTS:			

Total Propane Savings: 220 gallons
Total Cost Savings: $833

Energy Savings Summary:

ECM #15 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$14,500
NJ Smart Start Equipment Incentive ($):	$500
Net Installation Cost ($):	$14,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$833
Total Yearly Savings ($/Yr):	$833
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.8
Simple Lifetime ROI	-10.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$12,495
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($4,055.70)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. Concord Engineering 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 $191 per MWH. This equates to $0.191 per kWh generated.

CEG has reviewed the existing roof, ground, and parking lot area potential of the facility being audited for the purposes of determining a potential for a photovoltaic system. The facility was evaluated for the most economical and feasible areas for the installation of a solar array, which included a roof mounted array. In lieu of a roof mount array the district could consider ground mount as an alternative option, it would require an area approximately 130'x100' for an equivalent system and additional tree clearing around the system to reduce shading. The ground array was not fully vetted as fields currently occupy most of the cleared land space known to be owned by the district, however the district should consider either option if they wish to pursue solar. A depiction of the area utilized at the facility is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Note this analysis did not include a structural evaluation to determine if the roof could accommodate the additional loading, which would be required to be performed prior to implementation. The total KWH production for the system is 115,836 kWh annually, reducing the overall utility bill for the school by approximately 20% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sharp Model ND-240QCJ panel. This panel has a "DC" rated full load output of 240 watts, and has a total panel conversion efficiency of 14.4%. Although panels rated at higher wattages are available through Sharp 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, ground area, or parking canopy style system area available at the 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**.

The proposed solar array for the 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 the 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 for the facility is as follows:

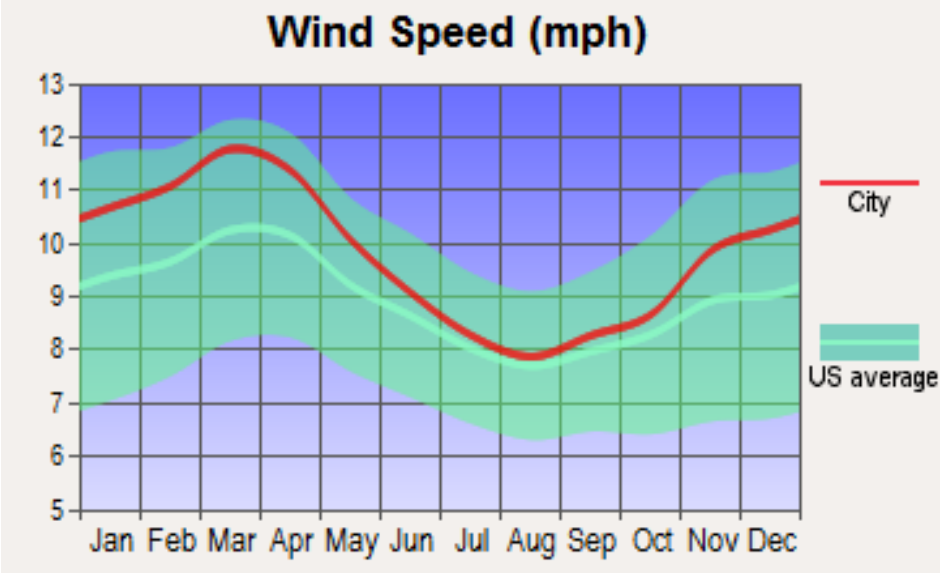
REM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$425,787
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$425,787
Maintenance Savings ($/Yr):	$22,134
Energy Savings ($/Yr):	$17,955
Total Yearly Savings ($/Yr):	$40,089
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.6
Simple Lifetime ROI	41.2%
Simple Lifetime Maintenance Savings	$332,010
Simple Lifetime Savings	$601,335
Internal Rate of Return (IRR)	4.7%
Net Present Value (NPV)	$52,792.88

Concord Engineering recommends the District review all options available for installation of solar PV systems at their facility 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 Array to the District at a reduced rate compared to their existing electric rate. It should be noted that current SREC pricing has significantly impacted the PPA market for public entities in addition to the end of the 30% grant in lieu of the investment tax credit. These recent market changes have made it more difficult for public entities to secure low cost power purchase price options.

Wind Generation

In addition to evaluating solar, Concord also conducted a review of the applicability of wind energy for the District. Wind energy production is another option available as a clean renewable energy generating source. 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 generated. Concord investigated the potential for smaller building mountable wind turbines, and horizontal turbines to maximize the available free space. In order to be economically viable a site requires a minimum average wind speed of 6 meters per second (13.5 mph). Based on the obtained wind data shown in **Figure 4** for Newark the annual average wind speed is 9.75 mph with a peak of 11.8 mph, making this area unattractive for wind development. Therefore, wind energy is not a viable option to implement.

Figure 4: Monthly Wind Speed
(Estell Manor, New Jersey)



IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The electricity usage profile demonstrates winter season dominated consumption load profile. The average summer (May-September) consumption is 36,798 kWh per month which is less than the average winter (October-April) consumption of 56,183 kWh per month. The historical usage profile is favorable as typically summer commodity rates are higher due to increased demand on the grid, while winter months see reduced grid demand. This profile is due to the reliance on electric heat throughout much of the facility.

Natural Gas:

The facility currently does not receive natural gas.

Fuel Oil:

The fuel oil profile demonstrates winter season dominated consumption load profile. Deliveries for oil occur regularly throughout the winter months, with little to no deliveries in the summer. The existing oil tank is approximately 500 gallons.

Propane:

The propane profile demonstrates a fairly constant load throughout the year except for July and August. The propane is currently used strictly for cooking needs at the school. The average consumption outside of July and August is 56 gallons per month.

Tariff Analysis:

Electricity:

The facility receives electrical service from Atlantic City Electric (ACE) on rate schedules MGS (Monthly General Service). The facility has contracted a Third Party Supplier (TPS) to provide electric commodity service. First Energy has been contracted however; the contract particulars such as product structure, price, term and conditions were not available for review or comments.

For electric supply (generation) service, the client has a choice to either use ACE's default service rate BGS or contract with a Third Party Supplier (TPS) to supply electricity.

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 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. ACE's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge (kWh and Demand), Societal Benefits Charge (SBC), and Securitization Transition Charge.

Fuel Oil & Propane:

Fuel Oil and Propane pricing contract particulars were not provided, however it appears the facility is on a day of delivery price schedule.

Electric Commodities Market Overview:

Current electricity market pricing has remained relatively stable over the last couple of years. Commodity pricing in 2008 marked historical highs in electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2013, 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 electricity supply requirements.

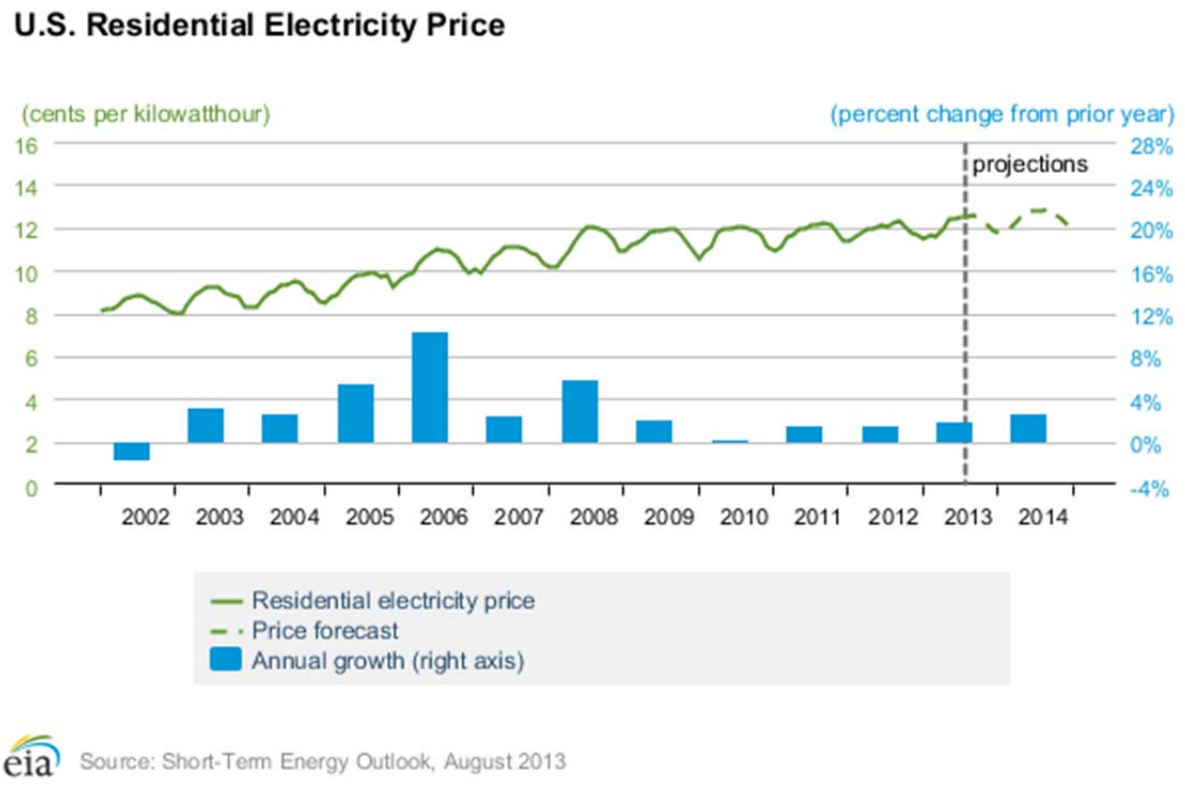
It is important to note that electric commodity market prices are moved by supply and demand, political conditions, market technicals and trader sentiment. This market is continuously changing. Energy commodity pricing is also correlated to weather forecasts. Because weather forecasts are dependable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

Short Term Energy Outlook - US Energy Information Administration (August 6, 2013):

Electricity

The Northeastern United States experienced a strong heat wave during mid-July. In response, many customers ran their air conditioners more than usual. EIA estimates the average residential customer in New England will use about 1.0 percent more electricity during the summer of 2013 (June-August) compared with last summer, while customers in the Middle Atlantic states are expected to use about 0.5 percent less electricity. In addition to increased electricity demand, the heat wave also caused temporary spikes in wholesale power prices. State retail rate regulations shield many residential customers from price swings in the wholesale power market, but EIA expects summer electricity prices in the Northeast to average about 2.7 percent higher than summer 2012, primarily as a result of higher fuel costs paid by generators.

Generation fuel costs and wholesale electricity prices have increased this year after a considerable decline in 2012. During the first half of 2013, EIA estimates the price of natural gas delivered to electric generators averaged $4.46 per MMBtu, 44 percent higher than the same period last year. Changes in the costs of providing electricity are not immediately reflected on retail customer bills because state regulatory commissions must approve rate changes in many areas of the country. EIA expects the residential retail price of electricity in 2013 will average 12.1 cents per kilowatthour, about 1.9 percent higher than the price last year.



The below recommendations presented by Concord Engineering are based on current information provided by the District for their facility's historical energy usage. Any 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 TPS electricity and natural gas supply contracts and historical billings be performed prior to performing any of the presented recommendations.

Recommendations:

1. Concord recommends the District continue its aggregation approach for 3rd party commodity supply procurement strategies for the purchase of electricity.

2. After review of the utility consumption report and current commodity pricing outlook, Concord recommends that the District utilize the advisement of a 3rd party unbiased Energy Consulting Firm licensed by the State of New Jersey Board of Public Utilities that is experienced in the procurement of commodities, New Jersey procurement laws, aggregation of facilities and energy supply risk and commodity management. This firm should be able to provide full service advisement over the term of the contract, provide market watch opportunities and identify any additional opportunities that may 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 utility and market historical prices and trends
   - Awareness of seasonal opportunities (e.g. shoulder months)
   - Negotiation of fair contractual terms
   - An aggressive, market based price

3. Concord recommends that the District review their current situation regarding third party purchasing for their facility. The District should review their current contract particulars and future pricing to formulate a strategy to optimize cost savings.

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

5. Concord recommends the District get in contact with their Atlantic City Electric Account Representative to discuss the potential of switching the main school account (#0219 4119 9990) rate structure over from Monthly General Service to Annual General Service. Given the fairly constant facility load and demand over 100 kilowatts, by switching to Annual Service could see a reduction in costs on their delivery portion of the bill. This will require the school to contact Atlantic City Electric and discussion changing from their current rate classification to a new one, along with the potential cost savings. The following are estimated savings based on Concords review of the delivery costs associated with each rate structure and using the schools previous years usage applied to the most recent published rate tariff.

UTILITY TARIFF CHANGE ANALYSIS			
UTILITY	**RATE SCHEDULE**	**EFFECTIVE DATE**	**ANNUAL RATE COST**
ACE	Monthly General Service - Secondary	Jan-14	$45,653
ACE	Annual General Service - Secondary	Jan-14	$32,235
	Tariff Change Annual Savings:		**$13,418**
Notes:	Rate Costs do not include cost of Electric Supply through 3rd party.		

X. INSTALLATION FUNDING OPTIONS

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

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.

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.

XI. ADDITIONAL RECOMMENDATIONS

In addition to the ECMs and REMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit, many of which facility's staff are already performing. Maintenance items and small operational improvements are typically achievable with on-site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building

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

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

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

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

F. Perform annual steam trap surveys to minimize energy waste caused by failed traps, and to maintain an inventory of system equipment.

G. Verify all HVAC control systems are utilizing setback and scheduling capabilities.

H. The School should consider the installation of advanced power strips in classrooms that can be used to power/charge computer, printers, monitors, speakers, tablets, and laptop computers in order to reduce the amount of idle power draw from these devices. (Smart Power Strips Model LPG3, Price ~$30)

I. Educate staff and students on awareness of wasteful energy practices such as leaving lights on unnecessarily, leaving on of non-essential computer and/or equipment at the end of the day, leaving of outside doors/windows open as a means to control room temperature, etc.

XII. ENERGY AUDIT ASSUMPTIONS

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

A. Cost Estimates noted within this report are based on industry accepted costing data such as RS Means™ Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
    a. operating hours
    b. equipment type
    c. control strategies
    d. scheduling
D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.
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.
H. Greenhouse Gas Emissions are calculated for each ECM, the basis for these emissions reductions are NJCEP published standard emissions factors, which are the following:.
    a. Electric Savings:
        1. CO_2: 1.52 lbs/kWh
        2. NO_X: 0.0028 lbs/kWh
        3. SO_2: 0.0065 lbs/kWh
    b. Natural Gas Savings:
        1. CO_2: 11.7 lbs/therm
        2. NO_X: 0.0092 lbs/therm

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Estell Manor 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 Upgrade - Interior	$625	$400	$200	$825	$550	$0	$550	15	$8,250	$0	900.0%	1.5	66.64%	$5,740.86
ECM #2	Lighting Upgrade - T8 to LED	$96,000	$32,000	$24,750	$103,250	$4,008	$1,000	$5,008	15	$75,120	$15,000	-27.2%	20.6	-3.74%	($43,464.82)
ECM #3	Lighting Upgrade - Exterior	$7,000	$3,000	$1,975	$8,025	$1,392	$0	$1,392	15	$20,880	$0	160.2%	5.8	15.29%	$8,592.61
ECM #4	Lighting Controls	$14,600	$3,400	$135	$17,865	$2,386	$0	$2,386	15	$35,790	$0	100.3%	7.5	10.28%	$10,618.91
ECM #5	Refrigerator Replacement	$780	$0	$0	$780	$62	$0	$62	15	$930	$0	19.2%	12.6	2.28%	($39.85)
ECM #6	CRT Monitor Replacement	$375	$0	$0	$375	$44	$0	$44	15	$660	$0	76.0%	8.5	8.07%	$150.27
ECM #7	Computer Power Optimization	$6,500	$3,500	$0	$10,000	$1,665	$0	$1,665	15	$24,975	$0	149.8%	6.0	14.45%	$9,876.66
ECM #8	De-stratification Fans	$3,000	$2,000	$0	$5,000	$412	$0	$412	15	$6,180	$0	23.6%	12.1	2.77%	($81.57)
ECM #9	High Efficiency XFMR	$18,000	$8,000	$0	$26,000	$2,218	$0	$2,218	15	$33,270	$0	28.0%	11.7	3.25%	$478.34
ECM #10	Fuel Conversion to Natural Gas	$3,500	$5,500	$0	$9,000	$7,156	$0	$7,156	15	$107,340	$0	1092.7%	1.3	79.50%	$76,427.86
ECM #11	Electric to HW Conversion	$110,000	$80,000	$0	$190,000	$4,188	$0	$4,188	20	$83,760	$0	-55.9%	45.4	-6.79%	($127,693.14)
ECM #12	Rooftop HP Replacement	$35,000	$33,000	$0	$68,000	$1,030	$0	$1,030	15	$15,450	$0	-77.3%	66.0	-14.58%	($55,704.17)
ECM #13	Rooftop HP to Natural Gas	$40,000	$35,000	$1,174	$73,826	$1,332	$0	$1,332	15	$19,980	$0	-72.9%	55.4	-13%	($57,924.67)
ECM #14	Air to Air HP to Geothermal	$98,000	$105,000	$8,100	$194,900	$3,964	$0	$3,964	20	$79,280	$0	-59.3%	49.2	-	($135,925.69)
ECM #15	Energy Star Kitchen Equipment	$9,500	$5,000	$500	$14,000	$833	$0	$833	15	$12,495	$0	-10.8%	16.8	-1.39%	($4,055.70)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	95 kW Solar Array	$255,472	$170,315	$0	$425,787	$17,955	$22,134	$40,089	15	$601,335	$332,010	41.2%	10.6	4.66%	$52,792.88

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* .

APPENDIX B

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 from July 1, 2013 to June 30, 2014:

Electric Chillers

Water-Cooled Chillers	$16 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	$185 - $450 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 - $92 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
A/C Economizing Controls	≤ 5 tons $85/unit; >5 tons $170/unit

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Gas Fired Boilers < 300 MBH	$2.00 per MBH, but not less than $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	$400 per unit, AFUE ≥ 95%
Boiler Economizing Controls	$1,200 - $2,700
Low Intensity Infrared Heating	$300 - $500 per unit

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps ≥ 20 hp	$60 per VFD rated hp
Rotary Screw Air Compressors ≥ 25 hp	$5,250 to $12,500 per drive
Cooling Towers ≥ 10 hp	$60 per VFD rated hp
Boiler Fans ≥ 5 HP	$65 to $155 per hp
Boiler Feed Water Pumps ≥ 5 HP	$60 to $155 per hp
Commercial Kitchen Hood up to 50 HP	Retrofit $55 – $300 per hp New Hood $55 - $250 per hp

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	$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

T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
For retrofit of T-8 fixtures by permanent de-lamping & new reflectors (Electronic ballast replacement required)	$15 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $200 per fixture
Metal Halide w/Pulse Start Including Parking Lot (For fixtures ≥ 150w)	$25 per fixture
HID ≥ 100w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	$70 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture

Prescriptive Lighting - LED

LED Display Case Lighting	$30 per display case
LED Shelf-Mtd. Display & Task Lights	$15 per linear foot
LED Portable Desk Lamp	$20 per fixture
LED Wall-wash Lights	$30 per fixture
LED Recessed Down Lights	$35 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$50 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	$150 per fixture
LED High-Bay-Aisle Lighting	$150 per fixture
LED Stairwell and Passageway Luminaires	$40 per fixture
LED Bollard Fixtures	$50 per fixture
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4)	$50 per fixture
LED Fuel Pump Canopy	$100 per fixture
LED Screw-based & Pin-based (PAR, MR, BR, R) Standards (A-Style) and Decorative Lamps	$10 per lamp for R/PAR20,MR/PAR16,Globe,Candelabra or Misc $20 per lamp for R/BR/PAR 30, R/BR/PAR 38-40, A-Lamp
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$30 per 4 foot $42 per 5 foot $65 per 6 foot
LED Retrofit Kits	To be evaluated through the customer measure path

Lighting Controls – Occupancy Sensors

Wall Mounted (Existing Facilities Only)	$20 per control
Remote Mounted (Existing Facilities Only)	$35 per control
Daylight Dimming Controls	$45 per fixture controlled
Occupancy Based hi-low Dimming Control	$35 per fixture controlled
Occupancy Sensor Remote Mounted	$35 per control

Refrigeration Doors/Covers

Energy-Efficient Doors/Covers for Installation on Open Refrigerated Cases	$100 per door
Aluminum Night Curtains for Installation on Open Refrigerated Cases	$3.50 per linear foot

Refrigeration Controls

Door Heater Controls	$50 per control
Electric Defrost Controls	$50 per control
Evaporator Fan Controls	$75 per control
Novelty Cooler Shutoff	$50 per control

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 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 an IRR of at least 10%.

APPENDIX C

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Estell Manor School

Primary Property Function: K-12 School
Gross Floor Area (ft²): 43,366
Built: 1955

For Year Ending: December 31, 2013
Date Generated: February 25, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Estell Manor School 128 Cape May Avenue Estell Manor, New Jersey 08319	_____ , (____)____-_____	Rosa Millar 128 Cape May Avenue Estell Manor, NJ 08319 6094762267 rmillar@estellmanorschool.com

Property ID: 3958034

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
55.8 kBtu/ft²

Source EUI
153 kBtu/ft²

Annual Energy by Fuel	
Propane (kBtu)	40,358 (2%)
Fuel Oil (No. 2) (kBtu)	414,000 (17%)
Electric - Grid (kBtu)	1,967,314 (81%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	47.5
National Median Source EUI (kBtu/ft²)	130.3
% Diff from National Median Source EUI	17%
Annual Emissions	
Greenhouse Gas Emissions (MtCO2e/year)	282

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp
(if applicable)

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

Estell Manor School

Window A/C

Tag	WAC	WAC	
Unit Type	Window A/C	Window A/C	
Qty	11	1	
Location	Classrooms (1955, 1975)	Speech Office	
Area Served	Classrooms	Speech Office	
Manufacturer	Thermal Zone	Amana	
Model #	WAC412230R	-	
Serial #	-	-	
Refrigerant	R410a	R22	
Cooling Capacity (Btu/h)	12,300	12,000.0	
Cooling Efficiency (EER)	9.8 EER	8.5 EER (Est.)	
Volts / Phase / Hz	208-230/1/60	-	
Approx Age	-	-	
ASHRAE Service Life	10	10	
Remaining Life	-	-	
Comments		Older Unit	

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Estell Manor School

AHUs

Tag	ERU-1	RTU-1	RHP-1
Unit Type	Energy Recovery Rooftop	Geothermal Rooftop	Rooftop Heat Pump
Qty	1	1	1
Location	Gym Roof	Gym Roof	1995 Roof
Area Served	Gymnasium RTU	Gymnasium	Main Office Area
Manufacturer	Semco	FHP	Trane
Model #	FV5000-6RN4AB	PGY240K04A	WCD075C400BB
Serial #	32918/MO19912-01	31971701001	J331424180
Cooling Type	None	Geothermal	Heat Pump
Cooling Capacity (Tons)	N/A	20.0	6.5
Cooling Efficiency (EER)	N/A	14.00	9.00
Heating Type	None	Geothermal	Electric
Heating Input (MBH)	N/A	180	18 kW
Heating Efficiency (%)	N/A	3.4 COP	3 COP
Supply Fan (HP)	5.00	5.00	1.00
Approx Age	9	9	15
ASHRAE Service Life	15	15	15
Remaining Life	6	6	0
Comments	5 HP EF, 1/6 HP Wheel Motor		

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

AHUs

Tag	RHP-2	RHP-3	HP-4
Unit Type	Rooftop Heat Pump	Rooftop Heat Pump	Geothermal HP
Qty	1	1	1
Location	1995 Roof	1995 Roof	Mech Room
Area Served	Classroom 109	Classroom 110	Gym Office, Rear Exit
Manufacturer	Trane	Trane	FHP
Model #	WCD036C4	WCD060C400BB	GT042-4VTC
Serial #	-	J391424220	KK046590
Cooling Type	Heat Pump	Heat Pump	Heat Pump
Cooling Capacity (Tons)	3.0	5.0	3.5
Cooling Efficiency (EER)	9.00	9.00	16.60
Heating Type	Electric	Electric	Geothermal
Heating Input (MBH)	6 kW	12 kW	42
Heating Efficiency (%)	3 COP	3 COP	3.7 COP
Supply Fan (HP)	0.33	0.60	0.50
Approx Age	15	15	9
ASHRAE Service Life	15	15	20
Remaining Life	0	0	11
Comments			

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

AHUs

Tag	UV-1 (AC-7)	UV	UV-2 (AC-3A)
Unit Type	Unit Ventilator	Unit Ventilator	Unit Ventilator
Qty		5	6
Location	Classroom 10	Classroom (1955)	Classroom (1995)
Area Served	Classroom 10	Classroom (1955)	Classroom (1995)
Manufacturer	Trane	Nesbitt	Trane
Model #	THPA03040C01B.WC 0A150	-	THPA04041C01B1CC 0AA00
Serial #	W94L23857	-	W94L24045
Cooling Type	Heat Pump	None	Heat Pump
Cooling Capacity (Tons)	2.5	N/A	3.5
Cooling Efficiency (EER)	10 SEER	N/A	9.5 SEER
Heating Type	Electric	Steam	Electric
Heating Input (MBH)	10 kW	-	13.2 kW
Heating Efficiency (%)	2.8 COP	-	3.2 COP
Supply Fan (HP)	-	-	0.25
Approx Age	19	20	19
ASHRAE Service Life	20	20	20
Remaining Life	1	0	1
Comments			

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

AHUs

Tag	HP-1	HP-2	HP-3
Unit Type	Geothermal Heat Pump	Geothermal Heat Pump	Geothermal Heat Pump
Qty	1	1	1
Location	Corridor Ceiling	Corridor Ceiling	Corridor Ceiling
Area Served	Corridor, Classroom 132	Lobby, Classroom 133	Corridor, Restrooms (2004)
Manufacturer	FHP	FHP	FHP
Model #	GT070	GT048	GT018
Serial #	-	-	-
Cooling Type	Geothermal	Geothermal	Geothermal
Cooling Capacity (Tons)	6.0	3.5	1
Cooling Efficiency (EER)	14.20	15.80	18.3
Heating Type	Geothermal	Geothermal	Geothermal
Heating Input (MBH)	50	35	12
Heating Efficiency (%)	3.4 COP	3.5 COP	3.7 COP
Supply Fan (HP)	0.75	0.50	0.25
Approx Age	9	9	9
ASHRAE Service Life	20	20	15
Remaining Life	11	11	6
Comments			

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

AHUs

Tag	UV
Unit Type	Unit Ventilator
Qty	
Location	Classroom (1975)
Area Served	Classroom (1975)
Manufacturer	-
Model #	-
Serial #	-
Cooling Type	None
Cooling Capacity (Tons)	N/A
Cooling Efficiency (EER)	N/A
Heating Type	Electric
Heating Input (MBH)	10 - 15 kW (Est)
Heating Efficiency (%)	100%
Supply Fan (HP)	0.17
Approx Age	20
ASHRAE Service Life	20
Remaining Life	0
Comments	

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Estell Manor School

Domestic Water Heaters

Tag	WWH-1	HWH-1	HWH-2
Unit Type	Geo Water to Water	Electric Boiler	Fuel Fired Heater
Qty	1	1	1
Location	Mech Room	Storage room	Boiler Room
Area Served	DHW Addition 2004	1975, 1995 Addition	1955 wing
Manufacturer	Addison	Bradford & White	Bock
Model #	WWH-060	MII120-18-3SF-042	32E
Serial #	-	HK-01-3405	12121558T
Size (Gallons)	80	119	32
Input Capacity (MBH/KW)	60 MBH	18 kW	104 MBH
Recovery (Gal/Hr)	150	-	114
Efficiency %	5.0 COP	100%	82%
Fuel	Electric (Geo)	Electric	Fuel Oil #2
Approx Age	9	2	2
ASHRAE Service Life	15	15	15
Remaining Life	6	13	13
Comments	w/ 80 Gallon A.O. Smith Storage Tank		0.75 GPH

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Estell Manor School

Boilers

Tag	B-1		
Unit Type	Oil Fired Boiler		
Qty	1		
Location	Boiler Room		
Area Served	1955, 1975 Addition		
Manufacturer	Weil McLain		
Model #	880		
Serial #	-		
Input Capacity (Btu/Hr)	1,082,000		
Rated Output Capacity (Btu/Hr)	872,000		
Approx. Efficiency %	81%		
Fuel	Fuel Oil #2		
Approx Age	3		
ASHRAE Service Life	35		
Remaining Life	32		
Comments	7.5 GPH		

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Estell Manor School

Pumps

Tag	P-1, 2	DWP-1,2	
Unit Type	End Suction Pump	Booster Skid	
Qty	2	2	
Location	Mech Room	Boiler Room	
Area Served	Addition 2004	Domestic Circulation Pump	
Manufacturer	B&G	Delta P Systems	
Model #	1510 BF 10.500	DDPVM-VFD-LL	
Serial #	CR4514-01-A40	-	
Horse Power	10.0	0.5	
Flow	150 GPM, 125' HD	50 GPM, 64' HD	
Motor Info	Westinghouse, US Motor, 215T	Baldor, Fr 56C	
Electrical Power	230/460V	230/460V	
RPM	1755	3450	
Motor Efficiency %	90.2% , 87.5%	68.0%	
Approx Age	9	2	
ASHRAE Service Life	18	18	18
Remaining Life	9	16	18
Comments			

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Estell Manor School

Exhaust Fans

Tag	EF-1	EF-9&10	EF-7&8
Unit Type	Downblast	Downblast	Downblast
Qty	1	2	2
Location	Gym Roof	1995 Roof	1995 Roof
Area Served	2004 Restrooms		
Manufacturer	Greenheck	Penn Ventilation	Penn Ventilation
Model #	GB-091-4	DX14B	DXAQ-10
Serial #	04A04448	-	-
Motor (HP)	-	-	-
Electrical (V/H/P)	-	-	-
Approx Age	9	14	14
ASHRAE Service Life	20	20	20
Remaining Life	11	6	6
Comments		Off	Off

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

Exhaust Fans

Tag	EF-3	EF-1	EF-4
Unit Type	Downblast	Downblast	Downblast
Qty	2	1	1
Location	1995 Roof	1995 Roof	1995 Roof
Area Served			
Manufacturer	Penn Ventilation	Penn Ventilation	Penn Ventilation
Model #	DXAQ-10	DX9B	XR94
Serial #	-	-	-
Motor (HP)	-	-	-
Electrical (V/H/P)	-	-	-
Approx Age	14	14	14
ASHRAE Service Life	20	20	20
Remaining Life	6	6	6
Comments	On	Off	Off

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

Exhaust Fans

Tag	EF-5	EF-2	EF-6
Unit Type	Downblast	Downblast	Downblast
Qty	1	1	1
Location	1995 Roof	1995 Roof	1995 Roof
Area Served			
Manufacturer	Penn Ventilation	Penn Ventilation	Penn Ventilation
Model #	FX13B	XQ94	DX12B
Serial #	-	-	-
Motor (HP)	-	-	1/4
Electrical (V/H/P)	-	-	115/60/1
Approx Age	14	14	14
ASHRAE Service Life	20	20	20
Remaining Life	6	6	6
Comments	Off		

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

Exhaust Fans

Tag	EF-12	EF-13	EF-14
Unit Type	Downblast	Downblast	Downblast
Qty	1	1	1
Location	1995 Roof	1995 Roof	1995 Roof
Area Served			
Manufacturer	Penn Ventilation	Penn Barry	Penn Ventilation
Model #	DXAQ10	DX12B	DXAQ10
Serial #	-	C12EZ60916	-
Motor (HP)	-	1/4	-
Electrical (V/H/P)	-	115/60/1	-
Approx Age	14	9	14
ASHRAE Service Life	20	20	20
Remaining Life	6	11	6
Comments			

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

Exhaust Fans

Tag	KEF-1	EF
Unit Type	Upblast	Downblast
Qty	1	8
Location	1975 Roof	1975 Roof
Area Served	Kitchen Hood	
Manufacturer	-	-
Model #	-	-
Serial #	-	-
Motor (HP)	-	-
Electrical (V/H/P)	-	-
Approx Age	-	-
ASHRAE Service Life	20	20
Remaining Life		
Comments		

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

APPENDIX E

ECM #1 - Interior
ECM #3 - Exterior
ECM #4 - Controls

CEG Project #: 1C13529 (ECM#1)
Facility Name: Estell Manor School
Address: 128 Cape May Avenue
City, State, Zip Estell Manor, NJ 08319

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
1	Main Office	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	11	0.69	1,802	Existing to Remain	No Change	4	63	0	0.69	1,802	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
1	Super/Principal Office	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	8	0.50	1,310	Existing to Remain	No Change	4	63	0	0.50	1,310	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	262	$41	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	$20.00	1.97
1	107 Conference Room	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	6	0.38	983	Existing to Remain	No Change	4	63	0	0.38	983	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	197	$30	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	$20.00	2.63
2	Bathroom - Main Office	3000	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	1	0.06	186	Existing to Remain	No Change	2	62	0	0.06	186	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	$6	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	17.34
1	Business Admin Office	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	8	0.50	1,310	Existing to Remain	No Change	4	63	0	0.50	1,310	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	262	$41	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	$20.00	1.97
3	Kitchenette Main Office	2600	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	1	0.06	161	Existing to Remain	No Change	2	62	0	0.06	161	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
4	IT Closet	1500	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	93	Existing to Remain	No Change	2	62	0	0.06	93	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
5	121 - Buildings & Grounds Office	2600	1x4 2-Lamp 32w T8 Pendant Prismatic	2	62	3	0.19	484	Existing to Remain	No Change	2	62	0	0.19	484	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	97	$15	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	$20.00	5.34
5	124 - Electric Room	1500	1x4 2-Lamp 32w T8 Pendant Prismatic	2	62	2	0.12	186	Existing to Remain	No Change	2	62	0	0.12	186	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	37	$6	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	43.36
6	Classroom #2 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Existing to Remain	No Change	2	62	0	0.74	1,637	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	327	$51	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	6.90
1	Boy's Restroom (1955)	3000	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	1	0.06	189	Existing to Remain	No Change	4	63	0	0.06	189	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	38	$6	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	42.67
7		2000	2x4 2-Lamp 32w T8 Recessed Paracube	2	62	2	0.12	248	Existing to Remain	No Change	2	62	0	0.12	248	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	50	$8	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	0.00
1	Girl's Restroom (1955)	3000	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	1	0.06	189	Existing to Remain	No Change	4	63	0	0.06	189	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	38	$6	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	42.67
7		3000	2x4 2-Lamp 32w T8 Recessed Paracube	2	62	2	0.12	372	Existing to Remain	No Change	2	62	0	0.12	372	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	74	$12	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	0.00
6	Classroom #1 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Existing to Remain	No Change	2	62	0	0.74	1,637	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	327	$51	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	6.90
6	Kindergarten (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Existing to Remain	No Change	2	62	0	0.74	1,637	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	327	$51	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	6.90
8		2200	4' 1-Lamp 32w T8 Surface Strip	1	32	1	0.03	70	Existing to Remain	No Change	1	32	0	0.03	70	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	14	$2	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	160.37
6	CST Office (1955)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	2	0.12	322	Existing to Remain	No Change	2	62	0	0.12	322	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	64	$10	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	25.01
6	Speech Office (1955)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	2	0.12	322	Existing to Remain	No Change	2	62	0	0.12	322	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	64	$10	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	25.01
9	Speech Office Toilet	1200	60w Incandescent A-Lamp	1	60	1	0.06	72	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	15	0.05	57	$9	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	3	$0	$27.00	$16.25	$43.25	$20.00	2.63	$50.00	$50.00	$100.00	FALSE	215.05
6	Child Study Office (1955)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	4	0.25	645	Existing to Remain	No Change	2	62	0	0.25	645	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	129	$20	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	$35.00	10.76
10		2600	40w Incandescent A-Lamp	1	40	2	0.08	208	Re-Lamp	Phillips A19 8w LED Lamp	1	8	2	0.02	42	0.06	166	$26	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	8	$1	$36.00	$32.50	$68.50	$40.00	1.10	$0.00	$0.00	$0.00	FALSE	0.00
6	Classroom #3 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Existing to Remain	No Change	2	62	0	0.74	1,637	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	327	$51	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	6.90
6	Classroom #4 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Existing to Remain	No Change	2	62	0	0.74	1,637	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	327	$51	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	6.90
6	Classroom #8 (Library)	2000	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	20	1.24	2,480	Existing to Remain	No Change	2	62	0	1.24	2,480	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	496	$77	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	4.55
6	Classroom #5 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	18	1.12	2,455	Existing to Remain	No Change	2	62	0	1.12	2,455	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	491	$76	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	4.60
6	Classroom #6 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	18	1.12	2,455	Existing to Remain	No Change	2	62	0	1.12	2,455	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	491	$76	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	4.60
11	Storage Room (1975)	1500	1x4 2-Lamp 32w T8 Surface No Lens Tube Guard	2	62	8	0.50	744	Existing to Remain	No Change	2	62	0	0.50	744	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	149	$23	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	10.84
6	Cafeteria (1975)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	55	3.41	8,866	Existing to Remain	No Change	2	62	0	3.41	8,866	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	4	20.0%	1,773	$275	$0.00	$0.00	$0.00	$0.00	-	$1,200.00	$200.00	$1,400.00	FALSE	5.09

ECM #1 - Interior
ECM #3 - Exterior
ECM #4 - Controls

EXISTING FIXTURES									PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
12	Kitchen (1975)	2200	1x4 2-Lamp 32w T8 Surface Opaque Lens	2	62	12	0.74	1,637	Existing to Remain	No Change	2	62	0	0.74	1,637	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
13		1200	1x4 2-Lamp 32w T8 Surface Vaportight	2	62	2	0.12	149	Existing to Remain	No Change	2	62	0	0.12	149	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
6		2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	136	Existing to Remain	No Change	2	62	0	0.06	136	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
12	Dishwasher Room	2200	1x4 2-Lamp 32w T8 Surface Opaque Lens	2	62	2	0.12	273	Existing to Remain	No Change	2	62	0	0.12	273	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
6	Kitchen Storage	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	136	Existing to Remain	No Change	2	62	0	0.06	136	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
6	Classroom #7 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	18	1.12	2,455	Existing to Remain	No Change	2	62	0	1.12	2,455	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	491	$76	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	4.60
6	Classroom #10 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	13	0.81	1,773	Existing to Remain	No Change	2	62	0	0.81	1,773	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	355	$55	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	6.37
14	Classroom #10 Toilet #1	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
14	Classroom #10 Toilet #2	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
6	#11 Faculty Lounge	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	9	0.56	1,228	Existing to Remain	No Change	2	62	0	0.56	1,228	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	246	$38	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	9.20
14	#11 Faculty Toilet #1	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
14	#11 Faculty Toilet #2	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
15	102 Nurse's Office	2600	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	9	0.84	2,176	Existing to Remain	No Change	3	93	0	0.84	2,176	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	435	$67	$0.00	$0.00	$0.00	$0.00	-	$600.00	$100.00	$700.00	FALSE	10.38
2	Nurse's Toilet	1200	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	1	0.06	74	Existing to Remain	No Change	2	62	0	0.06	74	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	15	$2	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	43.36
15	Nurse Storage Closet	1500	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	1	0.09	140	Existing to Remain	No Change	3	93	0	0.09	140	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	28	$4	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	23.12
3	Classroom #109 (1995)	2200	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	12	0.74	1,637	Existing to Remain	No Change	2	62	0	0.74	1,637	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	327	$51	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	6.90
6	Custodian Closet (1995)	1500	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	93	Existing to Remain	No Change	2	62	0	0.06	93	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	19	$3	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	34.69
16	Boy's Restroom (1995)	3000	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	216	Existing to Remain	No Change	2	72	0	0.07	216	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	43	$7	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	37.34
3		3000	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	3	0.19	558	Existing to Remain	No Change	2	62	0	0.19	558	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	112	$17	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	0.00
16	Girl's Restroom (1995)	3000	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	216	Existing to Remain	No Change	2	72	0	0.07	216	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	43	$7	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	37.34
3		3000	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	3	0.19	558	Existing to Remain	No Change	2	62	0	0.19	558	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	112	$17	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	0.00
17	Classroom #115 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Existing to Remain	No Change	4	114	0	1.37	3,010	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	602	$93	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	3.75
17	Classroom #114 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Existing to Remain	No Change	4	114	0	1.37	3,010	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	602	$93	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	3.75
18	Classroom #110 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Parabolic	4	114	12	1.37	3,010	Existing to Remain	No Change	4	114	0	1.37	3,010	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	602	$93	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	3.75
17	Classroom #111 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Existing to Remain	No Change	4	114	0	1.37	3,010	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	602	$93	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	3.75
17	Classroom #112 (1995)	1000	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	1,368	Existing to Remain	No Change	4	114	0	1.37	1,368	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	274	$42	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	8.25
17	Classroom #113 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Existing to Remain	No Change	4	114	0	1.37	3,010	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	602	$93	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	3.75
19	Storage #128 (2004)	1500	1x4 2-Lamp 32w T8 Pendant Utility Wire Guard	2	62	10	0.62	930	Existing to Remain	No Change	2	62	0	0.62	930	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	186	$29	$0.00	$0.00	$0.00	$0.00	-	$400.00	$100.00	$500.00	FALSE	17.34
19	Custodian Closet (2004)	1000	1x4 2-Lamp 32w T8 Pendant Utility Wire Guard	2	62	2	0.12	124	Existing to Remain	No Change	2	62	0	0.12	124	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	$4	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	26.01
2	Boy's Restroom (2004)	3000	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	6	0.37	1,116	Existing to Remain	No Change	2	62	0	0.37	1,116	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	223	$35	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	7.23
2	Girl's Retroom (2004)	3000	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	6	0.37	1,116	Existing to Remain	No Change	2	62	0	0.37	1,116	0.00	0	$0	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	223	$35	$0.00	$0.00	$0.00	$0.00	-	$200.00	$50.00	$250.00	FALSE	7.23

ECM #1 - Interior
ECM #3 - Exterior
ECM #4 - Controls

EXISTING FIXTURES									PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
20	Gymnasium	1000	8-Lamp 42w CFL High-Bay	8	336	24	8.06	8,064	Existing to Remain	No Change	8	336	0	8.06	8,064	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
15	Gym Rear Exit	2600	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	2	0.19	484	Existing to Remain	No Change	3	93	0	0.19	484	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
15	Gym Office #129	2600	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	2	0.19	484	Existing to Remain	No Change	3	93	0	0.19	484	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	97	$15	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	$20.00	5.34
2	Gym Office Restroom	2600	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	1	0.06	161	Existing to Remain	No Change	2	62	0	0.06	161	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	32	$5	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	20.01
14		2600	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	86	Existing to Remain	No Change	2	33	0	0.03	86	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
21		2600	18w CFL Shower Light	1	18	1	0.02	47	Existing to Remain	No Change	1	18	0	0.02	47	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
22	Stage	1000	250w Metal Halide High-Bay	1	295	2	0.59	590	Replace Fixture	3-Lamp T5HO High-Bay Fixture	3	182	2	0.36	364	0.23	226	$35	0	No New Controls	0	0.0%	0	$0	$500.00	$300.00	$800.00	$100.00	19.98	$0.00	$0.00	$0.00	FALSE	-
17	Music Room #132	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	9	1.03	2,257	Existing to Remain	No Change	4	114	0	1.03	2,257	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	451	$70	$0.00	$0.00	$0.00	$0.00	-	$600.00	$100.00	$700.00	FALSE	10.00
15	Gym Lobby	3200	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	2	0.19	595	Existing to Remain	No Change	3	93	0	0.19	595	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
23		3200	2-Lamp 32w T8 Steel Truss Pendant	2	66	14	0.92	2,957	Remove	Demo and Dispose use existing recessed lighting	0	0	14	0.00	0	0.92	2,957	$458	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	0.00	$0.00	$0.00	$0.00	FALSE	-
15	Hallway 2004 Section	3200	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	13	1.21	3,869	Existing to Remain	No Change	3	93	0	1.21	3,869	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	3	20.0%	774	$120	$0.00	$0.00	$0.00	$0.00	-	$900.00	$150.00	$1,050.00	FALSE	8.75
3	Hallway 1995 Section	3200	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	25	1.55	4,960	Existing to Remain	No Change	2	62	0	1.55	4,960	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	3	20.0%	992	$154	$0.00	$0.00	$0.00	$0.00	-	$900.00	$150.00	$1,050.00	FALSE	6.83
24	Hallway 1975-1955 Section	3200	2x2 2-Lamp 17w T8 Recessed Opaque w/ Reflector	2	33	19	0.63	2,006	Existing to Remain	No Change	2	33	0	0.63	2,006	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	4	20.0%	401	$62	$0.00	$0.00	$0.00	$0.00	-	$1,200.00	$200.00	$1,400.00	FALSE	22.51
9	1955 Storage Closet A	1500	60w Incandescent A-Lamp	1	60	1	0.06	90	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	19	0.05	71	$11	0	No New Controls	0	0.0%	0	$0	$27.00	$16.25	$43.25	$20.00	2.11	$0.00	$0.00	$0.00	FALSE	-
25	1955 Storage Closet B	1500	36w CFL Medium Base	1	36	1	0.04	54	Existing to Remain	No Change	1	36	0	0.04	54	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
9	1955 Large Storage Closet	1500	60w Incandescent A-Lamp	1	60	1	0.06	90	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	19	0.05	71	$11	0	No New Controls	0	0.0%	0	$0	$27.00	$16.25	$43.25	$20.00	2.11	$0.00	$0.00	$0.00	FALSE	-
16	Men's Faculty Toilet (1995)	1200	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	86	Existing to Remain	No Change	2	72	0	0.07	86	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	17	$3	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	37.34
16	Women's Faculty Toilet (1995)	1200	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	86	Existing to Remain	No Change	2	72	0	0.07	86	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	17	$3	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	37.34
25	Hallway Drink Fountain (1995)	3200	36w CFL Medium Base	1	36	1	0.04	115	Existing to Remain	No Change	1	36	0	0.04	115	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
26	Exterior - '95 Entrance	4000	8" Recessed Can 70w HID Metal Halide	1	92	2	0.18	736	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.12	488	$76	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	5.29	$0.00	$0.00	$0.00	FALSE	-
27		4000	15w CFL Up/Down Wall Mount Spot Lights	1	15	4	0.06	240	Existing to Remain	No Change	1	15	0	0.06	240	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
28	Exterior - '55 Entrance	4000	6" Square Recessed 15w CFL	1	15	2	0.03	120	Existing to Remain	No Change	1	15	0	0.03	120	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
28	Exterior - '55 Classroom Exit	4000	6" Square Recessed 15w CFL	1	15	1	0.02	60	Existing to Remain	No Change	1	15	0	0.02	60	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
28	Exterior - '75 Cafeteria Exit	4000	6" Square Recessed 15w CFL	1	15	1	0.02	60	Existing to Remain	No Change	1	15	0	0.02	60	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
9	Exterior - '55 Boiler Room Exit	4000	60w Incandescent A-Lamp	1	60	1	0.06	240	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	50	0.05	190	$29	0	No New Controls	0	0.0%	0	$0	$27.00	$16.25	$43.25	$20.00	0.79	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Hall Rear Exit #11	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-
30		4000	100w HPS Wallpak	1	116	1	0.12	464	Replace Fixture	26w LED Wall Pack	1	26	1	0.03	104	0.09	360	$56	0	No New Controls	0	0.0%	0	$0	$200.00	$150.00	$350.00	$100.00	4.48	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Rear Exit #12	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Rear Exit #13	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-
30	Exterior - '04	4000	100w HPS Wallpak	1	116	5	0.58	2,320	Replace Fixture	26w LED Wall Pack	1	26	5	0.13	520	0.45	1,800	$279	0	No New Controls	0	0.0%	0	$0	$1,000.00	$750.00	$1,750.00	$500.00	4.48	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Side Exit #18	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-

ECM #1 - Interior
ECM #3 - Exterior
ECM #4 - Controls

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS						LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
29	Exterior - '04 Main Entry	4000	Recessed Can 50w HID High Pressure Sodium	1	61	4	0.24	976	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	4	0.12	496	0.12	480	$74	0	No New Controls	0	0.0%	0	$0	$680.00	$260.00	$940.00	$140.00	10.75	$0.00	$0.00	$0.00	FALSE	-
31		4000	9" Recessed 100w Metal Halide	1	122	4	0.49	1,952	Re-lamp & Bypass ballast	40w LED Par 56 Self-ballast Mogul Base Lamp	1	41	4	0.16	656	0.32	1,296	$201	0	No New Controls	0	0.0%	0	$0	$680.00	$260.00	$940.00	$140.00	3.98	$0.00	$0.00	$0.00	FALSE	-
30	Exterior	4000	100w HPS Wallpak	1	116	2	0.23	928	Replace Fixture	26w LED Wall Pack	1	26	2	0.05	208	0.18	720	$112	0	No New Controls	0	0.0%	0	$0	$400.00	$300.00	$700.00	$200.00	4.48	$0.00	$0.00	$0.00	FALSE	-
32	Exterior - Pole Lamps	4000	250w Pole Mounted Shoebox HPS Type III	1	302	3	0.91	3,624	Replace Fixture Head	RAB 78w LED Area Light	1	78	3	0.23	936	0.67	2,688	$417	0	No New Controls	0	0.0%	0	$0	$2,250.00	$450.00	$2,700.00	$525.00	5.22	$0.00	$0.00	$0.00	FALSE	-
	TOTAL					**587**	**49**	**108,407**					**51**	**45**	**95,876**	**4**	**12,531**	**$1,942**			**68**	**12**	**15,391**	**$2,386**	**$7,554**	**$3,218**	**$10,772**	**$2,175**	**4.43**	**$14,600**	**$3,400**	**$18,000**	**$135.00**	**$7.49**

CEG Project #: 1C13529 (ECM#2)
Facility Name: Estell Manor School
Address: 128 Cape May Avenue
City, State, Zip Estell Manor, NJ 08319

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
1	Main Office	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	11	0.69	1,802	Replace Fixture	2x2 Recessed LED 38w	1	38	11	0.42	1,087	0.28	715	$111	0	No New Controls	0	0.0%	0	$0	$1,650.00	$715.00	$2,365.00	$550.00	16.38	$0.00	$0.00	$0.00	FALSE	-
1	Super/Principal Office	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	8	0.50	1,310	Replace Fixture	2x2 Recessed LED 38w	1	38	8	0.30	790	0.20	520	$81	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	158	$25	$1,200.00	$520.00	$1,720.00	$400.00	16.38	$50.00	$50.00	$100.00	$20.00	3.26
1	107 Conference Room	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	6	0.38	983	Replace Fixture	2x2 Recessed LED 38w	1	38	6	0.23	593	0.15	390	$60	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	119	$18	$900.00	$390.00	$1,290.00	$300.00	16.38	$50.00	$50.00	$100.00	$20.00	4.35
2	Bathroom - Main Office	3000	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	1	0.06	186	Replace Fixture	2x2 Recessed LED 20w	1	20	1	0.02	60	0.04	126	$20	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	12	$2	$139.00	$65.00	$204.00	$50.00	7.89	$50.00	$50.00	$100.00	FALSE	53.76
1	Business Admin Office	2600	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	8	0.50	1,310	Replace Fixture	2x2 Recessed LED 38w	1	38	8	0.30	790	0.20	520	$81	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	158	$25	$1,200.00	$520.00	$1,720.00	$400.00	16.38	$50.00	$50.00	$100.00	$20.00	3.26
3	Kitchenette Main Office	2600	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	1	0.06	161	Replace Fixture	2x4 Recessed LED 48w	1	48	1	0.05	125	0.01	36	$6	0	No New Controls	0	0.0%	0	$0	$200.00	$65.00	$265.00	$50.00	38.11	$0.00	$0.00	$0.00	FALSE	-
4	IT Closet	1500	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	93	Replace Fixture	1x4 Surface LED 48w	1	48	1	0.05	72	0.01	21	$3	0	No New Controls	0	0.0%	0	$0	$200.00	$65.00	$265.00	$50.00	66.05	$0.00	$0.00	$0.00	FALSE	-
5	121 - Buildings & Grounds Office	2600	1x4 2-Lamp 32w T8 Pendant Prismatic	2	62	3	0.19	484	Replace Fixture	1x4 Surface-Pendant LED 48w	1	48	3	0.14	374	0.04	109	$17	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	75	$12	$600.00	$195.00	$795.00	$150.00	38.11	$50.00	$50.00	$100.00	$20.00	6.89
5	124 - Electric Room	1500	1x4 2-Lamp 32w T8 Pendant Prismatic	2	62	2	0.12	186	Replace Fixture	1x4 Surface-Pendant LED 48w	1	48	2	0.10	144	0.03	42	$7	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	29	$4	$400.00	$130.00	$530.00	$100.00	66.05	$200.00	$50.00	$250.00	FALSE	56.00
6	Classroom #2 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Replace Fixture	1x4 Surface LED 48w	1	48	12	0.58	1,267	0.17	370	$57	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	253	$39	$2,400.00	$780.00	$3,180.00	$600.00	45.04	$300.00	$50.00	$350.00	FALSE	8.91
1	Boy's Restroom (1955)	3000	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	1	0.06	189	Replace Fixture	2x2 Recessed LED 38w	1	38	1	0.04	114	0.03	75	$12	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	23	$4	$150.00	$65.00	$215.00	$50.00	14.19	$200.00	$50.00	$250.00	FALSE	70.74
7		2000	2x4 2-Lamp 32w T8 Recessed Paracube	2	62	2	0.12	248	Replace Fixture	2x4 Recessed LED 48w	1	48	2	0.10	192	0.03	56	$9	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	38	$6	$400.00	$130.00	$530.00	$100.00	49.54	$0.00	$0.00	$0.00	FALSE	0.00
1	Girl's Restroom (1955)	3000	2x2 4-Lamp 17w T8 Recessed Prismatic	4	63	1	0.06	189	Replace Fixture	2x2 Recessed LED 38w	1	38	1	0.04	114	0.03	75	$12	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	23	$4	$150.00	$65.00	$215.00	$50.00	14.19	$200.00	$50.00	$250.00	FALSE	70.74
7		3000	2x4 2-Lamp 32w T8 Recessed Paracube	2	62	2	0.12	372	Replace Fixture	2x4 Recessed LED 48w	1	48	2	0.10	288	0.03	84	$13	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	58	$9	$400.00	$130.00	$530.00	$100.00	33.03	$0.00	$0.00	$0.00	FALSE	0.00
6	Classroom #1 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Replace Fixture	1x4 Surface LED 48w	1	48	12	0.58	1,267	0.17	370	$57	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	253	$39	$2,400.00	$780.00	$3,180.00	$600.00	45.04	$300.00	$50.00	$350.00	FALSE	8.91
6	Kindergarten (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Replace Fixture	1x4 Surface LED 48w	1	48	12	0.58	1,267	0.17	370	$57	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	253	$39	$2,400.00	$780.00	$3,180.00	$600.00	45.04	$300.00	$50.00	$350.00	FALSE	8.91
8		2200	4' 1-Lamp 32w T8 Surface Strip	1	32	1	0.03	70	Existing to Remain	No Change	1	32	0	0.03	70	0.00	0	$0	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	14	$2	$0.00	$0.00	$0.00	$0.00	-	$300.00	$50.00	$350.00	FALSE	160.37
6	CST Office (1955)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	2	0.12	322	Replace Fixture	1x4 Surface LED 48w	1	48	2	0.10	250	0.03	73	$11	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	50	$8	$400.00	$130.00	$530.00	$100.00	38.11	$200.00	$50.00	$250.00	FALSE	32.31
6	Speech Office (1955)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	2	0.12	322	Replace Fixture	1x4 Surface LED 48w	1	48	2	0.10	250	0.03	73	$11	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	50	$8	$400.00	$130.00	$530.00	$100.00	38.11	$200.00	$50.00	$250.00	FALSE	32.31
9	Speech Office Toilet	1200	60w Incandescent A-Lamp	1	60	1	0.06	72	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	15	0.05	57	$9	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	3	$0	$27.00	$16.25	$43.25	$20.00	2.63	$50.00	$50.00	$100.00	FALSE	215.05
6	Child Study Office (1955)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	4	0.25	645	Replace Fixture	1x4 Surface LED 48w	1	48	4	0.19	499	0.06	146	$23	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	100	$15	$800.00	$260.00	$1,060.00	$200.00	38.11	$200.00	$50.00	$250.00	$35.00	13.89
10		2600	40w Incandescent A-Lamp	1	40	2	0.08	208	Re-Lamp	Phillips A19 8w LED Lamp	1	8	2	0.02	42	0.06	166	$26	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	8	$1	$36.00	$32.50	$68.50	$40.00	1.10	$0.00	$0.00	$0.00	FALSE	0.00
6	Classroom #3 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Replace Fixture	1x4 Surface LED 48w	1	48	12	0.58	1,267	0.17	370	$57	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	253	$39	$2,400.00	$780.00	$3,180.00	$600.00	45.04	$300.00	$50.00	$350.00	FALSE	8.91
6	Classroom #4 (1955)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	12	0.74	1,637	Replace Fixture	1x4 Surface LED 48w	1	48	12	0.58	1,267	0.17	370	$57	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	253	$39	$2,400.00	$780.00	$3,180.00	$600.00	45.04	$300.00	$50.00	$350.00	FALSE	8.91
6	Classroom #8 (Library)	2000	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	20	1.24	2,480	Replace Fixture	1x4 Surface LED 48w	1	48	20	0.96	1,920	0.28	560	$87	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	384	$60	$4,000.00	$1,300.00	$5,300.00	$1,000.00	49.54	$300.00	$50.00	$350.00	FALSE	5.88
6	Classroom #5 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	18	1.12	2,455	Replace Fixture	1x4 Surface LED 48w	1	48	18	0.86	1,901	0.25	554	$86	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	380	$59	$3,600.00	$1,170.00	$4,770.00	$900.00	45.04	$300.00	$50.00	$350.00	FALSE	5.94
6	Classroom #6 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	18	1.12	2,455	Replace Fixture	1x4 Surface LED 48w	1	48	18	0.86	1,901	0.25	554	$86	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	380	$59	$3,600.00	$1,170.00	$4,770.00	$900.00	45.04	$300.00	$50.00	$350.00	FALSE	5.94
11	Storage Room (1975)	1500	1x4 2-Lamp 32w T8 Surface No Lens Tube Guard	2	62	8	0.50	744	Replace Fixture	1x4 Surface LED 48w	1	48	8	0.38	576	0.11	168	$26	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	115	$18	$1,600.00	$520.00	$2,120.00	$400.00	66.05	$200.00	$50.00	$250.00	FALSE	14.00
6	Cafeteria (1975)	2600	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	55	3.41	8,866	Replace Fixture	1x4 Surface LED 48w	1	48	55	2.64	6,864	0.77	2,002	$310	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	4	20.0%	1,373	$213	$11,000.00	$3,575.00	$14,575.00	$2,750.00	38.11	$1,200.00	$200.00	$1,400.00	FALSE	6.58

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
12	Kitchen (1975)	2200	1x4 2-Lamp 32w T8 Surface Opaque Lens	2	62	12	0.74	1,637	Replace Fixture	1x4 Surface LED 48w	1	48	12	0.58	1,267	0.17	370	$57	0	No New Controls	0	0.0%	0	$0	$2,400.00	$780.00	$3,180.00	$600.00	45.04	$0.00	$0.00	$0.00	FALSE	-
13		1200	1x4 2-Lamp 32w T8 Surface Vaportight	2	62	2	0.12	149	Replace Fixture	1x4 Surface LED 48w	1	48	2	0.10	115	0.03	34	$5	0	No New Controls	0	0.0%	0	$0	$400.00	$130.00	$530.00	$100.00	82.57	$0.00	$0.00	$0.00	FALSE	-
6		2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	136	Replace Fixture	1x4 Surface LED 48w	1	48	1	0.05	106	0.01	31	$5	0	No New Controls	0	0.0%	0	$0	$200.00	$65.00	$265.00	$50.00	45.04	$0.00	$0.00	$0.00	FALSE	-
12	Dishwasher Room	2200	1x4 2-Lamp 32w T8 Surface Opaque Lens	2	62	2	0.12	273	Replace Fixture	1x4 Surface LED 48w	1	48	2	0.10	211	0.03	62	$10	0	No New Controls	0	0.0%	0	$0	$400.00	$130.00	$530.00	$100.00	45.04	$0.00	$0.00	$0.00	FALSE	-
6	Kitchen Storage	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	136	Replace Fixture	1x4 Surface LED 48w	1	48	1	0.05	106	0.01	31	$5	0	No New Controls	0	0.0%	0	$0	$200.00	$65.00	$265.00	$50.00	45.04	$0.00	$0.00	$0.00	FALSE	-
6	Classroom #7 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	18	1.12	2,455	Replace Fixture	1x4 Surface LED 48w	1	48	18	0.86	1,901	0.25	554	$86	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	380	$59	$3,600.00	$1,170.00	$4,770.00	$900.00	45.04	$300.00	$50.00	$350.00	FALSE	5.94
6	Classroom #10 (1975)	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	13	0.81	1,773	Replace Fixture	1x4 Surface LED 48w	1	48	13	0.62	1,373	0.18	400	$62	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	275	$43	$2,600.00	$845.00	$3,445.00	$650.00	45.04	$300.00	$50.00	$350.00	FALSE	8.22
14	Classroom #10 Toilet #1	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
14	Classroom #10 Toilet #2	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
6	#11 Faculty Lounge	2200	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	9	0.56	1,228	Replace Fixture	1x4 Surface LED 48w	1	48	9	0.43	950	0.13	277	$43	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	190	$29	$1,800.00	$585.00	$2,385.00	$450.00	45.04	$300.00	$50.00	$350.00	FALSE	11.88
14	#11 Faculty Toilet #1	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
14	#11 Faculty Toilet #2	1200	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	40	Existing to Remain	No Change	2	33	0	0.03	40	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	8	$1	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	81.46
15	102 Nurse's Office	2600	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	9	0.84	2,176	Replace Fixture	2x4 Recessed LED 64w	1	64	9	0.58	1,498	0.26	679	$105	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	300	$46	$1,872.00	$585.00	$2,457.00	$450.00	19.08	$600.00	$100.00	$700.00	FALSE	15.08
2	Nurse's Toilet	1200	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	1	0.06	74	Replace Fixture	2x2 Recessed LED 20w	1	20	1	0.02	24	0.04	50	$8	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	5	$1	$139.00	$65.00	$204.00	$50.00	19.71	$50.00	$50.00	$100.00	FALSE	134.41
15	Nurse Storage Closet	1500	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	1	0.09	140	Replace Fixture	2x4 Recessed LED 64w	1	64	1	0.06	96	0.03	44	$7	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	19	$3	$208.00	$65.00	$273.00	$50.00	33.07	$50.00	$50.00	$100.00	FALSE	33.60
3	Classroom #109 (1995)	2200	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	12	0.74	1,637	Replace Fixture	2x4 Recessed LED 48w	1	48	12	0.58	1,267	0.17	370	$57	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	253	$39	$2,400.00	$780.00	$3,180.00	$600.00	45.04	$300.00	$50.00	$350.00	FALSE	8.91
6	Custodian Closet (1995)	1500	1x4 2-Lamp 32w T8 Surface Prismatic	2	62	1	0.06	93	Replace Fixture	1x4 Surface LED 48w	1	48	1	0.05	72	0.01	21	$3	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	$2	$200.00	$65.00	$265.00	$50.00	66.05	$50.00	$50.00	$100.00	FALSE	44.80
16	Boy's Restroom (1995)	3000	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	216	Replace Fixture	2x2 Recessed LED 38w	1	38	1	0.04	114	0.03	102	$16	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	23	$4	$150.00	$65.00	$215.00	$50.00	10.44	$200.00	$50.00	$250.00	FALSE	70.74
3		3000	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	3	0.19	558	Replace Fixture	2x4 Recessed LED 48w	1	48	3	0.14	432	0.04	126	$20	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	86	$13	$600.00	$195.00	$795.00	$150.00	33.03	$0.00	$0.00	$0.00	FALSE	0.00
16	Girl's Restroom (1995)	3000	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	216	Replace Fixture	2x2 Recessed LED 38w	1	38	1	0.04	114	0.03	102	$16	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	23	$4	$150.00	$65.00	$215.00	$50.00	10.44	$200.00	$50.00	$250.00	FALSE	70.74
3		3000	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	3	0.19	558	Replace Fixture	2x4 Recessed LED 48w	1	48	3	0.14	432	0.04	126	$20	5	Dual Technology Occupancy Sensor - Remote Mnt.	0	20.0%	86	$13	$600.00	$195.00	$795.00	$150.00	33.03	$0.00	$0.00	$0.00	FALSE	0.00
17	Classroom #115 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Replace Fixture	2x4 Recessed LED 64w	1	64	12	0.77	1,690	0.60	1,320	$205	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	338	$52	$2,496.00	$780.00	$3,276.00	$600.00	13.08	$300.00	$50.00	$350.00	FALSE	6.68
17	Classroom #114 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Replace Fixture	2x4 Recessed LED 64w	1	64	12	0.77	1,690	0.60	1,320	$205	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	338	$52	$2,496.00	$780.00	$3,276.00	$600.00	13.08	$300.00	$50.00	$350.00	FALSE	6.68
18	Classroom #110 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Parabolic	4	114	12	1.37	3,010	Replace Fixture	2x4 Recessed LED 64w	1	64	12	0.77	1,690	0.60	1,320	$205	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	338	$52	$2,496.00	$780.00	$3,276.00	$600.00	13.08	$300.00	$50.00	$350.00	FALSE	6.68
17	Classroom #111 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Replace Fixture	2x4 Recessed LED 64w	1	64	12	0.77	1,690	0.60	1,320	$205	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	338	$52	$2,496.00	$780.00	$3,276.00	$600.00	13.08	$300.00	$50.00	$350.00	FALSE	6.68
17	Classroom #112 (1995)	1000	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	1,368	Replace Fixture	2x4 Recessed LED 64w	1	64	12	0.77	768	0.60	600	$93	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	154	$24	$2,496.00	$780.00	$3,276.00	$600.00	28.77	$300.00	$50.00	$350.00	FALSE	14.70
17	Classroom #113 (1995)	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	12	1.37	3,010	Replace Fixture	2x4 Recessed LED 64w	1	64	12	0.77	1,690	0.60	1,320	$205	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	1	20.0%	338	$52	$2,496.00	$780.00	$3,276.00	$600.00	13.08	$300.00	$50.00	$350.00	FALSE	6.68
19	Storage #128 (2004)	1500	1x4 2-Lamp 32w T8 Pendant Utility Wire Guard	2	62	10	0.62	930	Replace Fixture	1x4 Surface LED 48w	1	48	10	0.48	720	0.14	210	$33	5	Dual Technology Occupancy Sensor - Remote Mnt.	2	20.0%	144	$22	$2,000.00	$650.00	$2,650.00	$500.00	66.05	$400.00	$100.00	$500.00	FALSE	22.40
19	Custodian Closet (2004)	1000	1x4 2-Lamp 32w T8 Pendant Utility Wire Guard	2	62	2	0.12	124	Replace Fixture	1x4 Surface LED 48w	1	48	2	0.10	96	0.03	28	$4	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	19	$3	$400.00	$130.00	$530.00	$100.00	99.08	$50.00	$50.00	$100.00	FALSE	33.60
2	Boy's Restroom (2004)	3000	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	6	0.37	1,116	Replace Fixture	2x2 Recessed LED 20w	1	20	6	0.12	360	0.25	756	$117	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	72	$11	$834.00	$390.00	$1,224.00	$300.00	7.89	$200.00	$50.00	$250.00	FALSE	22.40
2	Girl's Retroom (2004)	3000	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	6	0.37	1,116	Replace Fixture	2x2 Recessed LED 20w	1	20	6	0.12	360	0.25	756	$117	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	72	$11	$834.00	$390.00	$1,224.00	$300.00	7.89	$200.00	$50.00	$250.00	FALSE	22.40

EXISTING FIXTURES									PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
20	Gymnasium	1000	8-Lamp 42w CFL High-Bay	8	336	24	8.06	8,064	Existing to Remain	No Change	8	336	0	8.06	8,064	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
15	Gym Rear Exit	2600	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	2	0.19	484	Replace Fixture	2x4 Recessed LED 64w	1	64	2	0.13	333	0.06	151	$23	0	No New Controls	0	0.0%	0	$0	$416.00	$130.00	$546.00	$100.00	19.08	$0.00	$0.00	$0.00	FALSE	-
15	Gym Office #129	2600	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	2	0.19	484	Replace Fixture	2x4 Recessed LED 64w	1	64	2	0.13	333	0.06	151	$23	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	67	$10	$416.00	$130.00	$546.00	$100.00	19.08	$50.00	$50.00	$100.00	$20.00	7.75
2	Gym Office Restroom	2600	2x2 2-Lamp 32w T8 U-6" Recessed Prismatic	2	62	1	0.06	161	Replace Fixture	2x2 Recessed LED 20w	1	20	1	0.02	52	0.04	109	$17	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	10	$2	$139.00	$65.00	$204.00	$50.00	9.10	$50.00	$50.00	$100.00	FALSE	62.03
14		2600	2' 2-Lamp 17w T8 Wall Mount Wrap	2	33	1	0.03	86	Existing to Remain	No Change	2	33	0	0.03	86	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
21		2600	18w CFL Shower Light	1	18	1	0.02	47	Existing to Remain	No Change	1	18	0	0.02	47	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
22	Stage	1000	250w Metal Halide High-Bay	1	295	2	0.59	590	Replace Fixture	3-Lamp T5HO High-Bay Fixture	3	182	2	0.36	364	0.23	226	$35	0	No New Controls	0	0.0%	0	$0	$500.00	$300.00	$800.00	$100.00	19.98	$0.00	$0.00	$0.00	FALSE	-
17	Music Room #132	2200	2x4 4-Lamp 32w T8 Recessed Prismatic	4	114	9	1.03	2,257	Replace Fixture	2x4 Recessed LED 64w	1	64	9	0.58	1,267	0.45	990	$153	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	2	20.0%	253	$39	$1,872.00	$585.00	$2,457.00	$450.00	13.08	$600.00	$100.00	$700.00	FALSE	17.82
15	Gym Lobby	3200	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	2	0.19	595	Replace Fixture	2x4 Recessed LED 64w	1	64	2	0.13	410	0.06	186	$29	0	No New Controls	0	0.0%	0	$0	$416.00	$130.00	$546.00	$100.00	15.50	$0.00	$0.00	$0.00	FALSE	-
23		3200	2-Lamp 32w T8 Steel Truss Pendant	2	66	14	0.92	2,957	Remove	Demo and Dispose use existing recessed lighting	0	0	14	0.00	0	0.92	2,957	$458	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	0.00	$0.00	$0.00	$0.00	FALSE	-
15	Hallway 2004 Section	3200	2x4 3-Lamp 32w T8 Recessed Prismatic	3	93	13	1.21	3,869	Replace Fixture	2x4 Recessed LED 64w	1	64	13	0.83	2,662	0.38	1,206	$187	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	3	20.0%	532	$83	$2,704.00	$845.00	$3,549.00	$650.00	15.50	$900.00	$150.00	$1,050.00	FALSE	12.72
3	Hallway 1995 Section	3200	2x4 2-Lamp 32w T8 Recessed Prismatic	2	62	25	1.55	4,960	Replace Fixture	2x4 Recessed LED 48w	1	48	25	1.20	3,840	0.35	1,120	$174	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	3	20.0%	768	$119	$5,000.00	$1,625.00	$6,625.00	$1,250.00	30.96	$900.00	$150.00	$1,050.00	FALSE	8.82
24	Hallway 1975-1955 Section	3200	2x2 2-Lamp 17w T8 Recessed Opaque w/ Reflector	2	33	19	0.63	2,006	Replace Fixture	2x2 Recessed LED 20w	1	20	19	0.38	1,216	0.25	790	$123	4	Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mnt.	4	20.0%	243	$38	$2,641.00	$1,235.00	$3,876.00	$950.00	23.88	$1,200.00	$200.00	$1,400.00	FALSE	37.14
9	1955 Storage Closet A	1500	60w Incandescent A-Lamp	1	60	1	0.06	90	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	19	0.05	71	$11	0	No New Controls	0	0.0%	0	$0	$27.00	$16.25	$43.25	$20.00	2.11	$0.00	$0.00	$0.00	FALSE	-
25	1955 Storage Closet B	1500	36w CFL Medium Base	1	36	1	0.04	54	Existing to Remain	No Change	1	36	0	0.04	54	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
9	1955 Large Storage Closet	1500	60w Incandescent A-Lamp	1	60	1	0.06	90	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	19	0.05	71	$11	0	No New Controls	0	0.0%	0	$0	$27.00	$16.25	$43.25	$20.00	2.11	$0.00	$0.00	$0.00	FALSE	-
16	Men's Faculty Toilet (1995)	1200	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	86	Replace Fixture	2x2 Recessed LED 38w	1	38	1	0.04	46	0.03	41	$6	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	9	$1	$150.00	$65.00	$215.00	$50.00	26.09	$50.00	$50.00	$100.00	FALSE	70.74
16	Women's Faculty Toilet (1995)	1200	2x2 2-Lamp 34w T12 U Recessed Prismatic	2	72	1	0.07	86	Replace Fixture	2x2 Recessed LED 38w	1	38	1	0.04	46	0.03	41	$6	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	9	$1	$150.00	$65.00	$215.00	$50.00	26.09	$50.00	$50.00	$100.00	FALSE	70.74
25	Hallway Drink Fountain (1995)	3200	36w CFL Medium Base	1	36	1	0.04	115	Existing to Remain	No Change	1	36	0	0.04	115	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
26	Exterior - '95 Entrance	4000	8" Recessed Can 70w HID Metal Halide	1	92	2	0.18	736	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.12	488	$76	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	5.29	$0.00	$0.00	$0.00	FALSE	-
27		4000	15w CFL Up/Down Wall Mount Spot Lights	1	15	4	0.06	240	Existing to Remain	No Change	1	15	0	0.06	240	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
28	Exterior - '55 Entrance	4000	6" Square Recessed 15w CFL	1	15	2	0.03	120	Existing to Remain	No Change	1	15	0	0.03	120	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
28	Exterior - '55 Classroom Exit	4000	6" Square Recessed 15w CFL	1	15	1	0.02	60	Existing to Remain	No Change	1	15	0	0.02	60	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
28	Exterior - '75 Cafeteria Exit	4000	6" Square Recessed 15w CFL	1	15	1	0.02	60	Existing to Remain	No Change	1	15	0	0.02	60	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
9	Exterior - '55 Boiler Room Exit	4000	60w Incandescent A-Lamp	1	60	1	0.06	240	Re-Lamp	Phillips A19 12.5w LED Lamp	1	12.5	1	0.01	50	0.05	190	$29	0	No New Controls	0	0.0%	0	$0	$27.00	$16.25	$43.25	$20.00	0.79	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Hall Rear Exit #11	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-
30		4000	100w HPS Wallpak	1	116	1	0.12	464	Replace Fixture	26w LED Wall Pack	1	26	1	0.03	104	0.09	360	$56	0	No New Controls	0	0.0%	0	$0	$200.00	$150.00	$350.00	$100.00	4.48	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Rear Exit #12	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Rear Exit #13	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-
30	Exterior - '04	4000	100w HPS Wallpak	1	116	5	0.58	2,320	Replace Fixture	26w LED Wall Pack	1	26	5	0.13	520	0.45	1,800	$279	0	No New Controls	0	0.0%	0	$0	$1,000.00	$750.00	$1,750.00	$500.00	4.48	$0.00	$0.00	$0.00	FALSE	-
29	Exterior - '04 Gym Side Exit #18	4000	Recessed Can 50w HID High Pressure Sodium	1	61	2	0.12	488	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	2	0.06	248	0.06	240	$37	0	No New Controls	0	0.0%	0	$0	$340.00	$130.00	$470.00	$70.00	10.75	$0.00	$0.00	$0.00	FALSE	-

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS						LIGHTING CONTROLS COST					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
29	Exterior - '04 Main Entry	4000	Recessed Can 50w HID High Pressure Sodium	1	61	4	0.24	976	Re-lamp & Bypass ballast	30w LED Par 56 Self-ballast Mogul Base Lamp	1	31	4	0.12	496	0.12	480	$74	0	No New Controls	0	0.0%	0	$0	$680.00	$260.00	$940.00	$140.00	10.75	$0.00	$0.00	$0.00	FALSE	-
31		4000	9" Recessed 100w Metal Halide	1	122	4	0.49	1,952	Re-lamp & Bypass ballast	40w LED Par 56 Self-ballast Mogul Base Lamp	1	41	4	0.16	656	0.32	1,296	$201	0	No New Controls	0	0.0%	0	$0	$680.00	$260.00	$940.00	$140.00	3.98	$0.00	$0.00	$0.00	FALSE	-
30	Exterior	4000	100w HPS Wallpak	1	116	2	0.23	928	Replace Fixture	26w LED Wall Pack	1	26	2	0.05	208	0.18	720	$112	0	No New Controls	0	0.0%	0	$0	$400.00	$300.00	$700.00	$200.00	4.48	$0.00	$0.00	$0.00	FALSE	-
32	Exterior - Pole Lamps	4000	250w Pole Mounted Shoebox HPS Type III	1	302	3	0.91	3,624	Replace Fixture Head	RAB 78w LED Area Light	1	78	3	0.23	936	0.67	2,688	$417	0	No New Controls	0	0.0%	0	$0	$2,250.00	$450.00	$2,700.00	$525.00	5.22	$0.00	$0.00	$0.00	FALSE	-
	TOTAL					**587**	**49**	**108,407**					**546**	**34**	**70,016**	**15**	**38,391**	**$5,951**			**68**	**12**	**10,546**	**$1,635**	**$103,410**	**$35,393**	**$138,803**	**$26,925**	**18.80**	**$14,600**	**$3,400**	**$18,000**	**$135.00**	**$10.93**

APPENDIX F

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
Estell Manor School	9730	SHARP ND-240QCJ	397	17.5	6,964	95.28	115,836	77.2	16,634	13.68

= Proposed PV Roof Layout

Notes:

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

Project Name: **LGEA Solar PV Project - Estell Manor School**
Location: **Estell Manor, NJ**
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$425,787
Annual kWh Production	115,836
Annual Energy Cost Reduction	$17,955
Average Annual SREC Revenue	$22,134

Simple Payback: **10.62** Years

Life Cycle Cost Analysis

Analysis Period (years):	15	Financing %:	100%
Discount Rate:	3%	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.155**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	6.00%	Average SREC Value ($/kWh)	$0.191

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	115,836	$17,955	$0	$28,959	$25,056	$18,060	$3,797	$3,797
2	$0	115,257	$18,493	$0	$28,814	$23,942	$19,174	$4,191	$7,988
3	$0	114,681	$19,048	$0	$28,670	$22,759	$20,357	$4,602	$12,590
4	$0	114,107	$19,619	$0	$28,527	$21,504	$21,613	$5,030	$17,620
5	$0	113,537	$20,208	$1,169	$28,384	$20,171	$22,946	$4,306	$21,926
6	$0	112,969	$20,814	$1,164	$22,594	$18,756	$24,361	($872)	$21,054
7	$0	112,404	$21,439	$1,158	$22,481	$17,253	$25,863	($355)	$20,700
8	$0	111,842	$22,082	$1,152	$22,368	$15,658	$27,459	$182	$20,881
9	$0	111,283	$22,744	$1,146	$22,257	$13,964	$29,152	$738	$21,620
10	$0	110,726	$23,427	$1,140	$16,609	$12,166	$30,950	($4,221)	$17,398
11	$0	110,173	$24,129	$1,135	$16,526	$10,257	$32,859	($3,596)	$13,803
12	$0	109,622	$24,853	$1,129	$16,443	$8,231	$34,886	($2,949)	$10,854
13	$0	109,074	$25,599	$1,123	$16,361	$6,079	$37,038	($2,280)	$8,574
14	$0	108,528	$26,367	$1,118	$10,853	$3,794	$39,322	($7,015)	$1,559
15	$0	107,986	$27,158	$1,112	$10,799	$1,369	$41,747	($6,272)	($4,713)
	Totals:	1,678,024	$333,936	$12,547	$320,645	$220,959	$425,787	($4,713)	-

Net Present Value (NPV) **$1,617**

APPENDIX G

POWERSMITHS

The ESP Calculator™

Energy Savings Payback Calculator

Toll Free : 1-800-747-9627 or (905) 791-1493

Project Description Estell Manor School

Date 6-Feb-14

Data Entry

Transformers on Project

QTY	kVA
	15
1	30
2	45
1	75
	112.5
	150
	225
	300
	500
	750
	1000
	1500
	2000
	7.5

		Calc Load kW	Calc Annual kWh
Available Full Load kW	**195**		
Average kVA (calc)	**49**		
equipment operating hrs/ day	**12**		
equipment operating days/yr	**235**		
Load during normal operating hours	**55%**	107	302,445
Load outside operating hours	**20%**	39	231,660
		Total Annual Load kWh:	**534,105**

Annual Cost to Operate Load Only

kWh rate	$ 0.155	Annual Consumption:	$ 82,786
demand rate ($/kW/mo) ex. $10.00	$0.00	Annual Demand:	$ -
		Total Cost to run load	**$ 82,786**

Annual Cost of Status Quo Transformer Losses & Associated Air Conditioning (A/C) burden

Nameplate Linear efficiency (normal op hrs)	96.5%	% electronics or current THD	10.0%
Calculated operating efficiency	96.2%		
Transformer kW Losses (Normal Operation)	4.3 kW		
Status quo Efficiency (Outside op. hrs)	95.0%		
Transformer kW Losses (Outside op. hrs)	2.1 kW		
Annual addititional kWh from transformers	24,303 kWh		
Annual Cost of Transformer Losses	$ 3,767		
A/C System Performance (kW/ton)	-		
Additional Tons of Cooling (on peak)	- tons		
Annual addititional kWh from A/C	- kWh		
Annual Cost of Associated A/C	$ -		

Summary with Status Quo Transformer

Annual Cost of feeding Building Load	$	82,786
Annual Cost of Transformer Losses	$	3,767
Annual Cost of Associated A/C	$	-
Electrical Bill (Status Quo Transformer)	**$**	**86,553**

Using Powersmiths instead of status quo transformers

Powersmiths Efficiency (Normal Operation)	98.6%	
Powersmiths kW Losses (Normal Operation)	1.5	kW
Powersmiths Efficiency (Outside op. hrs)	97.6%	
Transformer kW Losses (Outside op. hrs)	1.0	kW
Annual addititional kWh from transformers	9,991	kWh
Annual Cost of Powersmiths Losses	$ 1,549	
Additional Tons of Cooling (on peak)	-	tons
Annual addititional kWh from A/C	-	kWh
Annual Cost of Associated A/C	$ -	

Comparing Status Quo & Powersmiths

	Status Quo	Powersmiths	
Annual Cost of feeding Building Load	$ 82,786	$ 82,786	
Annual Cost of Transformer Losses	$ 3,767	$ 1,549	
Annual Cost of Associated A/C	$ -	$ -	**Reduction**
Annual estimated Electrical Bill	$ 86,553	$ 84,335	**3%**

Peak kW reduction (normal op hours)	**2.8**	**kW**
Annual kWh reduction	**14,312**	**kWh**
Reduction in Air Conditioning Load (on peak)	**-**	**tons**

Cost Analysis (calc)

Energy Cost Escalation (above inflation)	2.0%
Annual Power Quality Benefit	$ -

	Annual Operating Cost	Life Cycle Operating Cost & Savings	
		20 years	32 years
Status Quo Transformers	$3,767	$111,950	$227,168
Powersmiths Transformers	$1,549	$46,022	$93,388
Savings with Powersmiths	**$2,218**	**$65,928**	**$133,780**

Cost

	Cost
Powersmiths Transformers	$30,000
Status Quo Transformers	$0

Payback on total cost

	13.52 years		current kWh rate:
Cost of Energy Savings	$ 0.066	**/kWh**	**$0.155**
Cost - Benefit Ratio	2.4	**times less to save a kWh than to buy a kWh**	

Leasing Option

	60 Month Term	48 Month Term	36 Month Term
Total Annual Leasing Payments	**$7,585**	**$9,252**	**$11,772**
Net Annual Cost with savings	$5,367	$7,034	$9,554

Summary of Environmental Benefits

Annual Reduction in Greenhouse Gases (per EPA)	Equivalence
11 tons of CO2	2 Acres trees planted
34 tons of Coal	1 Car Emissions
83 kgs of SO2	1 homes heated
36 kgs of NOx	

Status Quo Transformer (Normal Operation)

Enter the average efficiency of the transformers. While NEMA TP1 is legislated minimum efficiency, it only applies at a single 35% load point, and under ideal linear load profile. Since most transformers are much less loaded than 35%, be sure to use lower efficiency to reflect load level.

Status Quo Transformer (Outside Op. hours)

Transformer efficiency is typically lower than normal when lightly loaded (86-89% when 10-15% loaded for most sizes)

% electronics or Current THD

IEEE Std 1100 and other industry references document transformer losses can more than double when feeding electronics when installled compared to ideal linear load in a manufacturer's factory test.

Transformer Operating Losses

Transformer Losses = kW load/net efficiency - kW load.

A/C Performance (kW/ton)

Varies widely depending on age and technology of cooling system. As low as 0.5 to over 2kW/ton (1.25-1.5 is often tp)
Unlike most substation transformers that are vented to the exterior, most building distribution transformers are ventilated within the building, and their heat losses therefore add to the cooling load.

Powersmiths Efficiency (Normal Operation) & (Outside Op. hours)

Available on Powersmiths product data sheet

Energy Cost escalation (above inflation)

It is well recognized that energy rates are increasing much faster than inflation. Enter the % over inflation

Annual Power Quality Benefit

Savings attributable to reduced downtime, equipment locks & failures associated with poor power quality

Cost

Cost of transformers. Enter dollar figure for transformers under consideration. If the interest is to look at the justification for replacing existing transformers, enter $0 in the conventional transformer cost field.

Energy Operating Cost

Energy OPERATING COST (normal op) = (transformer + cooling) kW losses x kWh rate x hrs/day x days/yr + demand charge
Demand charge is not included in the calculation of losses outside normal hours to be conservative.

Return on Investment (ROI)

ROI on Incremental Cost is based on dividing the Incremental Investment in Powersmiths by the Annual Savings
ROI on Total Transformer Cost is based on dividing the Total Transformer Cost by the Annual Savings

Cost of Energy Savings

In its simplest form, the cost of energy savings represents the cost to save a kWh as opposed to paying for it according to the prevailing kWh rate.

The equation is: Cost of Energy Savings = (Incremental Product Cost / Lifetime kWh saved)

Leasing

Powersmiths Leasing has many benefits, including avoiding the use of capital, offsetting monthly leasing payment with the reduction in monthly energy bill from using Powersmiths

Environmental Benefits

Conversion rates from kWh to emission reduction and equivalent benefits are published by the EPA, and reflect environmental benefits derived from reduced emissions associated with reduced power generation.

TERMS OF USE

Power Quality Institute has used its best efforts in developing the ESP Calculator ™ with the intent of providing an easy to use and useful calculation tool. However, data entered and assumptions made may not accurately reflect all variables that apply in a given facility. The results are therefore estimates only and may differ from actual measurements.
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