



LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

**LENAPE REGIONAL
HIGH SCHOOL DISTRICT
96 WILLOW GROVE ROAD
SHAMONG, NJ 08088
ATTN: MR. JAMES H. HAGER,
SCHOOL BUSINESS ADMINISTRATOR**

PREPARED BY:

CONCORD ENGINEERING GROUP



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

CEG CONTACT:

**KEVIN BLANKENBUEHLER, ME
DIRECTOR OF ENERGY SERVICES
EMAIL: KBLANK@CONCORD-ENGINEERING.COM**

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Enclosures:

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Document 3 – Cherokee Energy Report

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I. EXECUTIVE SUMMARY

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

Entity:	Lenape Regional High School District
Facilities:	Lenape High School Shawnee High School Cherokee High School Seneca High School
District Contact Person:	James Hager, Business Administrator
Facility Contact Person:	Anthony Vorio, Director of Buildings & Grounds

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

Short-term Payback Energy Conservation Measures:

The Energy Conservation Measures (ECMs) identified with a simple payback of 0 to 5 years are considered very cost effective and should be considered a high priority for the District. It should be noted that in many cases ECM's in this range can be performed utilizing qualified "in house" staff that can further reduce the payback period. It is recommended if the District proceeds with "in house" installation they review equipment being purchased to ensure the energy efficiency equipment standards outlined in this report are met or exceeded.

Medium-term Payback Energy Conservation Measures:

The Energy Conservation Measures (ECMs) identified with a simple payback of 5 to 10 years are considered cost effective and should be considered by the District. In many cases these measures can provide significant savings, however the costs to implement are higher, stretching the payback beyond five years.

Long-term Payback Energy Conservation Measures:

The Energy Conservation Measures (ECMs) identified with a simple payback of over 10 years. The ECMs that have much longer paybacks are considered capital improvement ECMs. These typically have high installation costs that are more difficult to justify based solely on the energy savings associated with the improvement. Despite the long paybacks, these ECMs in many cases provide valuable and much needed infrastructure improvements for the facility. These ECMs

include boiler upgrades, HVAC equipment upgrades, etc. It should also be noted that projects under a 15 year payback should be reviewed in the event the District wishes to move forward with an Energy Savings Improvement Program where these projects could be included that program.

The following table outlines the District's Short, Medium, and Long Term payback Energy Conservation Measures.

LENAPE REGIONAL HIGH SCHOOL DISTRICT ECMs LIST				
ENERGY CONSERVATION MEASURES LIST	Lenape High School	Shawnee High School	Cherokee High School	Seneca High School
Lighting Upgrades	L	M	M	M
Gymnasium Lighting Upgrades	S	M	M	M
Lighting Upgrade Media Center	S			
Lighting Upgrade LED Option	L	L	L	L
Lighting Controls	S	S	S	S
Exterior Lighting Upgrade	S		L	
Vending Miser Controls	S	S	S	S
Refrigeration Controls	M	L	L	M
Premium Efficiency Motors	L		M	
DX to CHW Conversion	L	L		
Window Replacement	L			
Kitchen Hood Controls	L	L		M
Electric to Gas Booster Heater	L			
Condensing Heating Boiler Upgrades				M
Domestic Hot Water Boiler Upgrades	S			
Pony Chiller	L			
Demand Controlled Ventilation		L		L
BMS Scheduling Optimization		S		
Variable Frequency Drives		L		
DHW Tank Insulation			S	
Solar Photovoltaic System	L	L	L	L
TOTAL	16	12	10	10
COMMENTS	ECM's are categorized into Short Term (0 - 5 yrs) designated "S", Medium Term (5 - 10 yrs) designated "M", and Long Term (10+ yrs) designated "L" to assist in prioritizing projects for implementation.			

Combined Project Approach:

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

The Energy Savings Improvement Program (ESIP) allows for financing of any combination of energy efficiency projects across multiple facilities into one large project. The term of the financing must be under 15 years and the savings provides the revenue for the financing cost. The combination of all facilities into one large energy efficiency project provides Lenape Regional with the opportunity to implement over \$1,000,000 worth of the ECMs identified within this report with an overall simple payback of 5.9 years. Given the short payback period of the presented combination of measures the district can consider additional projects to be combined in the total project cost that may not be self-justifiable, however have some energy savings value and are able to be carried by the total project savings. The program financing allows for the implementation with little to no upfront cost for Lenape Regional. Implementation of an ESIP provides significant benefits and should be strongly considered by the district. The total Entity Project Summary table below shows the savings, costs, incentives and paybacks for the recommended ECMs at Lenape Regional High School District.

Table 1
ESIP -Total Entity Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL ENERGY EFFICIENCY PROJECTS					
FACILITY ENERGY EFFICIENCY PROJECTS	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Lenape High School	\$66,742	\$303,121	\$33,273	\$269,848	4.0
Shawnee High School	\$19,765	\$121,139	\$4,909	\$116,230	5.9
Cherokee High School	\$48,445	\$366,939	\$18,315	\$348,624	7.2
Seneca High School	\$29,572	\$257,542	\$16,500	\$241,042	8.2
Total Entity Project	\$164,524	\$1,048,741	\$72,997	\$975,743	5.9
Total Entity Energy Costs: \$2,396,539 Est. Total Entity Energy Savings: \$164,524 Overall Entity Percent Reduction: 6.9%					

Implementation of all ECMs identified within the ESIP – Entity Total Project Summary table represents a total annual savings of approximately \$164,524 for the District. The individual facility project summaries are shown within each facility energy audit report.

Other Considerations:

Maintenance and Operational Measures:

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

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors to limit unnecessary infiltration.
3. Clean all light fixtures to maximize light output to provide better light output and avoid the use of task lighting where otherwise not necessary.

4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Ensure energy recovery media are cleaned regularly to optimize its heat transfer capability.
6. Review all control system scheduling and setbacks to ensure the most energy efficiency set up is being used.

Renewable Energy Measures:

Renewable Energy Measures (REMs) were also reviewed for implementation at Lenape Regional High School District. Concord Engineering utilized a combination of roof mounted solar arrays, canopy style parking lot solar arrays, and ground mount arrays to house PV systems throughout the district's buildings. The total solar electric production potential for these systems is approximately 3,084,021 kWh, which would reduce the District's grid purchased electric energy by 20%. The system's calculated simple payback of approximately 15 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. Concord Engineering recommends the Owner review all funding options available with the implementation of this renewable energy measure.

Overall Assessment:

Overall, Lenape Regional High School District's facilities are well maintained and operating fairly efficient. There are numerous ECMs that can be implemented to further reduce energy use and save on the facilities' operating costs. The total energy cost of \$2,396,539 could be reduced by approximately 7% through the implementation of the ECMs recommended in this audit. Concord recommends the District review all of the measures presented in this report, and compare with their long term facilities plan to assist in prioritizing the recommendations you believe to be a top priority. The Lenape Regional High School District is in an excellent position to perform a combined project that could help cover the cost of the recommended capital improvements through the energy savings.

II. INTRODUCTION

The comprehensive energy audit covers the following buildings:

- Lenape High School
- Shawnee High School
- Cherokee High School
- Seneca High School

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

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

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft²/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

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

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

- Building envelope (roof, windows, etc.)

- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

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

III. METHOD OF ANALYSIS

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

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 $\pm 20\%$.

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

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

ECM Calculation Equations:

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST**A. Energy Usage**

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

**Table 2
Electric Utility Summary**

ELECTRIC UTILITY USAGE PER FACILITY			
FACILITY	ANNUAL ELECTRIC UTILITY		
DESCRIPTION	USAGE (KWH)	COST (\$)	AVE RATE (\$/KWH)
Lenape High School	3,774,322	\$474,257	\$0.13
Shawnee High School	3,286,078	\$341,882	\$0.10
Cherokee High School	4,828,822	\$516,079	\$0.11
Seneca High School	3,391,760	\$352,754	\$0.10
Total	15,280,982	\$1,684,972	\$0.11

Table 3
Natural Gas Summary

NATURAL GAS UTILITY USAGE PER FACILITY			
FACILITY	ANNUAL NATURAL GAS UTILITY		
DESCRIPTION	USAGE (THERMS)	COST (\$)	AVE RATE (\$/THERM)
Lenape High School	188,244	\$169,818	\$0.90
Shawnee High School	170,764	\$167,759	\$0.98
Cherokee High School	228,636	\$236,994	\$1.04
Seneca High School	132,987	\$136,996	\$1.03
Total	720,631	\$711,567	\$0.99

B. Energy Use Index (EUI)

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

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

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

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

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

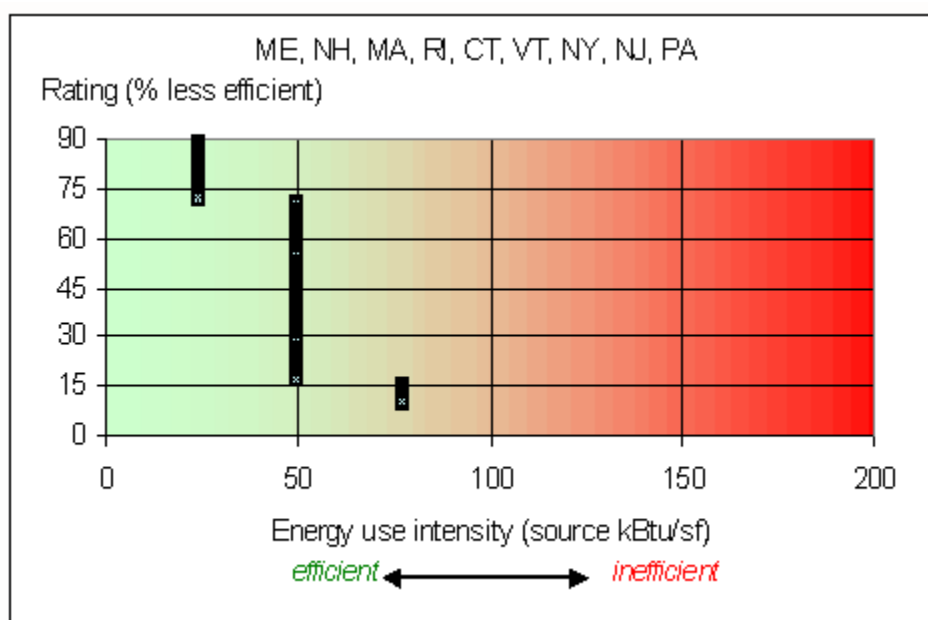
Table 4
Energy Use Index Summary

ENERGY USE INDEX PER FACILITY			
FACILITY	BUILDING AREA	ENERGY USE INDEX	
DESCRIPTION	(SF)	SITE (KBTU/SF/YR)	SOURCE (KBTU/SF/YR)
Lenape High School	332,603	95	189
Shawnee High School	263,345	107	210
Cherokee High School	435,464	91	182
Seneca High School	255,737	97	206

See the Appendix C - Statement of Energy Performance for comparison to other facilities
Highlighted areas are estimated.

Figure 1 through 4 below depicts a national EUI grading for the source energy use of the building types similar to the district's buildings.

Figure 1
Source Energy Use Intensity Distributions: High Schools



Overall all have source energy use indexes above what is considered a very efficient high school. The schools have recently been renovated with many systems being upgraded to energy efficient systems. It is recommended that the district review its operation strategies as well as review the recommendations in the audit to increase the source energy intensity of its buildings.

C. EPA Energy Benchmarking System

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

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

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

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

User Name: LenapeRegionalHSDistrict
Password: lgeaceg2011

Security Question: What city were you born in?
Security Answer: "Lenape"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 5
Energy Star Performance Summary

ENERGY STAR PERFORMANCE RATING PER FACILITY			
FACILITY	ENERGY STAR PERFORMANCE RATING		
DESCRIPTION	SCORE	AVERAGE	POTENTIAL CERTIFICATIONS
Lenape High School	41	50	N/A
Shawnee High School	25	50	N/A
Cherokee High School	53	50	N/A
Seneca High School	25	50	N/A

See the Appendix C - Statement of Energy Performance for comparative facilities

Score: "N/A" represents facility that could not receive a rating. See Energy Star website for details.

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

V. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

Solar Generation

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

The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The analysis depreciates the value of the SREC over the fifteen year analysis period starting with a value of \$250 per MWH and a minimum value of \$100 per MWH. 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 area and parking lot canopy area potential of the facilities being audited for the purposes of determining a potential for a photovoltaic system. Parking Lot Canopy and Roof Array solar systems were evaluated at all of the facilities. It should be noted a structural analysis of the roofs was not performed as part of this analysis. A depiction of the area utilized at each facility is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. The system sizes are shown below for each building where installation of a solar PV system is feasible. The total KWH production for all facilities combined is 3,084,021 kWh annually, reducing the overall utility bill for the district by approximately twenty percent (20%). A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix** within each facility report. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

Table 6
Renewable Energy Summary

POWER PRODUCTION SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	PRODUCTION SUMMARY		
DESCRIPTION	ELECTRIC PRODUCTION (KWH)	TOTAL FACILITY USE (KWH)	% REDUCTION
Lenape High School	568,613	3,774,322	15%
Shawnee High School	212,094	3,286,078	6%
Cherokee High School	725,922	4,828,822	15%
Seneca High School	1,577,392	3,391,760	47%
Total	3,084,021	15,280,982	20%

The proposed photovoltaic array layout is designed based on the specifications for the Sharp NU-U235F2 panel. This panel has a “DC” rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through 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 or canopy style system area available at each existing facility. Estimated solar array generation is calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array for each facility is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite

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

Direct purchase involves 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 per facility is as follows:

Table 7
Renewable Financial Summary

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	DIRECT PURCHASE FINANCIAL SUMMARY		
DESCRIPTION	INSTALLATION COST (\$)	TOTAL SAVINGS (\$)	INTERNAL RATE OF RETURN
Lenape High School	\$3,093,073	\$289,768	4.6%
Shawnee High School	\$1,083,977	\$62,586	-1.8%
Cherokee High School	\$3,985,840	\$216,386	-2.5%
Seneca High School	\$7,732,559	\$465,464	-1.3%
Total	\$15,895,449	\$1,034,204	

CEG recommends Lenape Regional High School District to review all options available for installation of solar PV systems at their facilities including a Power Purchase Agreement (PPA). This option utilizes providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Arrays to the District at a reduced rate compared to their existing electric rate. 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 the Solar Analysis, Concord Engineering also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on Concord Engineering's review of the applicability of wind energy for the facility, it was determined that the average wind speed of 4.5 to 5.5m/s is not adequate, and available space is very limited for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

VI. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of each of the schools included in the audit. Irregularities in the load profile will indicate potential problems within the facilities. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facilities' energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The electricity usage profile demonstrates both a summer cooling and winter heating load profile. Historical usage is relatively steady throughout the year with an average monthly usage of 1,273,415 kWh across all four schools. The average summer (June - Sept) consumption is 1,294,873 kWh and the average winter (Oct – May) consumption is 1,262,687 kWh. The largest consumption months were September, May, June and September.

The historical usage profile is very beneficial and will allow for more competitive energy prices when shopping for alternative suppliers mainly due to the relatively steady year-long load profile. Third Party Supplier (TPS) electric commodity contracts that offer a firm, fixed price for 100% of the facilities' electric requirements and are lower than the PSE&G or Atlantic City Electric's BGS-FP default rate are recommended.

Natural Gas:

The Natural Gas Usage Profile demonstrates a typical natural gas (heat load) profile. The average winter (Nov-Mar) consumption is 115,870 therms and the average summer (Apr-Oct) consumption is 20,183 therms. The largest consumption months were December, January, and February.

This load profile will yield less favorable natural gas pricing when shopping for alternative suppliers. This is because the higher winter month consumption will yield higher pricing which will not be offset by similar summer month consumption. Nymex commodity pricing is generally higher in the winter months of November – March and lower in the summer months of April – October. Obtaining a flat load profile, (usage is similar each month), will yield optimum natural gas pricing when shopping for alternative suppliers.

Tariff Analysis:

Electricity:

Cherokee and Lenape receive electric distribution service through Public Service Electric & Gas Company (PSE&G) on a Large Power and Light Service rate schedule of LPLS and LPLP.

Seneca and Shawnee receive electric distribution service through Atlantic City Electric (ACE) on an Annual General Service rate schedule of AGS. All facilities are currently contracted with a Third Party Supplier (TPS), South Jersey Energy Company via the ACES Energy Aggregation Program for Schools to provide electric commodity service. For electric supply (generation) service, the client has a choice to either use PSE&G's or ACE's default service rate BGS-FP or contract with a Third Party Supplier (TPS) to supply electric.

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

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

The Auction Process has consisted of two auctions that are held concurrently, one for larger customers on an hourly price plan (BGS-CIEP) and one for smaller commercial and residential customers on a fixed-price plan (BGS-FP). This facility's rate structure is based on the fixed-price plan (BGS-FP). The utility's (PSE&G and ACE) delivery service rate includes the following charges: Customer Service Charge, Distribution Charge (kWh and Demand), Societal Benefits Charge (SBC), and Securitization Transition Charge.

Natural Gas:

Cherokee, Seneca and Shawnee receive natural gas distribution service through South Jersey Gas (SJG) on a General Service Gas – Large Volume (GSG-LV) rate schedule. Lenape receives natural gas distribution service through Public Service Electric and Gas (PSE&G) on a Large Volume Gas (LVG) rate schedule. All facilities are currently contracted with a Third Party Supplier (TPS), Hess Corporation via the ACES Energy Aggregation Program for Schools to provide natural gas commodity service.

SJG and PSE&G both are required to provide basic gas supply service (BGSS) to customers who choose not to shop from a Third Party Supplier (TPS) for natural gas commodity. The option is essential to protect the reliability of service to consumers as well as protecting consumers if a third party supplier defaults or fails to provide commodity service. Please refer to the links below for a recap of natural gas BGSS charges from SJG for rate schedule GSG-LV and PSE&G for rate schedule LVG.

- <http://www.southjerseygas.com/108/tariff/bgssrates.pdf>
- <http://www.pseg.com/companies/pseandg/schedules/pdf/commodity.pdf>

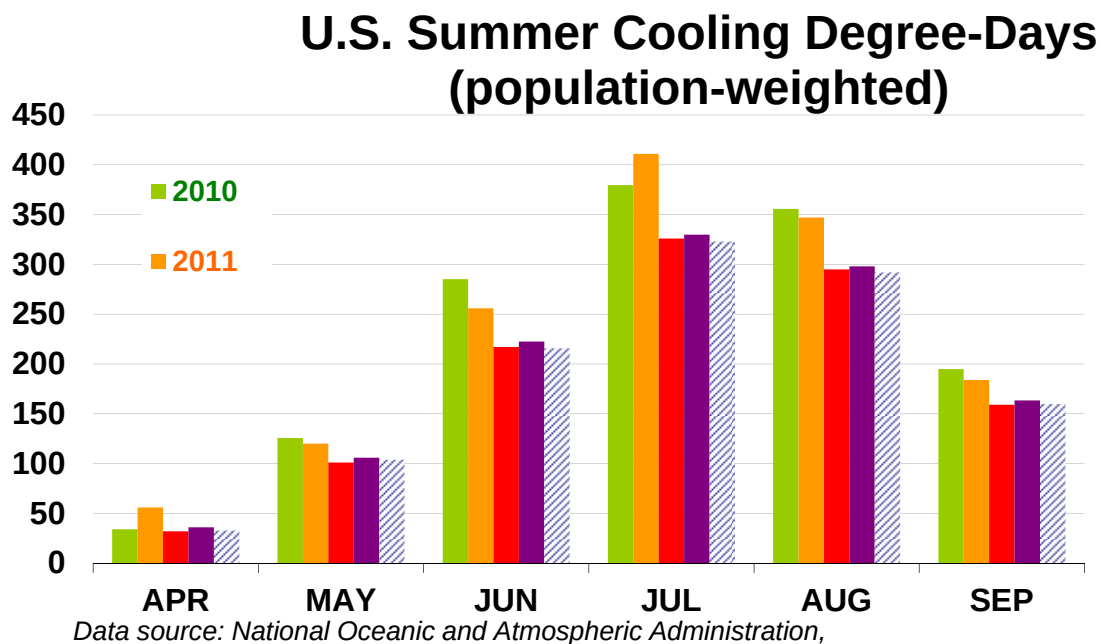
The utilities, SJG and PSE&G, are responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. The SJG and PSE&G

delivery service rates include the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

Electric and Natural Gas Commodities Market Overview:

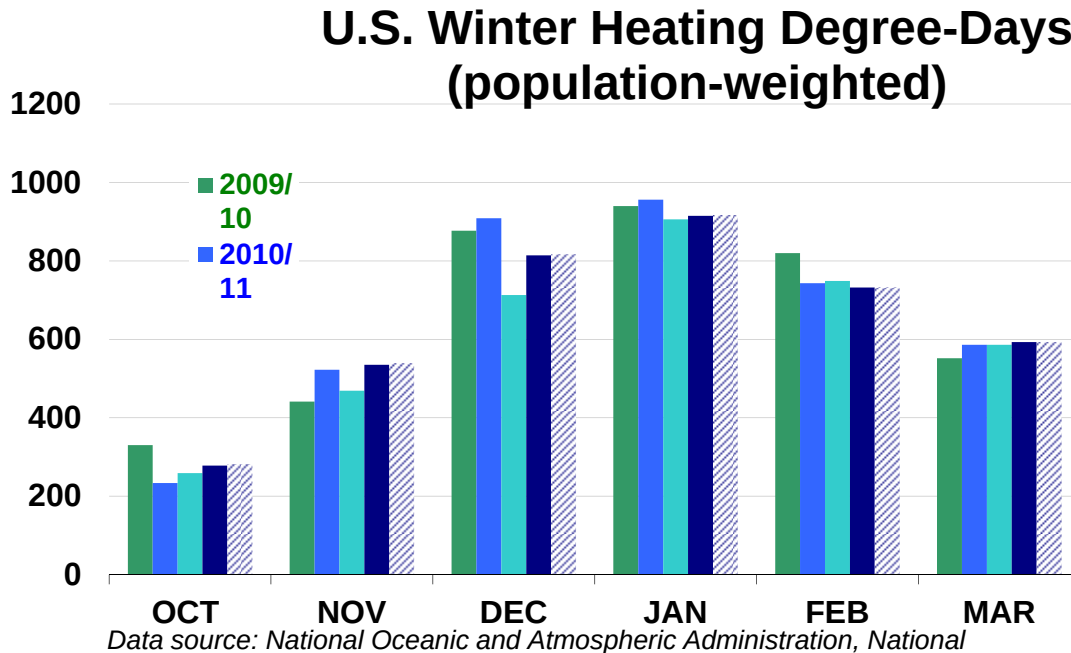
Current electricity and natural gas market pricing has remained relatively stable over the last year. Commodity pricing in 2008 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2011, has decreased dramatically over 2008 historic highs and continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier's for both natural gas and electricity supply requirements.

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



Source: Short-Term Energy Outlook,





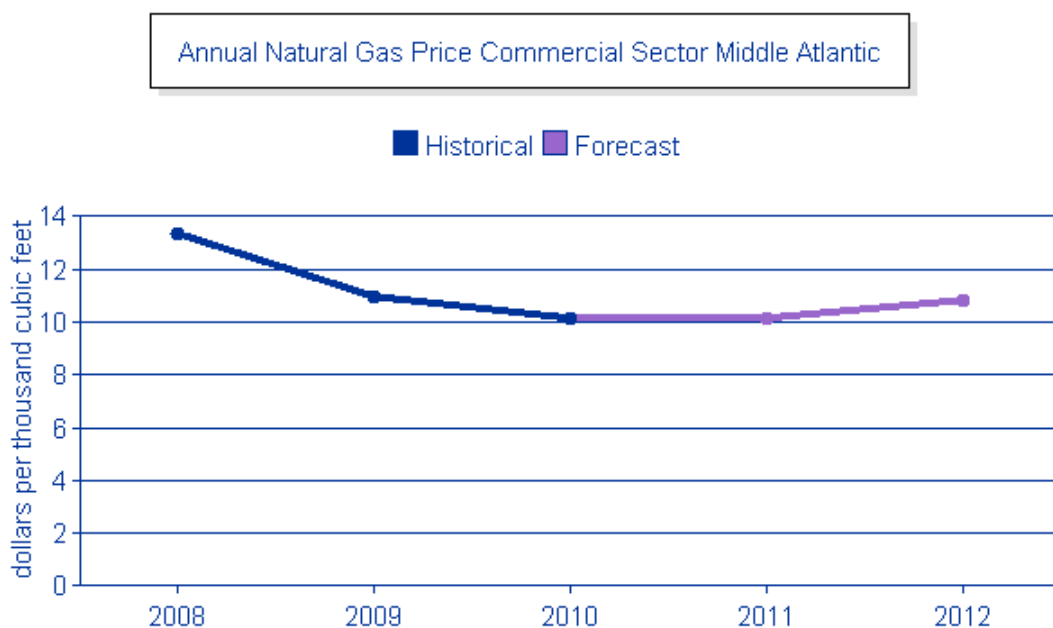
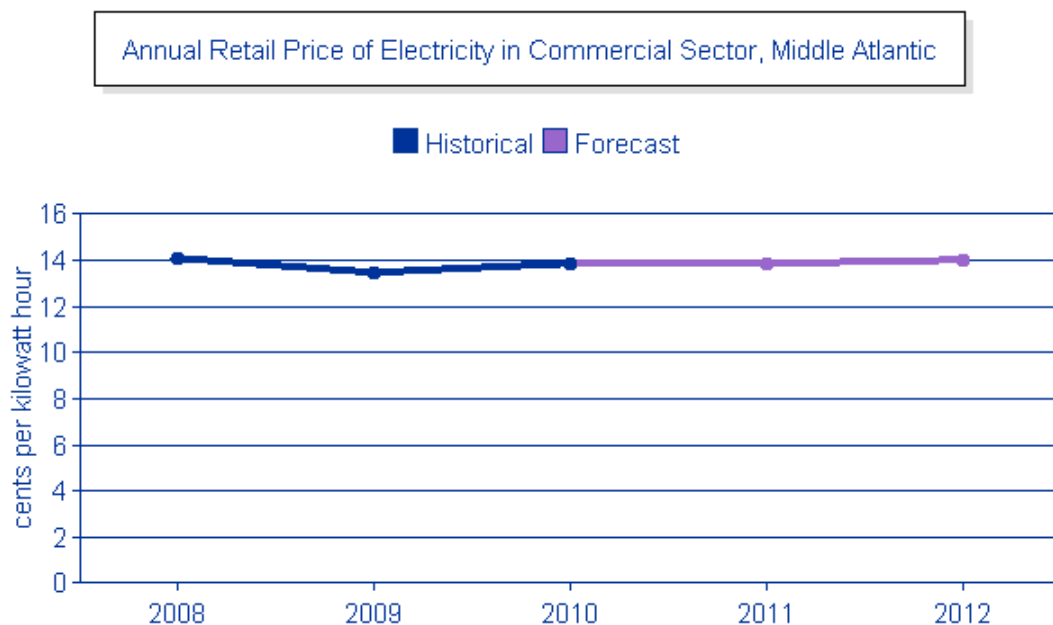
Source: Short-Term Energy Outlook,



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

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

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



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

Recommendations:

1. Concord Engineering recommends a continued account aggregation approach for 3rd party commodity supply procurement strategies for electric supply service as well as natural gas commodity supply service options. Aggregating the usage of all District facilities for electricity and natural gas supply service allows the District to achieve the most beneficial reduction in commodity supply costs. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive and contract terms longer than 12 months are desirable. Contracts due to expire in the near term would continue to yield favorable pricing.
2. Concord Engineering recommends exploring new electricity pricing options that would either extend the existing electric supply contract beyond their current expiration date, or have a new contract price commence upon the expiration date. Concord Engineering also recommends exploring new natural gas pricing options or have a new contract price commence prior to the current contract's expiration date.
3. After review of the utility consumption, billing, third party supply contracts and current commodity pricing outlook, Concord Engineering recommends that District continue their use of their in-house utility billing review and accounting. However, the District should explore the utilization and advisement of a 3rd party unbiased Energy Consulting Firm experienced in the procurement of commodities, New Jersey procurement laws, aggregation of facilities and energy supply risk and commodity management if they wish to explore further utility cost savings opportunities. 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
4. Concord Engineering recommends the District explore an aggregated Demand Response Program that may be available for its facilities. Demand response is the action of end users lowering their demand for electric (reducing consumption) in order to help balance supply and demand on the electric grid and ensure stability. The greatest need for demand response typically occurs during times of peak electricity demand, between the hours of 11 am and 6 pm, when extra strain is placed on the grid from situations such as increased air conditioning use on hot days or downed power lines resulting from a storm. Significant incentives are available for clients enrolled in demand response programs. It

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

The recommendations and projected savings presented by Concord Engineering are based on current information provided by the Lenape Regional High School District for its facilities' utility usage. Any projected savings presented with these recommendations are estimates only based on that information. It is recommended that further analysis and review of more recent utility data and actual Third Party Supplier invoices be performed prior to performing any of the presented recommendations.

VII. INSTALLATION FUNDING OPTIONS

Concord Engineering 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%.

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.

Concord Engineering 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 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 debt. The program requires evaluation to ensure a positive cash-flow through the entire 15 year financing period. The first phase of implementing an ESIP is the development of an Energy Savings Plan (ESP) to verify the energy savings, construction costs, and overall financial model.

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

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

Table 8
ESIP -Total Entity Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Lenape High School	\$66,742	\$303,121	\$33,273	\$269,848	4.0
Shawnee High School	\$19,765	\$121,139	\$4,909	\$116,230	5.9
Cherokee High School	\$48,445	\$366,939	\$18,315	\$348,624	7.2
Seneca High School	\$29,572	\$257,542	\$16,500	\$241,042	8.2
Total Entity Project	\$164,524	\$1,048,741	\$72,997	\$975,743	5.9
Total Entity Energy Costs:			\$2,396,539		
Est. Total Entity Energy Savings:			\$164,524		
Overall Entity Percent Reduction:			6.9%		

VIII. ENERGY AUDIT ASSUMPTIONS

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

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