LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

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I. EXECUTIVE SUMMARY

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

Entity: Millstone Twp. Board of Education

Facilities: Millstone Elementary School
Millstone Middle School
Millstone Primary School

Municipal Contact Person: Bernard Biesiada, School Business Administrator
Facility Contact Person: Keith Buckalew, Supervisor of Buildings & Grounds

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

The Energy Conservation Measures (ECMs) identified within the report represents the potential annual savings at the facilities. It is recommended to consider all ECMs as part of the District's initiative to save energy, reduce emissions, and lower operating costs. Concord Engineering recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. All of the ECM's presented in this report have been categorized into three groups defined as Short-term (or Fast) Paybacks ranging from 0 to 5 years, Medium-term Paybacks ranging from 5 to 10 years, and Long-term Paybacks of over 10 years to assist the District in prioritizing projects.

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 lying 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.

ENERGY CONSERVATION MEASURE (ECM) SUMMARY LIST			
ENERGY CONSERVATION MEASURES LIST	**Millstone Elementary School**	**Millstone Middle School**	**Millstone Primary School**
General Lighting Upgrade	S		S
General Lighting Controls Upgrade	M	S	S
Cafeteria/Gym Lighting Upgrade	S		S
Cafeteria/Gym Lighting Controls Upgrade	M		S
Exterior Lighting Upgrade	S		
AC Unit Upgrades	L		
Set Computers to Automatic Stand-by or Hibernate Modes	S		
Valve Blanket Insulation	L		
Domestic Water VFD Skid		M	
NEMA Premium Motor Upgrades			L
VFD on Hot Water Pumps			L
Vending Miser Controls			S
Energy Star Refrigerator Replacement			L
Kitchen Domestic Gas Booster Heater			L
Domestic Hot Water Heater Upgrade			L
Solar Photovoltaic System	L	L	L
TOTAL	**9**	**4**	**11**
COMMENTS	1)ECM's are catagorized 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. 2)ECM's not inlcuded in the ESIP project are grayed out.		

Renewable Energy Conservation Measures:

Renewable Energy Measures (REMs) were also reviewed for implementation at all of the facilities in the Millstone Township School District. Concord Engineering utilized a combination of roof mounted solar arrays and canopy style parking lot solar arrays to house PV systems throughout the District's buildings. The District's facilities have a total estimated solar system potential of 1,205 kW DC that could generate 1,373,236 kilowatt-hours annually offsetting 52% of the total energy purchased from the grid. The system's calculated simple payback of 16.8 years is not within 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 electric and gas, Concord Engineering recommends they continue to purchase their electric and gas commodity through a third party supplier once the current contract has expired. Further recommendations are outlined in the Energy Procurement Section of this report that could assist the District in finding additional savings through their utility bills.

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 over time. However, the maintenance items and small operational improvements below are typically achievable with on-site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building, further recommendations per building our provided in the building reports:

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 windows and doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Verify all control systems are utilizing setback and scheduling capabilities.
6. 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.

Implementation Strategy Moving Forward:

It is recommended the District strongly consider all projects with a simple payback of ten years and under for implementation. However consideration should be taken on projects over ten years as they may be necessary capital improvements. The District should also consider pursuing any and all additional NJ Clean Energy Programs in order to receive the maximum incentives available.

Furthermore, 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 the District with the opportunity to implement many of the ECMs identified within this report with an overall simple payback of 14 years. (See grey highlighted entries in ECM table above for included recommendations) The program financing allows for the implementation with little to no upfront cost for the District. Implementation of an ESIP provides significant benefits and should be strongly considered. The District should also keep in mind that interest in utilizing the ESIP program should be combined with incentive programs such as NJ Smart Start and Direct Install in order to help offset the total project costs with incentives in order to try and include longer payback (or "capital") improvements that could not otherwise be performed. The Total Entity Project Summary table below shows the savings, costs, incentives and paybacks for all ECMs at each facility. (Note: Renewable Energy Measures are not included in this summary table). It is recommended the District review all Facility ECM's to achieve the most effective ESIP plan moving forward.)

Table 1
ESIP -Total Entity Project Summary

COMBINED POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Millstone Elementary School	$18,946	$124,229	$7,160	$117,069	6.2
Millstone Middle School	$7,704	$51,491	$60	$51,431	6.7
Millstone Primary School	$15,426	$237,156	$3,355	$233,801	15.2
Total Entity Project	**$42,076**	**$412,876**	**$10,575**	**$402,301**	**9.6**

Total Entity Energy Costs:	**$454,424**
Est. Total Entity Energy Savings:	**$42,076**
Overall Entity Percent Reduction:	**9.3%**

Overall Assessment:

Based on the analysis conducted, Millstone Elementary School has above average operating costs (utility) when compared to facilities of similar occupancy and use. Other schools in the district such as Millstone Middle School and Millstone Primary School on the other hand, have site and source energy rating which are much lower than the average among similar facilities. For example, in regards to operating efficiencies, the Millstone Elementary School is 11% less efficient because it consumes more energy per square foot than similar facilities. Through the energy audit surveys and creation of the major equipment list by facility some of the typical reasons that energy costs can be average are operational deficiencies due to equipment exceeding its service life and not operating at 100% or not being optimally controlled. With this being said, the District can continue their push towards energy efficiency by reviewing the future implementation of the recommended ECMs noted in this report. The implementation of the recommended measures will further reduce energy use, save on the overall facilities' operating costs and replace much needed major equipment exceeding its useful life. The total energy cost of $454,424 could be reduced by approximately 9.3% through the implementation of the ECMs recommended in this audit utilizing the combined approach detailed in the **ESIP - Total Entity Project Summary** table. Since the total project is capable of being funded through the savings, Concord Engineering highly recommends the District take advantage of this opportunity and utilize one of the recommended funding options. The District should also review additional conventional funding opportunities for these projects and determine which option fits the District's budget most positively in the short term and the future.

Samplings of the large capital projects noted in the combined project approach consist of domestic hot water replacement and variable speed drives on the hot water pumps at the Primary School. Other projects that are included in the combined project are:

- Lighting and Lighting Controls Upgrades
- Set Computers to Automatic Stand-by or Hibernate Modes
- NEMA Premium Motor Replacements
- Vending Miser Controls

On the whole, Concord Engineering recommends the implementation and further review of the above-noted projects contained in the combined project approach by the District. With the implementation of the projects, the District can continue towards its goal of gaining energy efficiency and providing suitable learning environments for its students.

II. INTRODUCTION

The comprehensive energy audit covers the following buildings in Millstone Township BOE:

- Millstone Elementary School
- Millstone Middle School
- Millstone Primary School

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

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

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

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

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

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)

- Lighting systems and controls
- Facility-specific equipment

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

III. METHOD OF ANALYSIS

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

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved.

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

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

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

ECM Calculation Equations:

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

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

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

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

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

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

Net Present Value calculations 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)**
Millstone Elementary School	690,990	$97,445	$0.141
Millstone Middle School	1,198,800	$158,703	$0.132
Millstone Primary School	751,360	$107,049	$0.142
Total	**2,641,150**	**$363,198**	**$0.14**

Table 3
Natural Gas Summary

NATURAL GAS UTILTY USAGE PER FACILITY			
FACILITY	**ANNUAL NATURAL GAS UTILITY**		
DESCRIPTION	**USAGE (THERMS)**	**COST ($)**	**AVE RATE ($/THERM)**
Millstone Elementary School	24,939	$23,785	$0.95
Millstone Middle School	45,511	$40,215	$0.88
Millstone Primary School	29,635	$27,226	$0.92
Total	**100,085**	**$91,226**	**$0.91**

B. Energy Use Index (EUI)

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

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

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

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

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

Table 4
Energy Use Index Summary

ENERGY USE INDEX PER FACILITY			
FACILITY	**BUILDING AREA**	**ENERGY USE INDEX**	
DESCRIPTION	**(SF)**	**SITE (KBTU/SF/YR)**	**SOURCE (KBTU/SF/YR)**
Millstone Elementary School	59,495	82	176
Millstone Middle School	133,009	65	139
Millstone Primary School	82,000	67	142
Total	274,504		

Figures 1 and 2 below depict a national EUI grading for the source energy use of various building types similar to the buildings at Millstone Twp. Public Schools.

Figure 1
Source Energy Use Intensity Distributions: Elementary School

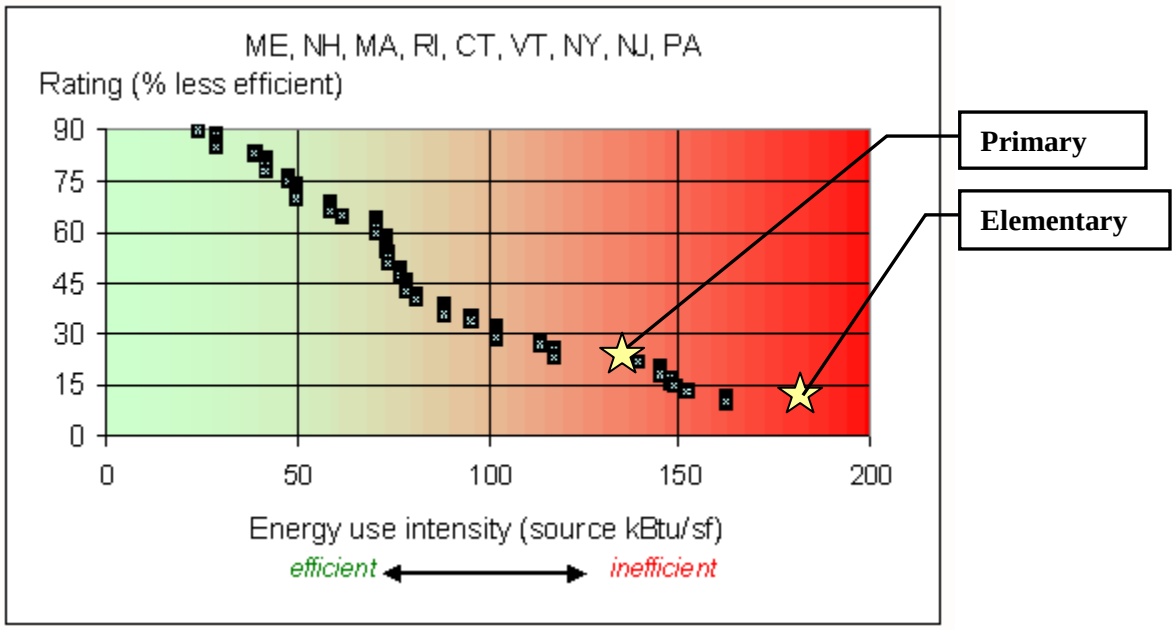
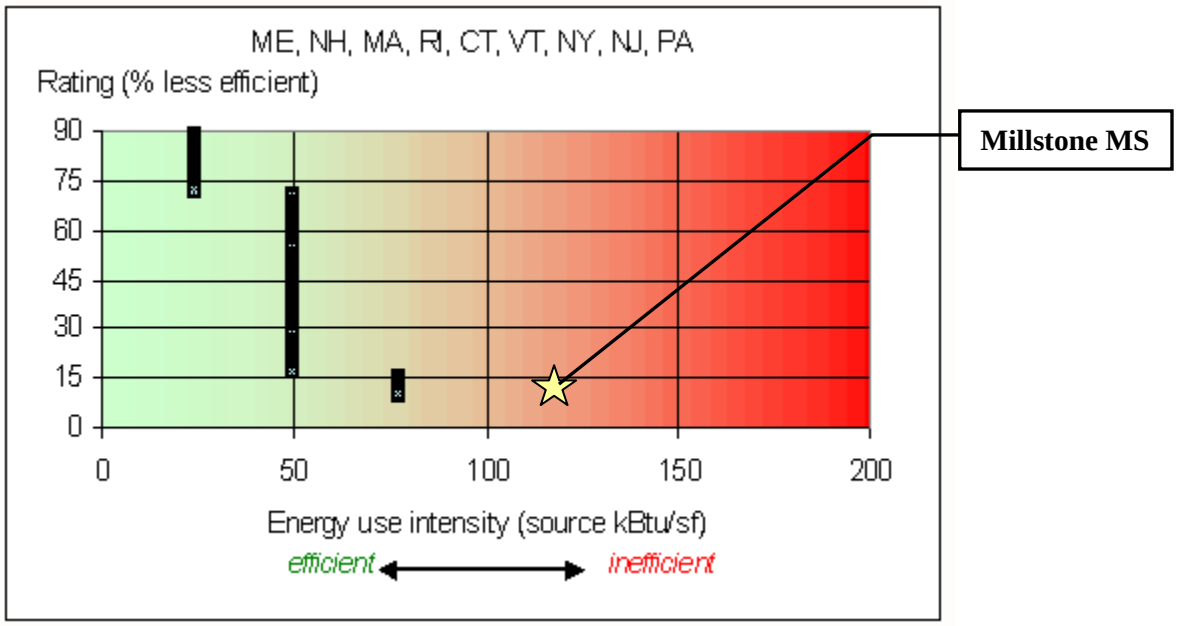


Figure 2
Source Energy Use Intensity Distributions: High School & Middle School



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:	Millstonetwpboe
Password:	lgeaceg2012
Security Question:	What city were you born in?
Security Answer:	"Millstone"

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**
Millstone Elementary School	25	50	N/A
Millstone Middle School	67	50	N/A
Millstone Primary School	52	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. Concord Engineering has assessed the feasibility of installing renewable energy measures (REM) for the District 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. Lastly, large areas of open land can be utilized for the installation of solar arrays by means of a ground mount system.

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 value of the credit varies upon the current need of the power companies. The average value per credit used in our financial calculations is $350 per MWH. This equates to $0.35 per kWh generated.

Concord Engineering has reviewed all of the facilities for applicability to install solar on roof, ground, or on parking lot canopies. The following table describes our findings for each building's potential system size, further information regarding locations of arrays and defined arrays can be found in each building's report.

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 1,373,236 kWh annually, reducing the overall utility bill for the District by approximately 52% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix** within each facility report. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

Table 6
Renewable Energy Summary

POWER PRODUCTION SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	**PRODUCTION SUMMARY**		
DESCRIPTION	**SYSTEM SIZE (KW_{DC})**	**ELECTRIC PRODUCTION (KWH)**	**% REDUCTION**
Millstone Elementary School	206.57	236,767	34.3%
Millstone Middle School	641.55	728,142	60.7%
Millstone Primary School	356.50	408,327	54.3%
Total	**1,205**	**1,373,236**	52%

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 235 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 mount system area 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 Millstone School District paying for 100% of the total project cost upfront in lieu of one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. The financial summary per facility is as follows:

Table 7
Renewable Financial Summary

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	**DIRECT PURCHASE FINANCIAL SUMMARY**		
DESCRIPTION	**INSTALATION COST ($)**	**TOTAL SAVINGS ($)**	**INTERNAL RATE OF RETURN**
Millstone Elementary School	$1,312,270	$78,627	-1.31%
Millstone Middle School	$4,046,629	$235,251	-1.66%
Millstone Primary School	$2,236,351	$136,007	-1.13%
Total	**$7,595,250**	**$449,886**	

Given the large amount of capital required by the District to invest in a solar system through a Direct Purchase Concord does not recommend pursuing this route. It would be more advantageous for the District to solicit Power Purchase Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by the Solar Arrays to the District at a reduced rate compared to their existing electric rate. Concord has performed a preliminary analysis that shows the potential benefits to the District in reduced electric pricing over the life of the

agreement. It is estimated that the District could potentially see a reduction in electric rate from 10% to 30% and thus the analysis performed shows three alternative pricing elements based on a 2 cent, 4 cent, and 5 cent rate reduction. The following table shows the potential year 1 and total 15 year electric cost savings for each of these alternative prices.

Wind Generation

In addition to the Solar Analysis, Concord Engineering also conducted a review of the applicability of wind energy for the District. 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. 5.0 m/s is not adequate enough to make wind an economically viable option for the District to pursue.

VI. 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 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 a steady year-long load profile with higher consumption in the winter. The average monthly consumption for all accounts combined is 220,096 kWh. The average monthly winter consumption (October – May) is 231,553 kWh and the average monthly summer consumption (June-July) is 197,180 kWh.

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 flat load profile and higher winter load profile. Third Party Supplier (TPS) electric commodity contracts that offer's a firm, fixed price for 100% of the facilities electric requirements and are lower than the JCPL's BGS-FP default rate are recommended.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile for all facilities. The average monthly usage for all accounts combined is 8,340 therms. The average monthly winter (Nov-Mar) consumption is 14,670 therms and the average monthly summer (Apr-Oct) consumption is 3,819 therms.

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

Third Party Supplier (TPS) natural gas commodity contracts that offer a product structure to include either 1) a fixed basis rate with a market based Nymex/commodity rate or 2) a fixed basis rate with fixed Nymex/commodity winter rate (Nov – March) and market based Nymex/commodity rate for the summer months (April – October) for 100% of the facilities **metered** natural gas requirements are both recommended due to current market pricing.

Tariff Analysis:

Electricity:

All facilities receive electrical service through JCP&L's rate tariff, General Service Secondary (GS). All facilities have contracted with a Third Party Supplier (TPS), Direct Energy to provide electric commodity service. For electric supply (generation) service, the client has a choice to either use JCP&L's default service rate BGS-FP or contract with a Third Party Supplier (TPS) to supply electricity. The Supplier's contract particulars to include the product structure, price, term and conditions were not available for review or comments.

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

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

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

The utility, JCP&L will continue to be responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. JCP&L's Delivery Service rate includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI.

Natural Gas:

The facilities currently receive natural gas distribution service through Public Service Gas & Electric (PSE&G) on rate schedule LVG (Large Volume Gas). It has been noted that the facilities have contracted with a Third Party Supplier (TPS) to provide natural gas commodity service. The Supplier's contracts particulars to include the product structure, price, term and conditions were not available for review or comments. For natural gas supply service, the client has a choice to either use PSE&G's default service rate BGSS or contract with a Third Party Supplier (TPS) to supply natural gas commodity service.

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

defaults or fails to provide commodity service. Please refer to the link below for a recap of natural gas BGSS charges from PSE&G.
http://www.pseg.com/companies/pseandg/schedules/pdf/commodity.pdf

The utilities 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. PSE&G and SJG's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

Electric and Natural Gas Commodities Market Overview:

Current electricity and natural gas market pricing has remained relatively stable over the last year. Commodity pricing in 2008 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2012, has decreased dramatically over 2008 historic highs and continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier's for both natural gas and electricity supply requirements.

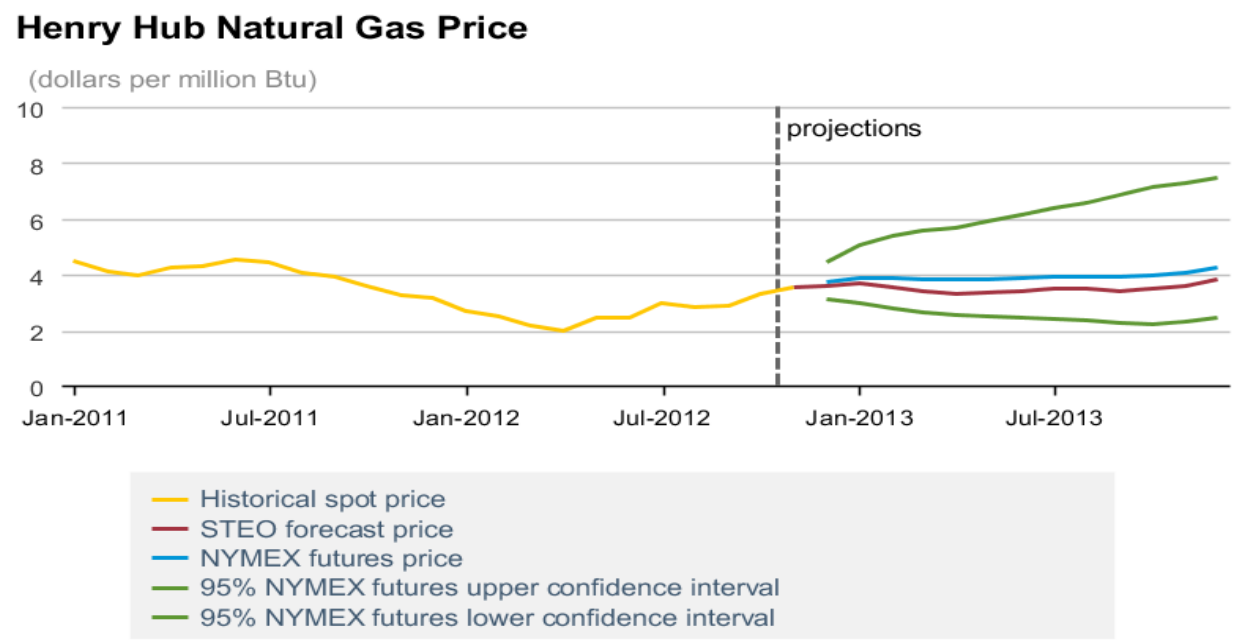
It is important to note that both natural gas and electric commodity market prices are moved by supply and demand, political conditions, market technicals and trader sentiment. This market is continuously changing. Energy commodity pricing is also correlated to weather forecasts. Because weather forecasts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

Short Term Energy Outlook - US Energy Information Administration (November 6, 2012):

Natural Gas

Natural gas spot prices averaged $3.31 per MMBtu at the Henry Hub in October 2012, up $0.46 per MMBtu from the September 2012 average and $0.25 per MMBtu less than the October 2011 average. EIA expects the Henry Hub natural gas price will average $2.77 per MMBtu in 2012 and $3.49 per MMBtu in 2013, increases of $0.06 per MMBtu in 2012 and $0.14 per MMBtu in 2013 from last month's Outlook.

Natural gas futures prices for February 2013 delivery (for the five-day period ending November 1, 2012) averaged $3.86 per MMBtu. Current options and futures prices imply that market participants place the lower and upper bounds for the 95-percent confidence interval for February 2013 contracts at $2.76 per MMBtu and $5.39 per MMBtu, respectively. At this time last year, the February 2012 natural gas futures contract averaged $3.97 per MMBtu and the corresponding lower and upper limits of the 95-percent confidence interval were $2.89 per MMBtu and $5.45 per MMBtu.

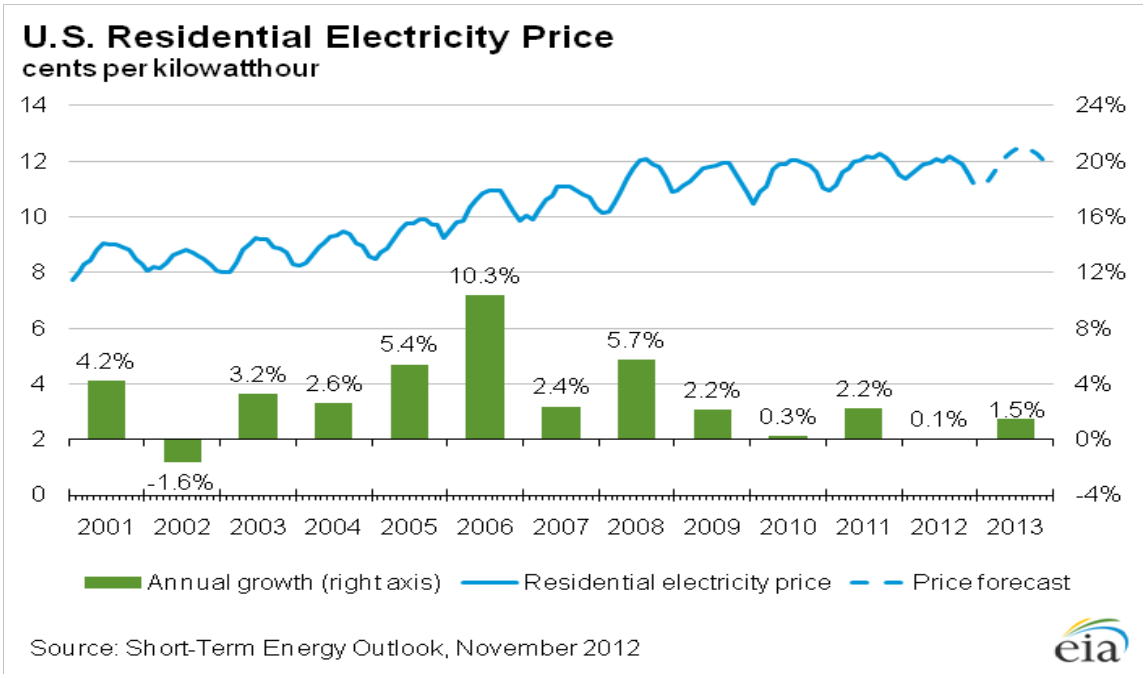


eia Source: Short-Term Energy Outlook, November 2012

Note: Confidence interval derived from options market information for the 5 trading days ending November 1, 2012. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Electricity

EIA expects the nominal U.S. residential electricity price will rise by just 0.1 percent during 2012, which would be the smallest year-over-year increase in ten years. Residential prices during 2013 are projected to rise by 1.5 percent to an average of 11.98 cents per kilowatthour.



The below recommendations presented by CEG are based on current information provided by the Board of Education for the school facilities utility usage and billings. Any savings presented with these recommendations are estimates only based on that information. ***It is highly recommended that further analysis and review of more recent utility data and actual current TPS contracts be performed prior to performing any of the presented recommendations.***

Recommendations:

1. CEG recommends an aggregated approach for 3rd party commodity supply procurement strategies for both electric and natural gas supply service. Aggregating the usage of all school facilities accounts for electricity and natural gas supply service, would allow the facilities to achieve a 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. It is important to aggregate usage where available and take advantage of these current market prices quickly, before energy increases.

   Overall, after review of the utility consumption, billing, and current commodity pricing outlook, CEG recommends that the facilities either hire a New Jersey licensed Energy Agent or participate in an energy supply aggregation group for both electricity and natural gas supply service for all facilities. Many licensed Energy Agents allow their fee to be rolled into the 3rd party supplier agreement so that the BOE does not have any out of pocket expenses. Most aggregation groups utilize the advisement of a 3rd party unbiased Energy Consulting Firm experienced in the aggregation of and procurement of retail electricity and natural gas commodity. It is important to note that the Energy Consulting Firm should incorporate a rational, defensible strategy for purchasing commodity in volatile markets based upon the following:

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

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

CEG recommends that the BOE explore Demand Response Programs that may be available in aggregate for its facilities. Demand response is the action of end users lowering their demand for electric (reducing consumption) in order to help balance supply and demand on the electric grid and ensure stability. The greatest need for demand response typically occurs during times of peak electricity demand, between the hours of 11 am and 6 pm, when extra strain is placed on the grid from situations such as increased air conditioning use on hot days or downed power lines resulting from a storm. Significant incentives are available for clients enrolled in demand response programs. It is strongly recommended that the BOE utilize an experienced 3rd party unbiased energy consulting firm prior to initiating any demand response RFP's and/or 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.

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 (15) years for energy purchase contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

Energy Savings Improvement Program (ESIP):

Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources. This program provides public entities to make valuable facility infrastructure improvements that are associated with energy savings. All energy savings projects are eligible as long as the financing period does not extend beyond 15 years. The financing can be utilized for all aspects of energy efficiency project implementation including, energy savings plan development, engineering, construction management, construction management, commissioning, and measurement and verification.

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

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

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

Table 8
ESIP -Total Entity Project Summary

COMBINED POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Millstone Elementary School	$18,946	$124,229	$7,160	$117,069	6.2
Millstone Middle School	$7,704	$51,491	$60	$51,431	6.7
Millstone Primary School	$15,426	$237,156	$3,355	$233,801	15.2
Total Entity Project	**$42,076**	**$412,876**	**$10,575**	**$402,301**	**9.6**

Total Entity Energy Costs:	**$454,424**
Est. Total Entity Energy Savings:	**$42,076**
Overall Entity Percent Reduction:	**9.3%**

VIII. ENERGY AUDIT ASSUMPTIONS

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

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