



LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR: **OLD BRIDGE TOWNSHIP
MUNICIPAL COMPLEX
ONE OLD BRIDGE PLAZA
OLD BRIDGE, NJ 08857
ATTN: MR. JEROME PREVETE**

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

CONCORD
ENGINEERING
WWW.CONCORD-ENGINEERING.COM

CEG CONTACT: **WILLIAM CONLEY, P.E.
MECHANICAL ENGINEER
EMAIL: WCONLEY@CONCORD-ENGINEERING.COM**

REPORT ISSUANCE: **NOVEMBER 6, 2012**

PROJECT No: **9C12048**

TABLE OF CONTENTS

I.	EXECUTIVE SUMMARY	3
II.	INTRODUCTION	9
III.	METHOD OF ANALYSIS.....	11
IV.	HISTORIC ENERGY CONSUMPTION/COST.....	13
	A. ENERGY USAGE	13
	B. ENERGY USE INDEX (EUI).....	14
	C. EPA ENERGY BENCHMARKING SYSTEM.....	16
V.	RENEWABLE/DISTRIBUTED ENERGY MEASURES	18
VI.	ENERGY PURCHASING AND PROCUREMENT STRATEGY	22
VII.	INSTALLATION FUNDING OPTIONS.....	28
	A. INCENTIVE PROGRAMS.....	28
	B. FINANCING OPTIONS	31
VIII.	ENERGY AUDIT ASSUMPTIONS	33

Enclosures:

Document 1 – Municipal Complex (Administration Building, Recreation Center, Senior Center,
Code Official Building and Department of Public Works Building)

Document 2 – Library

Document 3 – Ice Rink

REPORT DISCLAIMER

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

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

I. EXECUTIVE SUMMARY

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

Entity: Old Bridge Township

Facilities: Municipal Complex (incl. Administration Building, Recreation Center, Senior Center, Code Official Building and Department of Public Works Building)
Library
Ice Rink Arena

Municipal Contact Person: Jerome Prevete, Township Representative

Facility Contact Person: Alex Tucciarone, Construction Official

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program for Old Bridge Township Municipal facilities. The purpose of this analysis is to provide the Township insight into the energy savings potential that exists within facilities at the Municipal Complex. Energy Efficiency changes and upgrades requires support from the building occupants, operations personnel and the administrators of the Township 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 Old Bridge Township Municipal Complex.

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 Township's initiative to save energy, reduce emissions, and lower operating costs. Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. 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 Township 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 Township. 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 Township 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 Township. 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 Township wishes to move forward with an Energy Savings Improvement Program where these projects could be included that program

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

Old Bridge Township Municipal Complex					
ENERGY CONSERVATION MEASURES LIST					
	Municipal Complex	Library	Ice Rink		
Lighting Upgrade	S	S	M		
Lighting Controls Upgrade	S	M	S		
Domestic Hot Water Heater Upgrade	L		L		
Radiant Heating System	M				
DDC System Upgrade	M	L	L		
Boiler Upgrade	L	L	L		
Chiller Replacement	L				
Split system/ Rooftop Replacement	L	L			
Walk-in Cooler Controls	M				
Solar Photovoltaic System	L	L	L		
TOTAL	10	6	6		
COMMENTS	1) 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. 2) Grey ECM boxes indicate that the ECM is included in the ESIP summary.				

Renewable Energy Conservation Measures:

Renewable Energy Measures (REMs) were also reviewed for implementation at all of the facilities at the Municipal Complex. CEG utilized a combination of roof mounted solar arrays to house PV systems throughout the buildings. The Township's facilities have a total estimated solar system potential of 505.1 kW DC that could generate 639,581 kilowatt-hours annually offsetting 17% of the total energy purchased from the grid. The system's calculated simple payback of 9.37 years is within the standard 10 year simple payback threshold; in addition, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options available with the implementation of this renewable energy measure.

Energy Procurement Recommendations:

The Township is currently contracted with a third party supplier for electric on only one of their accounts. This is the account that serves the Administration Building, Recreation Center and Senior Center at the Municipal Complex. CEG recommends they continue to purchase their

electric through a third party supplier once the current contract has expired in addition to adding the other facilities within the complex. CEG also recommends the township pursue contracting with a third party supplier for natural gas service at each of the facilities. Further recommendations are outlined in the Energy Procurement Section of this report that could assist the Township 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 are 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 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 Township 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 Township 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 Township with the opportunity to implement many of the ECMs identified within this report with an overall simple payback of 12.3 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 Township. Implementation of an ESIP provides significant benefits and should be strongly considered. The Township 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 Township review all Facility ECM’s to achieve the most effective ESIP plan moving forward.)

Table 1
ESIP -Total Entity Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Municipal Complex	\$93,143	\$925,926	\$23,288	\$902,638	9.7
Library	\$37,757	\$560,382	\$13,152	\$547,230	14.5
Ice Rink	\$11,903	\$278,489	\$4,723	\$273,766	23.0
Total Entity Project	\$142,803	\$1,764,797	\$41,163	\$1,723,634	12.1

Total Entity Energy Costs:	\$566,114
Est. Total Entity Energy Savings:	\$142,803
Overall Entity Percent Reduction:	25.2%

Overall Assessment:

Based on the analysis conducted, the overall electrical consumption of the facilities is about average when compared to facilities of similar occupancy and use. However, the natural gas usage reported on the gas bills provided to CEG during this audit process for the administration building and central plant seems to be exceptionally low for facilities that utilize gas fired heating equipment (i.e boilers). The electrical and gas usage of the Library and the Ice Rink are average when compared to facilities of similar occupancy and use. 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 Township 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 \$566,114 could be reduced by approximately 25.2% 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, CEG highly recommends the Township take advantage of this opportunity and utilize one of the recommended funding options. The Township should also review additional conventional funding opportunities for these projects and determine which option fits the Township's budget most positively in the short term and the future.

A sampling of the large capital projects noted in the combined project approach consists of the DDC controls upgrades, the boiler upgrades, and rooftop replacement project at the library throughout the facilities. These projects would be in addition to the lighting and lighting controls upgrades at all of the facilities.

On the whole, CEG recommends the implementation and further review of the above-noted projects contained in the combined project approach by the Township. With the implementation of the projects, the Township can continue towards its goal of gaining energy efficiency.

II. INTRODUCTION

The comprehensive energy audit covers the following buildings in Old Bridge Township:

- Municipal Complex (incl. Administration Building, Recreation Center, Senior Center, Code Official Building and Department of Public Works Building)
- Library
- Ice Rink Arena

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)
Municipal Complex	2,824,538	\$372,386	\$0.13
Library	610,560	\$98,634	\$0.16
Ice Rink	436,960	\$52,886	\$0.12
Total	3,872,058	523,905	\$0.14

Table 3
Natural Gas Summary

NATURAL GAS UTILITY USAGE PER FACILITY			
FACILITY	ANNUAL NATURAL GAS UTILITY		
DESCRIPTION	USAGE (THERMS)	COST (\$)	AVE RATE (\$/THERM)
Municipal Complex	17,746	\$20,070	\$1.13
Library	6,868	\$7,986	\$1.16
Ice Rink	13,180	\$14,152	\$1.07
Total	37,793	42,209	\$1.12

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

ENERGY USE INDEX PER FACILITY			
FACILITY	BUILDING AREA	ENERGY USE INDEX	
DESCRIPTION	(SF)	SITE (KBTU/SF/YR)	SOURCE (KBTU/SF/YR)
Municipal Complex	122,600	93	278
Library	52,000	53	148
Ice Rink	31,250	90	204
Total:	205,850		

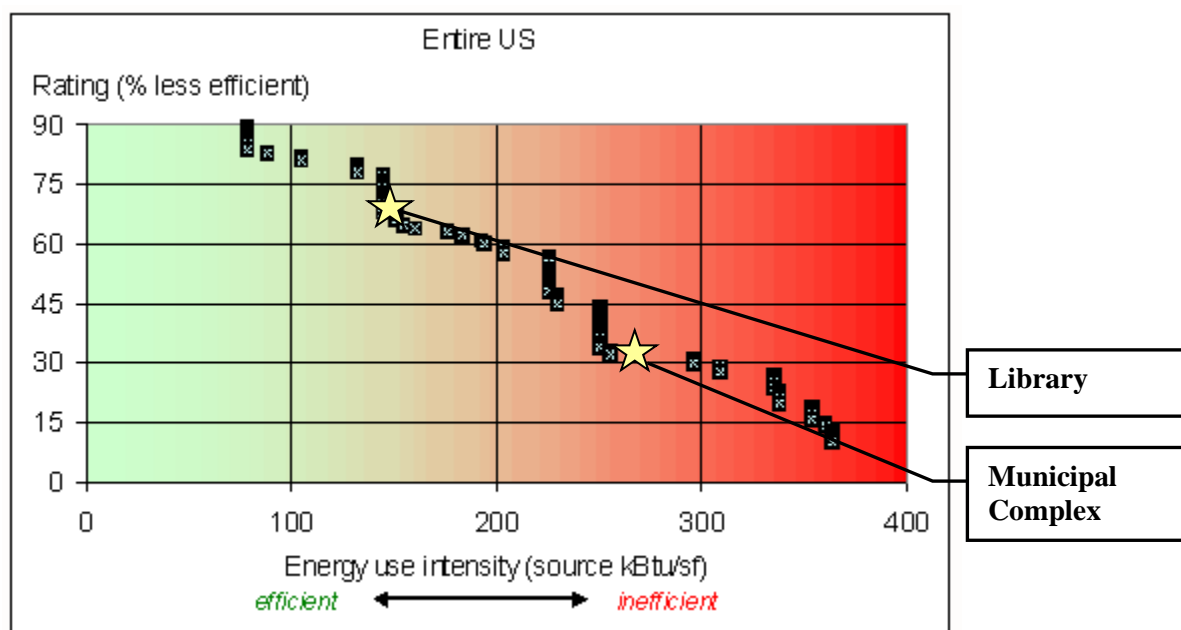
See the Appendix C - Statement of Energy Performance for comparason to other facilities
Highlighted areas are estimated.

x

Summary

Figures 1 below depict a national EUI grading for the source energy use of the various buildings at Old Bridge Township Municipal Complex.

Figure 1
Source Energy Use Intensity Distributions



C. EPA Energy Benchmarking System

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

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

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

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

User Name: Oldbridgetwp2012

Password: lgeaceg2012

Security Question: What city were you born in?

Security Answer: "oldbridge"

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
Municipal Complex	N/A	50	N/A
Library	N/A	50	N/A
Ice Rink	N/A	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 Township 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.

CEG 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 639,581 kWh annually, reducing the overall utility bill for the Township by approximately 17% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix** within each facility report. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

Table 6
Renewable Energy Summary

POWER PRODUCTION SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	PRODUCTION SUMMARY		
DESCRIPTION	ELECTRIC PRODUCTION (KWH)	TOTAL FACILITY USE (KWH)	% REDUCTION
Municipal Complex	324,354	2,824,538	11%
Library	114,255	610,560	19%
Ice Rink	200,972	436,960	46%
Total	639,581	3,872,058	17%

The proposed photovoltaic array layouts are 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 not generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Direct purchase involves Old Bridge Township 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
Municipal Complex	\$1,530,464	\$162,712	6.4%
Library	\$563,005	\$62,566	7.2%
Ice Rink	\$973,892	\$101,814	6.2%
Total	\$3,067,361	\$327,092	

Given the large amount of capital required by the Township to invest in a solar system through a Direct Purchase Concord does not recommend pursuing this route. It would be more advantageous for the Township 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 Township at a reduced rate compared to their existing electric rate.

Wind Generation

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the Township. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed of 5.0 m/s is not adequate enough to make wind an economically viable option for the Township to pursue.

VI. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

A 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. For this report, the facility's energy consumption data was gathered from the Township and presented 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 Overview:

The electricity usage profile demonstrates a steady year-long load profile for the facilities that have occupancy during the summer months. The average monthly usage for all accounts combined is 322,672 kWh.

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

Natural Gas Overview:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months have low consumption. The average monthly winter (Nov-Mar) consumption is 5,658 therms and the average monthly summer (Apr-Oct) consumption is 1,357 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 of the facilities currently receive electric distribution service through JCP&L on rate schedule GSS (General Service Secondary – 3 Phase) and Outdoor Lighting Service. Only the account that services the Administration Building, Senior Center and Recreation Center currently have a Third Party Supplier (TPS) to provide electric commodity service in lieu of Basic Generation Service from the utility. For electric supply (basic generation) service, the client has a choice to either use JCP&L'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, 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.

Natural Gas:

All facilities currently receive natural gas service through Public Service Gas & Electric Company (PSE&G), on rate schedule LVG (Large Volume Gas) and GSG (General Service Gas). The facilities currently do not receive natural gas supply service from a Third Party Supplier. 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.

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.

The utility, PSE&G is 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 natural gas from.

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 2010 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.

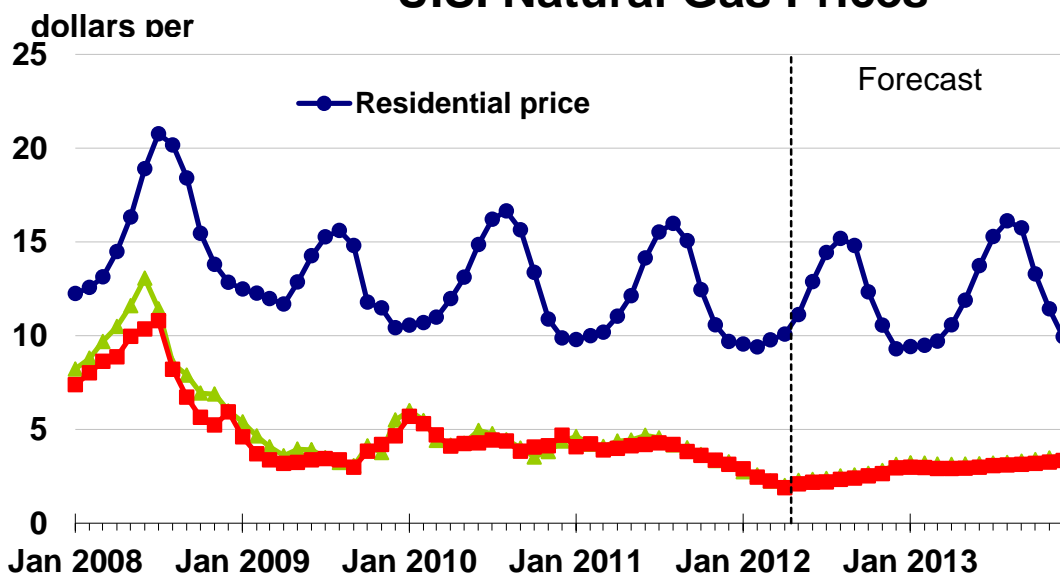
It is important to note that both natural gas and electric commodity market prices are moved by supply and demand, political conditions, market technicals and trader sentiment. This market is continuously changing Energy commodity pricing is also correlated to weather forecasts. Because weather forecasts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

Short Term Energy Outlook - US Energy Information Administration (May 8, 2012):

Natural Gas: Natural gas spot prices averaged \$1.95 per MMBtu at the Henry Hub in April 2012, down \$0.23 per MMBtu from the March 2012 average and the lowest average monthly price since March 1999, which also was the last time the Henry Hub price averaged less than \$2 per MMBtu. Abundant supplies and lower winter heating demand this year have contributed to the recent low prices. EIA expects the Henry Hub natural gas price will average \$2.45 per MMBtu in 2012, a small downward revision from \$2.51 per MMBtu expected in last month's Outlook. EIA revised its forecast for 2013 down to \$3.17 per MMBtu, from \$3.40 per MMBtu.

Working natural gas inventories continue to set new seasonal record highs as the very mild winter contributed to much-lower-than-normal inventory draws. As of April 27, 2012, according to EIA's [Weekly Natural Gas Storage Report](#), working inventories totaled 2,576 Bcf, 840 Bcf greater than last year's level and 857 Bcf above the 5-year (2007-2011) average. EIA expects that inventory levels at the end of October 2012 will set a new record high at 4,096 Bcf (U.S. Working Natural Gas in Storage Chart), although the record will largely be due to high levels already present at the start of the injection season. The projected increase of 1,623 Bcf in working gas inventory during the 2012 injection season (from the end of March to the end of October) is the smallest build since 2002. Limits on storage capacity, as well as high demand from the electric power sector this summer, will limit the overall level of injections. In 2013, working inventory levels recede from record highs, although they will still remain robust compared with recent history.

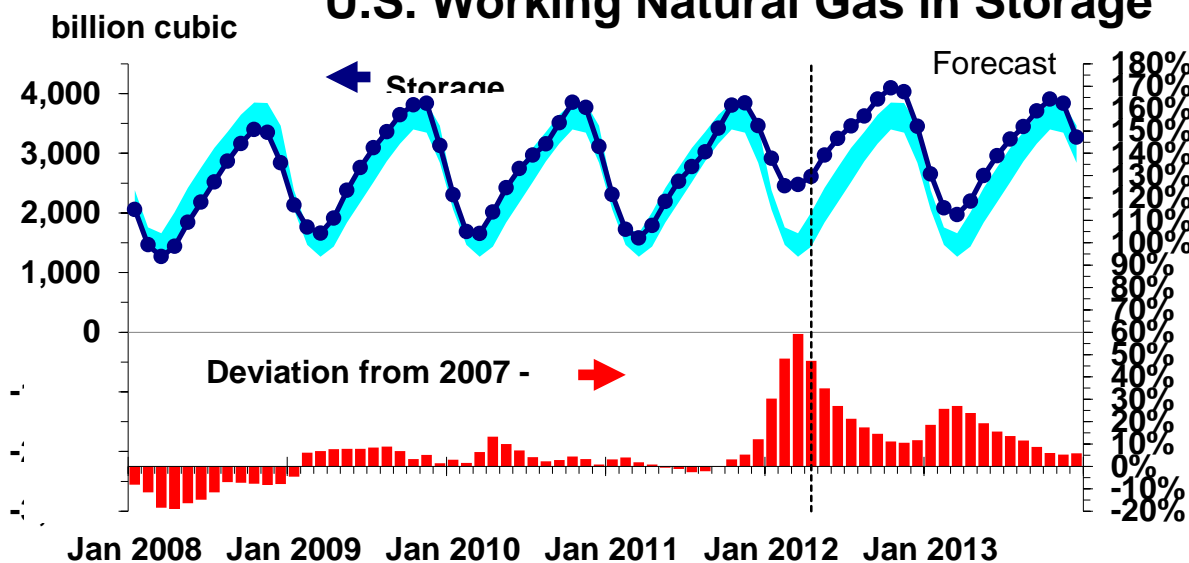
U.S. Natural Gas Prices



Source: Short-Term Energy Outlook, May 2012



U.S. Working Natural Gas in Storage

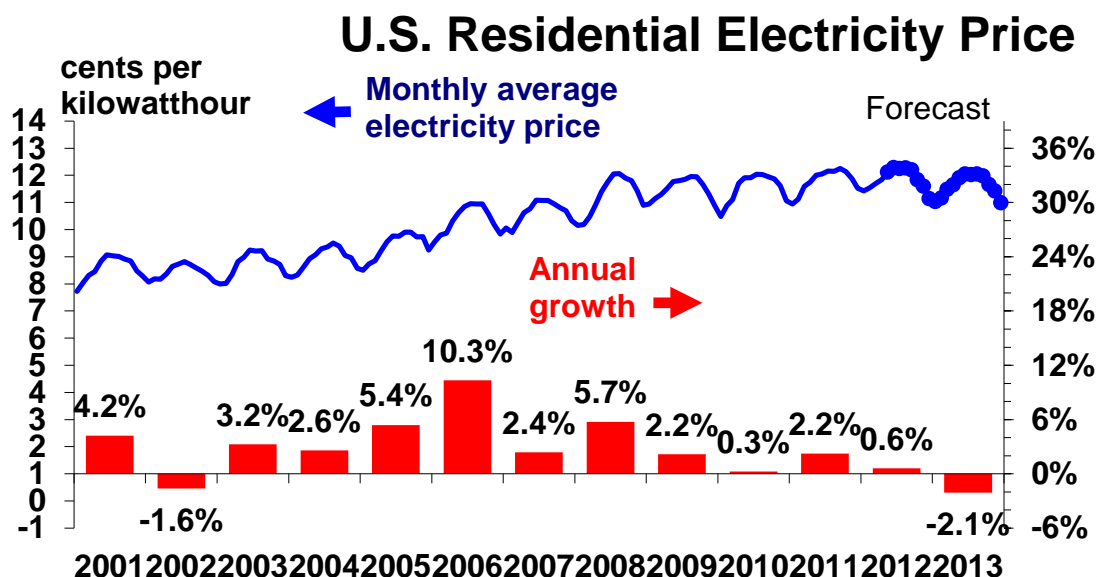


Note: Colored band around storage levels represents the range between the minimum

Source: Short-Term Energy Outlook, May 2012



Electricity: EIA forecasts average U.S. residential electricity prices to rise by 0.6 percent in 2012, and then fall by 2.1 percent in 2013. The rising costs of transmitting and distributing electricity to retail customers offset some of the declining fuel costs.



Recommendations:

1. CEG recommends an aggregation approach for 3rd party commodity supply procurement strategies for both electric and natural gas supply service. Aggregating the usage of all municipal facilities for electricity and natural gas supply service, would allow the facilities to either continue to achieve or 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. Contracts due to expire in the near term would continue to yield very favorable pricing. It is important to aggregate usage where available and take advantage of these current market prices quickly, before energy increases.

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

Overall, after review of the utility consumption, billing, and current commodity pricing outlook, CEG recommends that the facilities investigate the possibility of participation in the ACES energy supply aggregation group for both electricity and natural gas supply service for all facilities. It is important to note that any 3rd party supply contracting 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

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

VII. INSTALLATION FUNDING OPTIONS

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

A. Incentive Programs:

Pay For Performance

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

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

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant \$0.10 per square foot between \$5,000 and \$50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)
2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example \$0.11 / kWh for 15% savings, \$0.12/ kWh for 17% savings, ... and \$1.10 / Therm for 15% savings, \$1.20 / Therm for 17% saving, ...) Increased incentives result from projected savings above 15%.
3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example \$0.07 / kWh for 15% savings, \$0.08/ kWh for 17% savings, ... and

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

Direct Install Program

The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 150 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 60% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to www.njcleanenergy.com) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures. The following measures are potential candidates for Direct Install:

- Lighting Upgrade
- Lighting Controls

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.

Energy Efficiency and Conservation Block Grants

The EECGB provides supplemental funding up to \$50,000 for counties and local government entities to implement energy conservation measures. The EECGB funding is provided through the American Recovery and Reinvestment Act (ARRA). The local government must be among the eligible local government entities listed on the NJ Clean Energy website as follows - <http://njcleanenergy.com/commercial-industrial/programs/eeecbg-eligible-entities>. This program is limited to municipalities and counties that have not already received grants directly through the US department of Energy.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

B. Financing Options:Municipal Bonds

Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school Townships, 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 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
Municipal Complex	\$93,143	\$925,926	\$23,288	\$902,638	9.7
Library	\$37,757	\$560,382	\$13,152	\$547,230	14.5
Ice Rink	\$11,903	\$278,489	\$4,723	\$273,766	23.0
Total Entity Project	\$142,803	\$1,764,797	\$41,163	\$1,723,634	12.1

Total Entity Energy Costs:	\$566,114
Est. Total Entity Energy Savings:	\$142,803
Overall Entity Percent Reduction:	25.2%

VIII. ENERGY AUDIT ASSUMPTIONS

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

- A. Cost Estimates noted within this report are based on industry accepted costing data such as RS 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.