ENERGY AUDIT – FINAL REPORT

LAWRENCE TOWNSHIP
SENIOR CENTER
30 DARRAH LANE
LAWRENCE TOWNSHIP, NJ 08648
ATTN: MR. TREY KEYMOORE

CEG PROPOSAL NO. 9C08127

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I. EXECUTIVE SUMMARY

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

Lawrence Township Senior Center
30 Darrah Lane
Lawrenceville, NJ 08648

Municipal Contact Person: Trey Keymoore
Facility Contact Person: Joseph Sliwinski

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, 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.

The annual energy costs at this facility are as follows:

Electricity	$ 15,245
Natural Gas	$ 6,607
Total	$ 21,852

The potential annual energy cost savings are shown below in Table 1. The cost of each measure for this level of auditing is ± 20% until detailed engineering, specifications, and hard proposals are obtained.

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)
1	Upgrade Fluorescent Lighting System	$7,343	$3,202	2.3
2	Install LED Exit Signs	$498	$320	1.6
3	Install Interior Lighting Controls	$275	$88	3.1
4	Install Parking Lot Lighting Controls	$10,050	$515	19
5	Install Boiler Controls	$5,000	$682	7.3
6	Replace Heating Hot Water Boiler	$30,940	$2,145	14.4
7	Replace PTAC's in Arts Room	$3,816	$400	9.5
8	Replace Split AHU's	$39,792	$3,255	12.2

The estimated demand and energy savings are shown below in Table 2. The information in this table corresponds to the ECM's in Table 1.

Table 2
Estimated Energy Savings

ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECT DEMAND (KW)	ELECT CONSUMPTION (KWH)	NAT GAS (THERMS)
1	Upgrade Fluorescent Lighting System	6.83	17,035	-
2	Install LED Exit Signs	-	1,702	-
3	Install Interior Lighting Controls	-	468	-
4	Install Parking Lot Lighting Controls	-	2,738	-
5	Install Boiler Controls	-	-	449
6	Replace Heating Hot Water Boiler	-	-	1,411
7	Replace PTAC's in Arts Room	-	2,132	-
8	Replace Split AHU's	-	11,357	737

Concord Engineering Group strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under seven (7) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for the Lawrence Township Senior Center:

- **ECM #1:** Upgrade Fluorescent Lighting System
- **ECM #2:** Install LED Exit Signs
- **ECM #3:** Install Interior Lighting Controls
- **ECM #5:** Install Boiler Controls

II. INTRODUCTION

The Senior Center is a 9,800 square feet facility that includes a multi-purpose room, administration offices, game room, arts & crafts room, exam room, kitchen, main hall, foyer, conversation room, mechanical/electrical rooms, restrooms, etc. The facility was constructed in 1991 of wood and brick construction with R-19 exterior wall insulation and R-30 insulation in the attic. The exterior windows are double pane solar glazing units.

The first energy auditing task was to collect and review two years worth of utility energy data for electricity and natural gas. This information was used to analyze operational characteristics, calculate energy benchmarks for comparison to industry averages, estimate savings potential, and establish a baseline to monitor the effectiveness of implemented measures. A computer spreadsheet was used to enter, sum, and calculate benchmarks and to graph utility information (see Appendix A).

The Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr) and can be 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 annual consumption of all fuels to BTU's then dividing by the area (gross square footage) of the building. EUI is a good indicator of the relative potential for energy savings. A comparatively low EUI indicates less potential for large energy savings. Blueprints obtained from the Township were used to calculate the gross area of the three buildings.

Obtaining Architectural and Mechanical drawings, a building profile was created that included age, occupancy, description, and existing conditions of Architectural and Mechanical Systems. The profile noted the major energy – consuming equipment or systems and components that are inherently inefficient. Also, by reviewing the mechanical drawings and equipment schedules, questions regarding the lighting systems/controls, HVAC zone controls, or setback operations were noted.

The site visit was spent inspecting the actual systems and answering specific questions from the preliminary review. The building manager provided occupancy schedules, O & M practices, the building energy management program, and other information that has an impact on energy consumption.

The post-site work included evaluation of the information gathered during the site visit, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on mechanical, lighting and building envelope improvements.

III. METHOD OF ANALYSIS

The first step in the energy analysis is the site survey. The auditor surveys the entire site to inventory the building envelope (roof, windows, etc.), the heating, ventilation, and air conditioning equipment (HVAC), the lighting equipment, other facility-specific equipment, and to gain an understanding of how each facility is used.

The collected data is then processed using engineering calculations; Microsoft Excel spread- sheets or Trane Trace 700™ building simulation software that calculates the anticipated energy usage. The actual energy usage is entered directly from the utility bills. The anticipated energy usage is compared to the actual usage. If necessary, corrections are made to the site-collected data until the anticipated energy usage matches the actual usage. This process develops an end-use baseline for all of the fuels used at the facility. This baseline is used to calculate the energy savings for the measures that are recommended in this report.

The savings in this report are not duplicative. The savings for each recommendation may actually be higher if the individual recommendations were installed instead of the entire project. For example, the lighting module calculates the change in wattage and multiplies it by the new operating hours instead of the existing operating hours (if there was a change in the hours at all). The lighting controls module calculates the change in hours and multiplies it by the new system wattage instead of the existing wattage. Therefore, if you chose to install the recommended lighting system but not the lighting controls, the savings achieved with the new lighting system would actually be higher because there would have been no reduction in the hours of use.

The same principal follows for heating, cooling, and temperature recommendations – even with fuel switching. If there are recommendations to change the temperature settings to reduce fuel use, then the savings for the heating/cooling equipment recommendations are reduced, as well.

Our thermal module calculates the savings for temperature reductions utilizing Microsoft Excel spreadsheets or Trane Trace 700™ building simulation software. The savings are calculated in "output" values – meaning energy, not fuel savings. To show fuel savings we multiply the energy values times the fuel conversion factor (these factors are different for electricity, natural gas, fuel oil, etc.) and also take into account the heating/cooling equipment efficiency. The temperature recommendation savings are lower when the heating/cooling equipment is more efficient or is using a cheaper fuel.

Thermal recommendations (insulation, windows, etc.) are evaluated by taking the difference in the thermal load due to reduced heat transfer. Again, the "thermal load" is the thermal load after the other recommendations have been accounted for.

Lastly, installation costs, refer to Appendix B, are then applied to each recommendation and simple paybacks are calculated. Costs are derived from Means Cost Data, other industry publications, and local contractors and suppliers. The NJ SmartStart Building® program incentives (refer to Appendix C) are calculated for the appropriate ECM's and subtracted from the installed cost prior to calculation of the simple payback. In addition, where applicable, maintenance cost savings are estimated and applied to the net savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. Public Service Electric and Gas Company (PSE&G) provides electricity to the facility under the MD/GLP Electric Rate. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the most current rate structure available.

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from January-08 to December-08. PSE&G supplies the natural gas to the facility under the General Service GH Multi-Family rate. Below is the average unit cost for the utilities at this facility.

Description	Average
Electricity	18.8¢ /kWh
Natural Gas	$1.52 / Therm

Table 3
Electricity Billing Data

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
1/08	6,180	26	$864
2/08	6,180	25	$880
3/08	6,180	27	$872
4/08	5,715	24	$798
5/08	5,910	33	$863
6/08	8,550	48	$1,953
7/08	10,470	50	$2,295
8/08	8,550	49	$2,057
9/08	7,305	49	$1,833
10/08	5,490	29	$996
11/08	5,130	26	$915
12/08	5,340	23	$919
Totals	**81,000**	**50 Max**	**$15,245**

Figure 1
Electricity Usage Profile

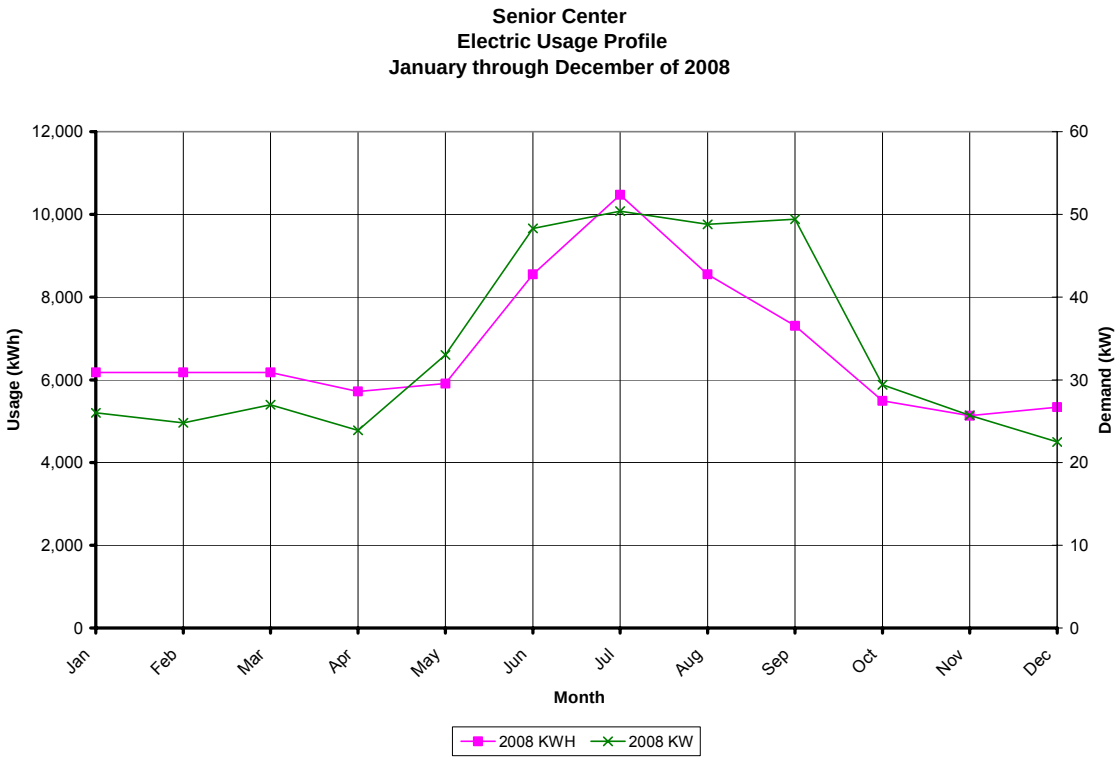
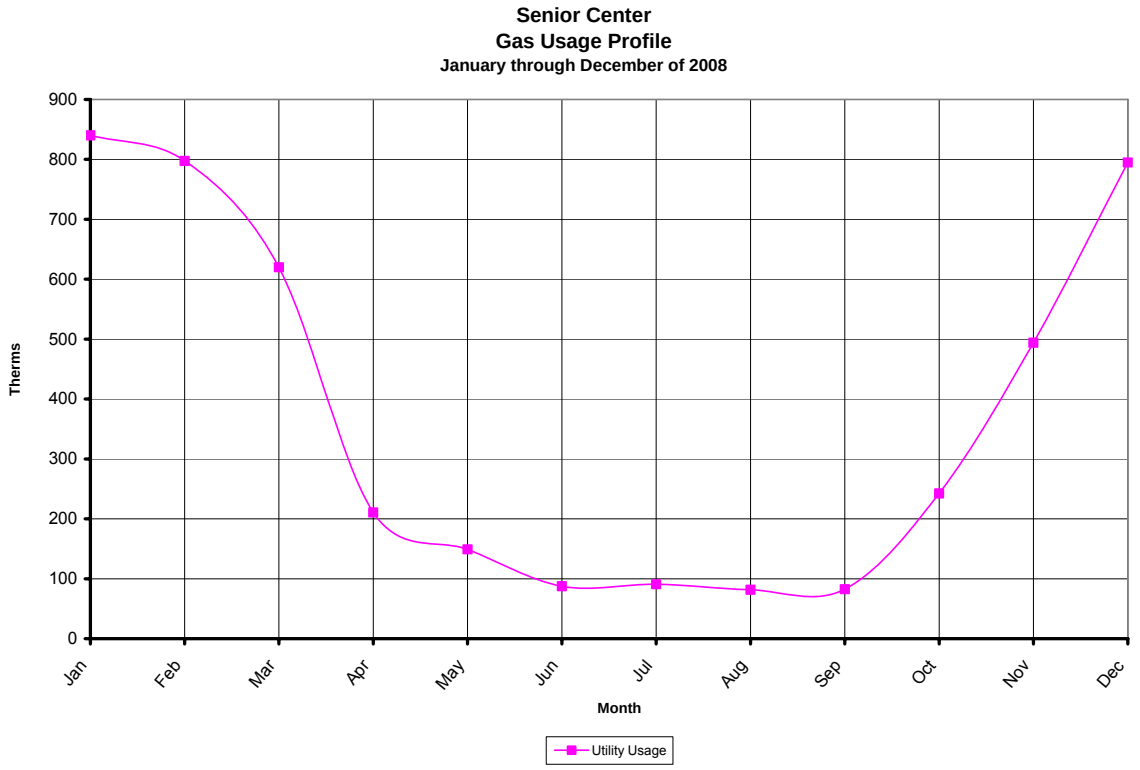


Table 4
Natural Gas Billing Data

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
1/08	814	$1,160
2/08	774	$1,171
3/08	601	$977
4/08	204	$338
5/08	144	$268
6/08	85	$168
7/08	88	$186
8/08	78	$134
9/08	79	$128
10/08	234	$333
11/08	477	$659
12/08	770	$1085
Totals	**4,348**	**$6,607**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

The Energy Use Index is a measure of the total energy consumed in cooling and heating a building or facility in a year, expressed in British thermal units (Btu) per conditioned gross square footage.

Senior Center Building EUI = (Electric Usage in kBtu/h + Gas Usage in kBtu/h) / SF

Electric = [(81,000 kWh) * (1000 W/kW) * (3.414 Btu/h / 1 W)]/ (1000 Btu/h / 1 kBtu/h)
= 276,534 kBtu/h

Gas = [(4,348 Therms) * (100,000 Btu/h / 1 W)] / (1000 Btu/h / 1 kBtu/h) = 434,800 kBtu/h

EUI = (276,534 kBtu/h + 434,800 kBtu/h) / (9,798 SF)

Senior Center Building EUI = 72.6 kBtu/SF

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 you to track and assess 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 more emphasis is being placed throughout multiple arenas on carbon reduction, greenhouse gas emissions and other environmental impacts.

In accordance with the Local Government Energy Audit Program, CEG has created an Energy Start account for the municipal in order to allow the municipal access to monitoring their yearly energy usage as it compares to facilities of similar type. The account can be accessed at the following address, the username and password are also listed below:

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

Username: Lawrencetwp
Password: lgeaceg2009

Specific building types are detailed on the ENERGY STAR website. A Senior Center is not among the building types classified by the Energy Star Portfolio Manager program. A Benchmark cannot be created for the building at this time due to a lack of information to compare the senior center's performance against. In the absensce of the benchmarking program the EUI can be used to track the buildings performance. The lower the EUI the more energy efficient the building is. This can be done by using the above "Energy Use Index" calculation and the monthly utility bills.

V. FACILITY DESCRIPTION

The Senior Center is a 9,800 square feet facility that includes a multi-purpose room, administration offices, game room, arts & crafts room, exam room, kitchen, main hall, foyer, conversation room, mechanical/electrical rooms, restrooms, etc. The facility was constructed in 1991 of wood and brick construction with R-19 exterior wall insulation and R-30 insulation in the attic. The exterior windows are double pane solar glazing units.

Heating System

The center is heated by a H. B. Smith gas-fired hot water boiler rated at 750,000 Btu/hr input and 562,000 Btu/hr (75% thermal efficiency at full load) that is approximately 18 years old. Due to age, the present thermal efficiency is estimated to be 60%. On March 24, 2009, we observed that the hot water supply temperature was 210ºF while the outside air temperature was 39ºF.

Hot water is distributed by two (2) 3/4 HP pumps (one on standby) to hot water coils in air handling units, unit heaters, cabinet heaters, and hot water heating coils.

Domestic Hot Water

Domestic hot water is provided by a RHEEM gas-fired, 75-gallon capacity hot water heater rated at 70,000 Btu/hr input. The approximated age is 18 years which is 8 years greater than the expected service life of this piece of equipment as outlined in 2007 ASHRAE Applications Handbook.

Cooling System

Cooling for the majority of the facility is provided by split-system air handling units with remote condensing units located at grade or on the roof. The air handling units are original to the facility (approximately 18 years old) and are an estimated 3 years past their service life as outlined in 2007 ASHRAE Applications Handbook. The condensing units are of the same age and have an estimated remaining service life of 2 years as noted in 2007 ASHRAE Applications Handbook. The air handling units that serve the Multi-Purpose Room are inaccessible and are need of replacement.

Ductless through-the-wall AC units, also original to the building; provide cooling to one of the Arts & Crafts Room as a separate thermal zone. The ductless split AC units have an estimated remaining service life of 2 years as noted in 2007 ASHRAE Applications Handbook.

Controls System

A master thermostat is located in the administration office that sets the heating/cooling mode, operation schedule, etc. for the slave thermostats in each space.

Lighting

The facility lighting is provided by 2-foot by 4-foot lay-in fixtures containing T12 lamps and magnetic ballasts. Standard switching is utilized and there are no other types of lighting controls present.

VI. MAJOR EQUIPMENT LIST

Following the completion of the field survey a detailed equipment list was created. The equipment within this list is considered major energy consuming equipment whose replacement could yield substantial energy savings. In addition, the list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Upgrade Fluorescent Lighting System

Description:

New lighting fixtures with fluorescent lamps and electronic ballasts are available as a more energy efficient option to older T-12 lighting fixtures. A simple change from the old, T-12 light fixture to the new can provide substantial savings. A typical drop-ceiling lay in fixture with four, 4-foot T12 lamps (34 Watt lamps) has a total wattage of about 154 Watts. By replacing the T-12 fixture with a new fixture containing T8 lamps, reflector and electronic ballasts the total wattage would be reduced to about 91 Watts per fixture and the space light levels and light quality would increase by about 15% and 35%, respectively.

CEG recommends a replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the Owner on electrical costs due to the better performance of the electronic ballasts. In addition to functional cost savings, the fixture replacement will also provide operational cost savings. The operational cost savings will be realized through the lesser number of lamps that will be required to be replaced per year. The expected lamp life of a T8 lamp, approximately 30,000 burn-hours, in comparison to the existing T12 lamps, approximately 20,000 burn-hours, will provide the Owner with fewer lamps to replace per year. Based on the operating hours of this portion of the facility, approximately 2,080 hours per year, the Owner will be changing approximately 33% less lamps per year.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix C, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $25 per fixture; T-5 or T-8 (3-4 lamp) = $30 per fixture.

$$\text{Smart Start®}\ \textit{Incentive} = (\#\ \textit{of}\ 1-2\ \textit{lamp fixtures} \times\ \$\ 25) + (\#\ \textit{of}\ 3-4\ \textit{lamp fixtures} \times\ \$\ 30)$$

$$\text{Smart Start®}\ \textit{Incentive} = (17 \times\ \$\ 25) + (75 \times\ \$\ 30) = \underline{\$2{,}675}$$

Maintenance Savings are calculated as follows:

$$Maintenance\ Savings = (\#\ of\ \ lamps \times \%\ reduction \times \$\ per\ lamp) + Installation\ Labor$$

$$Maintenance\ Savings\ (4\ Lamp\ Fixtures) = (284 \times 25\%\ reduction \times \$\ 2.00) + (\$20 \times 71) = \underline{\$1{,}562}$$

$$Maintenance\ Savings\ (3\ Lamp\ Fixtures) = (12 \times 33\%\ reduction \times \$\ 2.00) + (\$20 \times 4) = \$88$$

$$Maintenance\ Savings\ (2\ Lamp\ Fixtures) = (12 \times 50\%\ reduction \times \$\ 2.00) + (\$20 \times 6) = \$132$$

Total Maintenance Savings = $1,562 + $88 + $132 = $1,782

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$11,800
NJ Smart Start Equipment Incentive ($):	($2,675)
Maintenance Savings ($):	($1,782)
Net Installation Cost ($):	*$7,343*
Total Energy Savings ($ / yr):	*$3,202*
Simple Payback (yrs):	*2.3*

ECM #2: Install LED Exit Signs

Description:

LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. LED exit signs have been manufactured in a variety of shapes and sizes. There are also retrofit kits that allow for simply modification of existing exit signs to accommodate LED technology. The benefits of LED technology are substantial. LED exit signs will last for 20-30 years without maintenance. This results in tremendous maintenance savings considering that incandescent or fluorescent lamps need to be replaced at a rate of 1-5 times per year. Lamp costs ($2-$7 each) and labor costs ($8-$20 per lamp) add up rapidly. Additionally, LED exit lights only uses 3.8 Watts. In comparison, conventional exit signs use 20 Watts. It is recommended that samples of the products be installed to confirm that they are compatible with the existing electrical system.

Energy Savings Calculations:

This ECM replaces all of the existing exit signs, twelve (12) in total, throughout the building with highly energy efficient LED exit signs. A Pegasus Associates Lighting LED exit sign or equivalent was used for the bases of design.

Existing exit sign energy costs: 12 units x 20 watts/unit x 8,760 hrs/yr x $0.188/kWh = $395

New LED exit sign energy costs: 12 units x 3.8 watts/unit x 8,760 hrs x $0.188/kWh = $75

Net energy savings = $395 - $75 = $320

Installed cost of new LED exit signs = $80 x 12 = $960

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix C, the replacement of an incandescent exit sign warrants the following incentive: LED Exit Sign = $20 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ exit\ signs \times\ \$\ 20) = (12 \times \$20) = \$240$$

Maintenance Savings are calculated as follows:

$$Maintenance\ Savings = (\#\ of\ \ lamps \times \$\ \ per\ \ lamp) + Installation\ Labor$$

$$Maintenance\ Savings = (12 \times \$4.50) + (12 \times \$14) = \$222$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$960
NJ Smart Start Equipment Incentive ($):	($240)
Maintenance Savings ($):	($222)
Net Installation Cost ($):	*$498*
Total Energy Savings ($ / yr):	*$320*
Simple Payback (yrs):	*1.6*

ECM #3: Install Interior Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. This on/off dilemma was studied, and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Time clocks are often used which allow the user to set an on/off schedule. Time clocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, restrooms, lunch rooms, storage rooms, lounges, file rooms, etc.

Energy Savings Calculations:

From Appendix C of this report, we calculated the lighting power density (Watts/ft^2) of the existing facility to be 14,560 Watts / 9,800 SF = 1.48 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors. Total number of rooms to be retrofitted is five (990 SF).

10% x 1.48 Watts/SF x 990 SF x 3,200 hrs/yr.

= 469 kWh x $0.188 kWh

Savings = $88 / yr

The Concord team would recommend wall switches for individual rooms, ceiling mount sensors for large office areas and fixture mount box sensors for some applications as manufactured by Sensorswitch, Watt Stopper, or equivalent. Installation cost per dual-technology sensor is $75/unit. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $55/unit.

Total cost to install sensors is 5 units x $ 55/unit = $275.

Simple Payback = $275 / $88 = 3.1 years

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$375
NJ Smart Start Equipment Incentive ($):	$100
Maintenance Savings ($):	-
Net Installation Cost ($):	*$275*
Total Energy Savings ($ / yr):	*$88*
Simple Payback (yrs):	*3.1*

ECM #4: Install Parking Lot Lighting Controls

Description:

The parking lot lighting consists of ten (10) 150 Watt High Pressure Sodium (HPS) round luminaries on aluminum poles that are controlled by a photocell and astronomical clock. Together, the time clock and photocell control the site lighting to be on from dawn to dusk with automatic adjustments for spring and fall time changes. We estimate that the average yearly nighttime hours is approximately 10 hrs/day x 365 days/year = 3,650 hrs/year.

The Concord Engineering team recommends that a WattStopper DM-115-WP Bi-level HID Controller or equivalent be installed in the electrical circuit that feeds these parking lot fixtures so that after a certain time at night the controls will automatically reduce the lighting levels by 50%. This will also require a dimming ballast retrofit into each fixture so that the lamp can be dimmed to 50% of its capacity.

Energy Savings Calculations:

Energy cost savings = 10 fixtures x 50% x 150 Watts x 3,650 Hrs x $0.188/kWh = $515

Total installation cost including dimming ballasts, lift, and controller is $10,800. The SmartStart Buildings® incentive is $75 per fixture controlled which equates to an installation savings of $75/fixture x 10 fixtures = $750. Net installation cost is $10,050.

Simple Payback = $10,050 / $515 = 19.5 years

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,800
NJ Smart Start Equipment Incentive ($):	($750)
Maintenance Savings ($):	-
Net Installation Cost ($):	*10,050*
Total Energy Savings ($ / yr):	*$515*
Simple Payback (yrs):	*19.5*

ECM #5: Install Boiler Controller

Description:

The existing H. B. Smith sectional hot water boiler is rated at approximately 70% thermal efficiency. Due to its age and condition, the existing thermal efficiency is now closer to 60%. On March 29, 2009 the temperature of the hot water leaving the boilers was 188°F and the hot water was returning to the boilers at 200°F. The detailed weather data from the McGuire AFB Weather Station for the day of the inspection shows that the lowest outside air temperature was 39°F. Based on this data, the boiler could have delivered 160°F hot water and would have maintained the building temperature.

This energy conservation measure consists of installing a dynamic boiler controller, a temperature sensor, and LCD readout. Energy is saved by adjusting the burner run pattern to match the system's heat load. The controller determines the heat load by using a strap-on temperature sensor that monitors the boiler's hot water supply temperature and the rate this temperature is changing. Depending on the measured load, the burner is adjusted so that the boiler uses less fuel to generate the required amount of hot water. This action is similar to the industry-accepted method of outdoor air temperature reset control, but does not require an outdoor air temperature sensor.

Most manufacturers of dynamic boiler controllers will guarantee a 10% reduction in fuel consumption. CEG recommends the installation of a Tekmar Boiler Control System or equivalent system.

During 2008, this heating hot water boiler consumed an estimated 4,491 Therms of natural gas.

Energy Savings Calculations:

Energy savings = 10% x 4,491 Therms = 449 Therms

Cost savings = 449 Therms x $1.52/Therm = $682

The estimated cost for the boiler controls system installed is $5,000.

Simple payback = $5,000/$682 = 7.3 years

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,000
NJ Smart Start Equipment Incentive ($):	-
Maintenance Savings ($):	-
Net Installation Cost ($):	*$5,000*
Total Energy Savings ($ / yr):	*$682*
Simple Payback (yrs):	*7.3*

ECM #6: Replace Heating Hot Water Boiler

Description:

The Senior Center is heated by a 1991 H. B. Smith sectional hot water boiler which presently is about 60% efficient. As an alternative energy conservation measure, the Concord team recommends that this boiler be replaced by an Aerco Modulex high-efficiency boiler rated at 606 MBH each and 88% efficient or equivalent.

Existing Heating Hot Water Boiler:

Rated Capacity = 562 MBH (Natural Gas)

Combustion Efficiency = 65%
Radiation Losses = 5%
Thermal Efficiency = 60%

Replacement Boiler:

High Efficiency Aerco or Equal (with Sequencing Control & O/A HW Reset)

Rated Capacity = 606 MBH (Natural Gas)

Combustion Efficiency = 88%
Radiation Losses = 0.5%
Thermal Efficiency = 87.5%

Operating Data:

Heating Season Fuel Consumption = 4,491 Therms
(Based on gas billing data)
Average Cost of Natural Gas = $1.52/Therm

Energy Savings Calculations:

Energy Savings = Old Boiler Energy Input x ((New Boiler Efficiency – Old Boiler) / New Boiler Efficiency))

$$\text{Energy Savings} = 4{,}491 \text{ Therms} \times \frac{0.875-0.60}{(0.875)} = 1{,}411 \text{ Therms}$$

Cost Savings = Annual Energy Savings x $/Therm

= 1,411 Therms x $1.52/Therm = $2,145 / yr.

Installed cost of an Aerco Modulex high-efficiency boiler = $32,000. The SmartStart Buildings® incentive is $1.75 per MBH which equates to $1,060. Net installation cost = $30,940

Simple Payback = $30,940 / $2,145 = 14.4 Years

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$32,000
NJ Smart Start Equipment Incentive ($):	($1,060)
Maintenance Savings ($):	-
Net Installation Cost ($):	*$30,940*
Total Energy Savings ($ / yr):	*$2,145*
Simple Payback (yrs):	*14.4*

ECM #7: Replace Through-the-Wall AC in Art Room with Heat Pump Units

Description:

The two commercial through-the-wall air conditioning units that provide cooling for the building interior core are 1991 vintage one-ton Friedrich units with condensers/compressors inside the unit. These units are beyond their expected service life and are very inefficient. As outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook, the estimated service life for a commercial through-the-wall unit is 15 years.

This energy conservation measure would replace these units with high-efficiency packaged terminal air conditioning split system heat pump units with an EER=14. The new condenser/compressor would be located outside on a pad, not directly in the unit as in the existing units. This ECM would replace the existing thru-the-wall units with Carrier's Weathermaker Infinity line, or equivalent.

Energy Savings Calculations:

New Heat Pump Units Energy Savings =

[(Tons Refrigeration x 12,000 Btu/Ton) / (1000)/(New-Old EER) x Avg. Load Factor x Hrs. of Cooling] x No. of Units

Existing Through-the-Wall AC Units

Rated Capacity = 1.0 Ton per Unit
Condenser Unit Efficiency = 7.0 EER
Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity - $0.188 / kWh

Proposed High-Efficiency Condensing Unit

Rated Capacity = 1.0 Ton per Unit
New Condenser Unit Efficiency = 14.0 EER

Energy Savings = {[(1.0 Tons x 12,000 Btu/Ton)/1,000 Watts/kW) ÷ (14-7 Btu/Watt) x 0.15 x 1,800 hrs.] x 2 = 2,132 kWh/Yr.

Cost Savings = 2,132 kWh x $0.188/kWh = $400 / Yr.

Installed cost of (2) two high-efficiency heat pump units = $4,000. The SmartStart Buildings® incentive is $92 per unit which equates to $184. Net installation cost = $3,816

Simple Payback for This Measure = $3,816 / $400 = 9.5 Years

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$4,000
NJ Smart Start Equipment Incentive ($):	($184)
Maintenance Savings ($):	-
Net Installation Cost ($):	*$3,816*
Total Energy Savings ($ / yr):	*$400*
Simple Payback (yrs):	*9.5*

ECM #8: Replace Split Air Handling Units in the Multi-Purpose Room Closets

Description:

The multi-purpose room is heated and cooled by air handling units that are located in the ceiling space of the storage closets. These ceiling units contain hot water heating coils and DX coils along with air filters. Since the storage closets are so small, the units are extremely hard to access for performing routine maintenance (changing air filters, cleaning coils, lubricating bearings, etc.). Coils are dirty, filters need to be bent in half to install, inboard bearings cannot be greased due to access problems, etc. The multi-purpose room space is not receiving 100% of the conditioned air from these units due to these issues.

The Concord team strongly recommends that these split air handling units be replaced with high-efficiency vertical split air handling units with new high-efficiency condensers/compressors located on the outside pads. This would also allow for routine maintenance access which is critical to the operation and service life of these indoor air handling units along with increased air velocity to the space.

This ECM would replace the existing split air handling units with Trane Odyssey split air-handling units and matching air-cooled condensing units or equivalent.

Energy Savings Calculations:

New Split Outdoor Condenser Electrical Cost Savings =

[(Tons Refrigeration x 12,000 Btu/Ton) / (1000)/(New-Old EER) x Avg. Load Factor x Hrs. of Cooling] x No. of Units

Existing Units:

Rated Capacity = 8 Tons per Unit
Condenser Unit Efficiency = 6.0 EER (due to dirty coils, etc.)
Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity - $0.188/kWh

Proposed High-Efficiency Units:

Rated Capacity = 8 Tons per Unit
New Condenser Unit Efficiency = 14.0 EER

Energy Savings = {[(8 Tons x 12,000 Btu/Ton)/1,000 Watts/kW) ÷ (14-6 Btu/Watt) x 0.15 x 1,800 hrs.] x 3 units = 11,357 kWh/Yr.

Electrical Cost Savings = 11,357 kWh x $0.188/kWh = $2,135 / Yr.

New Split Indoor Vertical Air Handling Units Gas Savings =

Since the new units will be much more efficient in the heating mode with new hot water coils and other new technology, they will use less hot water to maintain space temperature

Existing Hot Water Coils:

Rated HW Coil Capacity = 86 MBH per Unit x 3 units = 258 MBH

Rated CFM = 8,000 CFM

Hot Water Energy Savings:

This measure would replace the entire air handling units (fans, hot water coils, motors, etc.). Furthermore, these vertical units would be specified to include electronic controls with programmable thermostats and ECM fan motors. The programmable thermostats will allow the maintenance staff to program occupied and unoccupied times, nighttime setback temperatures and room temperature setpoints.

Calculated energy savings/unit = [CFM x Cp x DA x (TA-TW) x PD x HY] / ŋ

CFM = air flow rate, CFM
Cp = specific heat of air, 0.24 BTU/lb-Fº
DA = air density, lb/ft^3
TA = ambient temperature, ºF
TW = average outdoor winter temperature, ºF (ASHRAE Weather Files)
PD = fractional decrease in exhaust operating hours during heating season
HY = exhaust operating hours during the heating season
ŋ = heating system efficiency

Energy Savings/Unit = [8,000 x 0.24 x 0.07 x (78 – 14) x 0.50 x 4,000] / 70% = 24,576 MBTU

= 245.8 Therms x 3 units = 737.4 Therms
Energy cost savings for this ECM = 737.4 Therms x $1.52 / Therm = $1,120

Installed cost of three (3) high-efficiency vertical split air handling units with high-efficiency (SEER=14) outdoor condensers including the ductwork modifications = $48,000. The SmartStart Buildings® incentive is $92/Ton x 24 Tons = $2,208. The estimated maintenance savings from open access to air filters, hot water coils, controls, etc. is estimated at 100 hrs/year x $60/hour = $6,000.

Total Energy Cost Savings = $2,135 + $1,120 = $3,255

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$48,000
NJ Smart Start Equipment Incentive ($):	($2,208)
Maintenance Savings ($):	($6,000)
Net Installation Cost ($):	*$39,792*
Total Energy Savings ($ / yr):	*$3,255*
Simple Payback (yrs):	*12.2*

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be 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). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the buildings being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 2340 S.F. can be utilized for a PV system on the Senior Center building. A depiction of the area utilized is shown in Appendix F. Using this square footage it was determined that a system size of 36.6 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 62,523 KWh annually, reducing the overall utility bill by 77% percent. A detailed financial analysis can be found in Appendix F. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 5% interest rate over 15 years. Direct purchase involves the local government paying for 100% of the total project cost upfront. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

PAYMENT TYPE	SIMPLE PAYBACK
Self-Finance	16 Years
Direct Purchase	10 Years

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for Lawrence Township and has determined it is not a viable option. Low average wind speeds for the area are not adequate for wind turbine generation. Typical wind turbines start producing energy at 8 mph wind speeds. Lawrence Township averages 4 mph wind speeds making this application impractical.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to Section IV, Figures 1 and 2 included within this report to reference the respective electricity and natural gas usage load profile for January through December 2008.

Electricity:

Section IV, Figure 1 demonstrates a typical cooling profile, (April –October), complimenting the heating load. It is evident that there is a significant reduction in the On Peak Load from September 2008 to November 2008 and a substantial increase from April 2008 to June 2008. The base-load shaping is important because a flat consumption profile will yield more competitive pricing when trying to procure third party supply.

Natural Gas:

Section IV, Figure 2 demonstrates a typical heating load (November –March), and complimentary cooling load (April –October). Consequently there is a clear separation between summer and winter loads consistent with Wholesale Energy Pricing. Heating loads carry a much higher average cost because of the higher demand for natural gas during the winter.

Tariff Analysis:

Electricity:

Lawrence Township (LT) receives electrical service through Public Service Electric and Gas Company (PSE&G) on a GLP or MD (General Lighting and Power) rate. This utility tariff is for delivery service for general purposes at secondary distribution voltages. The rate schedule has a Delivery Charge, Societal Benefits Charge, Non-utility Generation Charge, Securitization Charge, System Control Charge, Customer Account Services Charge, Standby Fee, Base Rate Distribution Adjustment Charge, Solar Pilot Recovery Charge and RGGI Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS).

Natural Gas:

LT receives natural gas service through Public Service Electric and Gas Company (PSE&G) on a GSGH utility rate class, when not receiving commodity by a Third Party Supplier. This utility tariff is for firm delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the

Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). It is pertinent to note, should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.
Imbalances occur when Third Party Suppliers are used to supply natural gas, full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used. Otherwise, imbalances can occur, jeopardizing economics and scheduling.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within Lawrence Township. CEG's primary observation is seen in Natural Gas. The average price of commodity per dth (dekatherm) for all buildings is $.103. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Lawrence could see significant savings if it were to take advantage of these current market prices quickly, before energy increases. Based on last year's historical consumption January – December 2008, and current natural gas rates, estimated savings of over $14,000 per year are seen. (Note: Savings were calculated using Lawrence Township Average Annual Consumption of and a variance of $.038 / therm utilizing a fixed one-year commodity contract). CEG recommends aggregating the entire natural gas load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG's secondary recommendation coincides with Lawrence Township's electric costs. CEG recognized the electric cost is not competitive with current market prices. Based on the current market, Lawrence Township is paying approximately $.0344 per unit above market in the PSE&G territory, and CEG recommends further advisement on these prices. Lawrence Township should also consider procuring energy on its own. CEG recommends alternative sourcing strategies.

CEG recommends that Lawrence Township schedule a meeting with their current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), Lawrence Township will learn more about the competitive supply process. Lawrence Township can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu, and should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the data to manage ongoing demand-side management projects. Furthermore, CEG recommends special attention to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with their utility representative. In addition, Lawrence Township should also ask the utility representative about alternative billing options. Some utilities allow for consolidated billing options when utilizing the service of a Third Party Supplier.

X. INSTALLATION FUNDING OPTIONS

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

i. *Performance Contracting* – Performance Contracting is an agreement between a local government and a private energy services company (ESCO) that uses future energy savings to pay for the entire cost of a building's energy efficiency retrofits/upgrades. A local government contracts with an ESCO, then the ESCO purchases, installs and maintains energy-saving equipment. According to State Assembly Bill # 1185, a local government may enter into guaranteed energy savings contracts within a 15-year period. An independent energy auditor must prepare the investment grade audit and perform the measurement/verification of the savings.

ii. *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.

iii. *County Improvement Authority* – Several local governments in New Jersey have received funding for energy projects through their County Improvement Authority.

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.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%. The 3-step process includes cleaning of the coils, rinsing and a microbicide treatment. Thoroughly cleaned coils are not as susceptible to re-fouling so they stay clean longer, reducing the cleaning cycle frequency

B. Maintain all weather stripping on windows and doors.

C. Use cog-belts instead of v-belts on all belt-driven fans, etc. These can reduce electrical consumption of the motor by 2-5%.

D. Repair/replace damaged or missing piping and ductwork insulation in the ceiling spaces.

E. Reduce lighting in specified areas where the foot candle levels are above 70 in private offices and above 30 in corridor, lobbies, etc. During the site survey, some areas were measured at over 100 foot candles.

F. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

G. Recalibrate existing sensors serving the air handling units. Sensors are currently ~ 5°F off desired setpoint.

H. Install a Vending Miser system to turn off vending machines when not in use.

I. Clean all fixtures to maximize light output.

J. Feel for air drafts around electrical outlets. Inexpensive pads are available, as are plugs for unused sockets.

Electric Cost Summary

PSE&G - svc MD

Senior Center

2008

Account # 62 809 480 5 6

Meter # 278005075

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	0	
KWH	6,180	6,180	6,180	5,715	5,910	8,550	10,470	8,550	7,305	5,490	5,130	5,340	81,000	
KW	26	25	27	24	33	48	50	49	49	29	26	23	50	Max
Monthly Load Factor	32%	37%	31%	33%	24%	25%	28%	24%	21%	25%	28%	32%	28%	
Electric Delivery, $													$0	
Delivery $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Electric Supply, $													$0	
Supply $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Total Cost, $	$864	$880	$872	$798	$863	$1,953	$2,295	$2,057	$1,833	$996	$915	$919	$15,244	
$/KWH	$0.140	$0.142	$0.141	$0.140	$0.146	$0.228	$0.219	$0.241	$0.251	$0.181	$0.178	$0.172	**$0.188**	

Summary of Natural Gas Cost

PSE&G - GSGH Multi Family

Senior Center **2008**

Account # 62 809 480 5 6

Meter # 2434250

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	**Total**
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	
Total MCF	815	774	601	204	145	85	88	79	80	235	478	770	4,354
BTU Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.03	1.03	1.03	1.03	12
Therms (Burner Tip)	839.9	797.4	619.8	210.8	149.1	87.6	90.9	81.8	82.7	242.5	493.9	794.8	4491.1
Total Distribution Cost		$316	$245	$73	$55	$36	$37	$34	$35	$83	$200	$323	1,438
Cost per Therm	$0.000	$0.396	$0.396	$0.347	$0.367	$0.413	$0.409	$0.421	$0.420	$37.340	$0.406	$0.406	$0.320
Total Commodity Cost		$855	$732	$264	$213	$132	$148	$100	$93	$250	$458	$762	4,007
Cost per Therm	$0.00	$1.07	$1.18	$1.25	$1.43	$1.50	$1.63	$1.22	$1.13	$1.03	$0.93	$0.96	$0.89
Total Cost	$1,160	$1,171	$977	$338	$268	$168	$186	$134	$128	$333	$659	$1,085	$6,605
Cost per Therm	$1.381	$1.468	$1.577	$1.602	$1.797	$1.918	$2.041	$1.640	$1.550	$1.371	$1.334	$1.365	**$1.471**

.= Utility Information Not Provided

CONSTRUCTION COST AND REBATES

CONCORD ENGINEERING GROUP

SENIOR CENTER

ECM 1 Upgrade Flourescent Lighting System

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Fixture Replacement	LS	$11,800	$0	$0	$11,800
Total Cost			$0	$0	$11,800
Utility Incentive					($2,675)
Total Cost Less Incentive					$9,125

ECM 2 Install LED Exit Signs

	Qty	Unit Cost $	Material $	Labor $	Total $
LED Exit Sign w/ Emergency Lighting	12	$80	$50	$30	$960
Total Cost			$50	$30	$960
Utility Incentive - NJ Smart Start					($240)
Total Cost Less Incentive					$720

ECM 3 Install Interior Lighting Controls

	Qty	Unit Cost $	Material $	Labor $	Total $
Dual-Technology Sensor	5	$75	$75	$0	$375
Total Cost			$75	$0	$375
Utility Incentive - NJ Smart Start					($100)
Total Cost Less Incentive					$275

ECM 4 Install Parking Lot Lighting Controls

	Qty	Unit Cost $	Material $	Labor $	Total $
Parking Lot Lighting Control System	1	$10,800	$0	$0	$10,800
Total Cost			$0	$0	$10,800
Utility Incentive - NJ Smart Start					($750)
Total Cost Less Incentive					$10,050

ECM 5 Install Boiler Controller

	Qty	Unit Cost $	Material $	Labor $	Total $
Boiler Controller	1	$5,000	$2,500	$2,500	$5,000
Total Cost			$2,500	$2,500	$5,000
Utility Incentive - NJ Smart Start					$0
Total Cost Less Incentive					$5,000

ECM 6 Replace Heating Hot Water Boiler

	Qty	Unit Cost $	Material $	Labor $	Total $
New Hot water Boiler	1	$32,000	$16,000	$16,000	$32,000
Total Cost			$16,000	$16,000	$32,000
Utility Incentive - NJ Smart Start					($1,060)
Total Cost Less Incentive					$30,940

ECM 7 Replace PTAC's in Arts Room

	Qty	Unit Cost $	Material $	Labor $	Total $
New PTAC Unit and Condensor	2	$2,000	$2,000	$2,000	$4,000
Total Cost			$2,000	$2,000	$4,000
Utility Incentive - N/A					($184)
Total Cost Less Incentive					$3,816

ECM 8 Replace Split AHU's in Multipurpose Room

	Qty	Unit Cost $	Material $	Labor $	Total $
New Split System Units	3	$16,000	$24,000	$24,000	$48,000
Total Cost			$24,000	$24,000	$48,000
Utility Incentive - N/A					($2,208)
Total Cost Less Incentive					$45,792

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SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

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

Gas Cooling

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

Desiccant Systems

	$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

EXISTING EQUIPMENT LIST

Concord Engineering Group

"Senior Center"

Boiler

Location	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	HB Smith	1	G300-S/W-11	A90-217	750	562	75%	Nat. Gas	18	35	17

Boiler - Pumps

Location	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	Amtrol	2	2GTV-3/4	-	3/4	1750	47	33.5	208	3	18	20	2

Domestic Hot Water Heater

Location	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Boiler Room	Rheem / RUUD	1	G75-75N-1	RRLN0407D09099	70	-	75	-	Nat. Gas	18	10	-8

Air Handling Units

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Coil	Heating Coil	Fan HP	Fan RPM	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Senior Center	Carrier	3	39LF03	-	96 MBh	86 MBh	2	1800	208	3	18	15	-3
Senior Center	Carrier	3	40AQ036	-	33.8 MBh	No Heating	1/3	High	208	3	18	15	-3
Senior Center	Carrier	1	39LF06	-	87.9 MBh	59.6 MBh	2	1290	208	3	18	15	-3

Exhaust Fans

Location	Manufacturer	Qty.	Model #	Serial #	Fan HP	Fan RPM	Volts	Phase	Notes	Approx. Age	ASHRAE Service Life	Remaining Life
Roof	PENN "Fumex"	1	FMX16B	-	1 1/2	1270	208	3	1991	18	25	7
Roof	PENN "Zephyr"	1	Z-121	-	280W	1075	115	1	1991	18	25	7
Roof	PENN "Zephyr"	2	Z-5	-	50W	1550	115	1	1991	18	25	7
Roof	PENN "Zephyr"	1	Z-10	-	130W	1050	115	1	1991	18	25	7

AC Condensers

Location	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life
Senior Center	Carrier	4	38BA-008	-	93MBh	8.9 EER	R-22	208	3	18	20	2
Senior Center	Carrier	2	38EN-030	-	31.4 MBh	7.6 EER	R-22	208	3	18	20	2
Senior Center	Carrier	1	38EN-036	-	38.1 MBh	7.6 EER	R-22	208	3	18	20	2
Senior Center	Friedrich	2	703-12A	-	12 Mbh	8.3 EER	R-22	208	3	18	20	2

Unit Heaters and Cabinet Unit Heaters

Location	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	GPM	CFM	RPM / HP	Efficiency (%)	Approx. Age	ASHRAE Service Life	Remaining Life
Senior Center	Trane	2	018-S	-	5.3 MBh	0.5	0.5	1050 / 1/25	-	18	18	0
Senior Center	Trane	2	3	-	20.2 MBh	2	200	700 / 1/30	-	18	18	0
Senior Center	Trane	1	2	-	13.4 MBh	1.5	145	700 / 1/60	-	18	18	0

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08127
Project: Lawrence Twp. Energy Audit - Senior Center
Address: 30 Darrah Lane East
City: Lawrence Twp.
Building SF: 9798

"Senior Center"

DATE: 05/26/2009
KWH COST: $0.188

EXISTING LIGHTING											PROPOSED LIGHTING							SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Entry - 01	2	High Hat	2496	60	0.12	299.52	$56.31	2	18 W CFL	18	0.04	89.856	$16.89	$3.75	$7.50	0.08	209.664	$39.42	0.19
2		Main hall - 02	8	2'X4' 4-Lamp T-12 Prism Lens, Indirect Fixture 2 Bulbs facing Up 2 down Magnetic Ballast	2496	154	1.23	3075.07	$578.11	8	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.73	1817.09	$341.61	$140.00	$1,120.00	0.50	1257.98	$236.50	4.74
3		Coat - 03	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	2496	122	0.24	609.024	$114.50	0	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.24	609.024	$114.50	0.00
4		Hall - 04	1	High Hat	2496	60	0.06	149.76	$28.15	1	18 W CFL	18	0.02	44.928	$8.45	$4.88	$4.88	0.04	104.832	$19.71	0.25
5		Gen. Off - 05	4	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	0.62	1537.54	$289.06	4	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.36	908.544	$170.81	$140.00	$560.00	0.25	628.992	$118.25	4.74
6		Exam - 06	2	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	0.31	768.768	$144.53	2	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	454.272	$85.40	$140.00	$280.00	0.13	314.496	$59.13	4.74
7		Toilet - 08	1	High Hat	2496	60	0.06	149.76	$28.15	1	18 W CFL	18	0.02	44.928	$8.45	$4.88	$4.88	0.04	104.832	$19.71	0.25
8		Dir. Off - 09	2	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	0.31	768.768	$144.53	2	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	454.272	$85.40	$140.00	$280.00	0.13	314.496	$59.13	4.74
9		Janitor - 10	1	1'X4' 1-Lamp T-12 No Lens Magnetic Ballast	2496	38	0.04	94.848	$17.83	1	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.03	74.88	$14.08	$100.00	$100.00	0.01	19.968	$3.75	26.64
10		Men - 11	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	2496	61	0.12	304.512	$57.25	0	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

11		Men - 11	2	1'X4' 1-Lamp T-12 Prism Lens Magnetic Ballast	2496	38	0.08	189.696	$35.66	2	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.06	149.76	$28.15	$100.00	$200.00	0.02	39.936	$7.51	26.64
12		Women - 12	2	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	2496	61	0.12	304.512	$57.25	0	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
13			2	1'X4' 1-Lamp T-12 Prism Lens Magnetic Ballast	2496	38	0.08	189.696	$35.66	2	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.06	149.76	$28.15	$100.00	$200.00	0.02	39.936	$7.51	26.64
14		Alcove - 13	1	High Hat	2496	100	0.10	249.6	$46.92	1	18 W CFL	18	0.02	44.928	$8.45	$4.88	$4.88	0.08	204.672	$38.48	0.13
15		Arts Crafts - 14	6	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	0.92	2306.3	$433.59	6	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.55	1362.82	$256.21	$140.00	$840.00	0.38	943.488	$177.38	4.74
16		Work Area - 15	2	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	0.31	768.768	$144.53	2	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	454.272	$85.40	$140.00	$280.00	0.13	314.496	$59.13	4.74
17		Arts Crafts - 16	4	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	0.62	1537.54	$289.06	4	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.36	908.544	$170.81	$140.00	$560.00	0.25	628.992	$118.25	4.74
18		Vest. - 17	1	100 W Metal Halide Fixture	2496	100	0.10	249.6	$46.92	1	28W Compact Fluorescent	28	0.03	69.888	$13.14	$4.88	$4.88	0.07	179.712	$33.79	0.14
19		Hall - 18	1	100 W Metal Halide Fixture	2496	100	0.10	249.6	$46.92	1	28W Compact Fluorescent	28	0.03	69.888	$13.14	$4.88	$4.88	0.07	179.712	$33.79	0.14
20		Foyer - 19	4	2'X4' 3-Lamp T-12 Prism Lens Magnetic Ballast	2496	116	0.46	1158.14	$217.73	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	609.024	$114.50	$120.00	$480.00	0.22	549.12	$103.23	4.65
21		Toilet - 20	1	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	2496	61	0.06	152.256	$28.62	0	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
22		Convo - 21	10	High Hat - Dimmable	2496	120	1.20	2995.2	$563.10	10	28W Compact Fluorescent	28	0.28	698.88	$131.39	$4.88	$48.80	0.92	2296.32	$431.71	0.11
23		Game room - 22	7	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	1.08	2690.69	$505.85	7	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.64	1589.95	$298.91	$140.00	$980.00	0.44	1100.74	$206.94	4.74
24		Toilet - 23	1	2'x2' 2-Lamp T-8 U-Tube, Prism Lens Electronic Ballast	2496	61	0.06	152.256	$28.62	0	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
25		Kitchen - 25	4	2'X4' 2-Lamp T-12 Prism Lens Magnetic Ballast	2496	78	0.31	778.752	$146.41	0	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.31	778.752	$146.41	0.00

26		Dry Stor. - 26	2	1'X4' 2-Lamp T-12 No Lens Magnetic Ballast	2496	78	0.16	389.376	$73.20	2	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.06	149.76	$28.15	$100.00	$200.00	0.10	239.616	$45.05	4.44
27		Mech. Room - 28	5	CFL - Porcelain	2496	13	0.07	162.24	$30.50	5	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.07	162.24	$30.50	0.00
28		Multipurpose - 29	36	2'X4' 4-Lamp T-12 Prism Lens Magnetic Ballast	2496	154	5.54	13837.8	$2,601.51	36	2'X4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	3.28	8176.9	$1,537.26	$140.00	$5,040.00	2.27	5660.93	$1,064.25	4.74
29		Storage - 30	1	1'X4' 1-Lamp T-12 No Lens Magnetic Ballast	2496	38	0.04	94.848	$17.83	1	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.03	74.88	$14.08	$100.00	$100.00	0.01	19.968	$3.75	26.64
30		Part Stor. - 31	1	1'X4' 1-Lamp T-12 No Lens Magnetic Ballast	2496	38	0.04	94.848	$17.83	1	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.03	74.88	$14.08	$100.00	$100.00	0.01	19.968	$3.75	26.64
31		Storage - 32	1	1'X4' 1-Lamp T-12 No Lens Magnetic Ballast	2496	38	0.04	94.848	$17.83	1	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.03	74.88	$14.08	$100.00	$100.00	0.01	19.968	$3.75	26.64
32		Part Stor. - 33	1	1'X4' 1-Lamp T-12 No Lens Magnetic Ballast	2496	38	0.04	94.848	$17.83	1	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.03	74.88	$14.08	$100.00	$100.00	0.01	19.968	$3.75	26.64
33		Storage - 34	1	1'X4' 1-Lamp T-12 No Lens Magnetic Ballast	2496	38	0.04	94.848	$17.83	1	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.03	74.88	$14.08	$100.00	$100.00	0.01	19.968	$3.75	26.64
34		Storage - 35	1	1'X4' 1-Lamp T-12 No Lens Magnetic Ballast	2496	38	0.04	94.848	$17.83	1	1'X4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	30	0.03	74.88	$14.08	$100.00	$100.00	0.01	19.968	$3.75	26.64
35		Mech. Room - 36	1	CFL - Porcelain	2496	13	0.01	32.448	$6.10	0	No Replacement	0	0.00	0	$0.00	$0.00	$0.00	0.01	32.448	$6.10	0.00
		Totals	123				14.71	36721.2	$6,903.58	110			7.52	18772.4	$3,529.21		$11,800.70	6.83	17035.2	$3,202.62	3.68

Senior Center PV Financials

Self Financed 95%-15 Year Term-5.0% Interest Rate

Total Project Cost	$294,400	System Size (kW)	36.80	Tax Rate	0.0%	
		Utility Rate ($/kWh)	$0.1880			
Net Project Cost	$294,400	Utility Rate Inflation	2.40%			
Percent Financed	**95%**	REC Value ($/kWh)	$0.350			
Capital Outlay	$14,720	Term (years)	**15**			
Financing Principal	$279,680	Rate	**5.0%**			

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Solar Generation (kWh)		57,428	57,141	56,855	56,571	56,288	56,007	55,727	55,448	55,171	54,895	54,620	54,347
Utility Rate per kWh		$0.188	$0.193	$0.197	$0.202	$0.207	$0.212	$0.217	$0.222	$0.227	$0.233	$0.238	$0.244
Federal Tax Credit		$0											
Cash effect of depreciation		$0	$0	$0	$0	$0	$0						
Avoided Utility Pmnt (from Solar Generation)		$10,796	$11,000	$11,208	$11,420	$11,635	$11,855	$12,079	$12,307	$12,539	$12,776	$13,017	$13,263
Revenue from REC Sale		$20,100	$19,999	$19,899	$19,800	$19,701	$19,602	$19,504	$19,407	$19,310	$19,213	$19,117	$19,022
Subtotal		$30,896	$31,000	$31,107	$31,219	$31,336	$31,457	$31,583	$31,714	$31,849	$31,989	$32,134	$32,284
Finance payment		($26,945)	($26,945)	($26,945)	($26,945)	($26,945)	($26,945)	($26,945)	($26,945)	($26,945)	($26,945)	($26,945)	($26,945)
Interest expense		($13,984)	($13,336)	($12,655)	($11,941)	($11,191)	($10,403)	($9,576)	($8,708)	($7,796)	($6,838)	($5,833)	($4,777)
Operations & Maintenance		$0	$0	$0	$0	$0	$420	$437	$454	$472	$491	$511	$531
Subtotal		($13,984)	($13,336)	($12,655)	($11,941)	($11,191)	($9,983)	($9,139)	($8,253)	($7,323)	($6,347)	($5,322)	($4,246)
Net Savings		$16,912	$17,664	$18,452	$19,278	$20,145	$21,474	$22,444	$23,460	$24,526	$25,642	$26,812	$28,039
Taxes on net savings (no tax on principle payment)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net savings after taxes		$16,912	$17,664	$18,452	$19,278	$20,145	$21,474	$22,444	$23,460	$24,526	$25,642	$26,812	$28,039
Principal Payment		($12,961)	($13,609)	($14,290)	($15,004)	($15,754)	($16,542)	($17,369)	($18,237)	($19,149)	($20,107)	($21,112)	($22,168)
Net Cash Flow After Taxes	($14,720)	$3,951	$4,055	$4,162	$4,274	$4,391	$4,932	$5,075	$5,223	$5,376	$5,535	$5,700	$5,871
Cumulative savings before taxes		$16,912	$34,576	$53,028	$72,306	$92,452	$113,926	$136,370	$159,830	$184,356	$209,998	$236,810	$264,849

Year	13	14	15	16	17	18	19	20	21	22	23	24	25
Solar Generation (kWh)	54,076	53,805	53,536	53,269	53,002	52,737	52,473	52,211	51,950	51,690	51,432	51,175	50,919
Utility Rate per kWh	$0.250	$0.256	$0.262	$0.268	$0.275	$0.281	$0.288	$0.295	$0.302	$0.309	$0.317	$0.324	$0.332
Federal Tax Credit													
Subtotal													
Avoided Utility Pmnt (from Solar Generation)	$13,513	$13,768	$14,028	$14,293	$14,563	$14,838	$15,118	$15,404	$15,694	$15,991	$16,293	$16,600	$16,914
Revenue from REC sale	$18,926	$18,832	$18,738	$18,644	$18,551	$18,458	$18,366	$18,274	$18,183	$18,092	$18,001	$17,911	$17,822
Subtotal	$32,440	$32,600	$32,766	$32,937	$33,114	$33,296	$33,484	$33,677	$33,877	$34,082	$34,294	$34,511	$34,735
Finance payment	($26,945)	($26,945)	($26,945)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest expense	($3,669)	($2,505)	($1,283)	($0)	($0)	($0)	($0)	($0)	$0	$0	$0	$0	$0
Operations & Maintenance	$553	$575	$598	$622	$647	$673	$699	$727	$756	$787	$818	$851	$885
Subtotal	($3,116)	($1,930)	($685)	$622	$647	$673	$699	$727	$756	$787	$818	$851	$885
Net Savings	$29,324	$30,670	$32,081	$33,559	$33,760	$33,968	$34,183	$34,405	$34,633	$34,869	$35,112	$35,362	$35,620
Taxes on net savings (no tax on principle payment)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net savings after taxes	$29,324	$30,670	$32,081	$33,559	$33,760	$33,968	$34,183	$34,405	$34,633	$34,869	$35,112	$35,362	$35,620
Principal Payment	($23,276)	($24,440)	($25,662)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Cash Flow After Taxes	$6,047	$6,230	$6,419	$33,559	$33,760	$33,968	$34,183	$34,405	$34,633	$34,869	$35,112	$35,362	$35,620
Cumulative savings before taxes	$294,172	$324,842	$356,923	$390,482	$424,242	$458,211	$492,394	$526,799	$561,432	$596,301	$631,413	$666,775	$702,395

Internal Rate of Return After Taxes	33%
NPV of After Tax Cash Flows	$92,512
NPV Discount Rate	8.00%

These Figures are estimates for discussion only.

Senior Center PV Financials
Purchase

Total Project Cost	$294,400	System Size (kW)	36.80	Tax Rate	0.0%
		Utility Rate ($/kWh)	$0.1880		
Net Project Cost	$294,400	Utility Rate Inflation	2.40%		
		REC Value ($/kWh) year 1-25	$0.350		
Capital Outlay	$294,400				

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Solar Generation (kWh)		57,428	57,141	56,855	56,571	56,288	56,007	55,727	55,448	55,171	54,895	54,620	54,347
Utility Rate per kWh		$0.188	$0.193	$0.197	$0.202	$0.207	$0.212	$0.217	$0.222	$0.227	$0.233	$0.238	$0.244
Capital Outlay	($294,400)												
Tax Credit		$0											
Cash effect of depreciation		$0	$0	$0	$0	$0	$0						
Avoided Utility Pmnt (from Solar Generation)		$10,796	$11,000	$11,208	$11,420	$11,635	$11,855	$12,079	$12,307	$12,539	$12,776	$13,017	$13,263
Revenue from REC Sale		$20,100	$19,999	$19,899	$19,800	$19,701	$19,602	$19,504	$19,407	$19,310	$19,213	$19,117	$19,022
Subtotal		$30,896	$31,000	$31,107	$31,219	$31,336	$31,457	$31,583	$31,714	$31,849	$31,989	$32,134	$32,284
Operations & Maintenance		$0	$0	$0	$0	$0	$420	$437	$454	$472	$491	$511	$531
Subtotal		$0	$0	$0	$0	$0	$420	$437	$454	$472	$491	$511	$531
Net Savings		$30,896	$31,000	$31,107	$31,219	$31,336	$31,877	$32,020	$32,168	$32,321	$32,480	$32,645	$32,816
Taxes on net savings		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Savings after taxes	($294,400)	$30,896	$31,000	$31,107	$31,219	$31,336	$31,877	$32,020	$32,168	$32,321	$32,480	$32,645	$32,816
Cumulative Savings	($294,400)	($263,504)	($232,504)	($201,397)	($170,177)	($138,841)	($106,964)	($74,944)	($42,776)	($10,455)	$22,026	$54,671	$87,487

Year	13	14	15	16	17	18	19	20	21	22	23	24	25
Solar Generation (kWh)	54,076	53,805	53,536	53,269	53,002	52,737	52,473	52,211	51,950	51,690	51,432	51,175	50,919
Utility Rate per kWh	$0.250	$0.256	$0.262	$0.268	$0.275	$0.281	$0.288	$0.295	$0.302	$0.309	$0.317	$0.324	$0.332
Avoided Utility Pmnt (from Solar Generation)	$13,513	$13,768	$14,028	$14,293	$14,563	$14,838	$15,118	$15,404	$15,694	$15,991	$16,293	$16,600	$16,914
Revenue from REC sale	$18,926	$18,832	$18,738	$18,644	$18,551	$18,458	$18,366	$18,274	$18,183	$18,092	$18,001	$17,911	$17,822
Subtotal	$32,440	$32,600	$32,766	$32,937	$33,114	$33,296	$33,484	$33,677	$33,877	$34,082	$34,294	$34,511	$34,735
Operations & Maintenance	$553	$575	$598	$622	$647	$673	$699	$727	$756	$787	$818	$851	$885
Subtotal	$553	$575	$598	$622	$647	$673	$699	$727	$756	$787	$818	$851	$885
Net Savings	$32,992	$33,175	$33,364	$33,559	$33,760	$33,968	$34,183	$34,405	$34,633	$34,869	$35,112	$35,362	$35,620
Taxes on net savings	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net savings after taxes	$32,992	$33,175	$33,364	$33,559	$33,760	$33,968	$34,183	$34,405	$34,633	$34,869	$35,112	$35,362	$35,620
Cumulative Savings	$120,479	$153,654	$187,018	$220,577	$254,337	$288,306	$322,489	$356,894	$391,527	$426,396	$461,508	$496,870	$532,491

After Tax IRR	9.9%
NPV of Net Savings After Taxes	$47,100
NPV Discount Rate	8.00%

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Senior Center	2340	Sunpower SPR230	160	14.7	2,353	36.80	57,428	5,280	15.64

.= Proposed PV Layout

Notes:
1. Estimated kWH based on 4.68 hours full output per day per 365 day year. Actual kWH will vary day to day.