



ENERGY AUDIT – FINAL REPORT

HOBOKEN **Public Library**

250 - 254 5th St.
Hoboken, NJ 07030
ATTN: Lina Podles

CEG PROPOSAL NO. 9C08143

CONCORD ENGINEERING GROUP



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I. EXECUTIVE SUMMARY

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

Hoboken
Public Library
250 - 254 5th St
Hoboken, NJ 07030

Facility Contact Person: Lina Podles

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	\$14,509
Natural Gas	\$20,441
Total	\$34,950

The potential annual energy cost savings are shown below in Table 1. Be aware that the measures are not additive because of the interrelation of several of the measures. The cost of each measure for this level of auditing is $\pm 20\%$ 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)	SIMPLE RETURN ON INVESTMENT
1	Interior Lighting Upgrades	\$12,714	\$3,026	4.3	23.2%
2	Install Compact Fluorescent Lamps	\$210	\$945	.2	500%
3	Interior Lighting Controls	\$275	\$69	4	25%
4	High-Efficiency Air conditioning Units (Indoor Packaged system)	\$14,100	\$1,113	12.7	7.87%
5	High-Efficiency Rooftop Units	\$7,050	\$783	9	11.1%
6	Domestic Water Heater Replacement	\$3,936	\$124	32	3.1%
7	Boiler Replacement – High Efficiency	\$43,648	\$3,636	12	8.33%

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)	NATURAL GAS (MBH)
1	Interior Lighting Upgrades	6.29	18,971	-
2	Install Compact Fluorescent Lamps	1.96	5,908	-
3	Interior Lighting Controls	-	446	-
4	High-Efficiency Air conditioning Units (Indoor Packaged system)	-	3,614	-
5	High-Efficiency Rooftop Units	-	5,087	-
6	Domestic Water Heater Replacement	-	-	90.5
7	Boiler Replacement – High Efficiency	-	-	2,674

Recommendation:

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 Hoboken, Public Library:

- **ECM #1:** Interior Lighting Upgrades
- **ECM #2:** Install Compact Fluorescent Lamps
- **ECM #3:** Interior Lighting Controls

Concord Engineering Group recommends that consideration be given to the implementation of all ECM's where equipment is substantially past its useful life. Equipment that is substantially past its useful life typically is inefficient, has higher maintenance costs and is more susceptible to mechanical failure. This equipment does not meet the criteria of simple payback at or under seven years on energy savings alone. Additional consideration should be given to maintenance costs, reliability as well as the length of time the owner expects to own and maintain the building. Concord Engineering Group recommends the following ECM for implementation based on useful life expectancy:

- **ECM #4:** High-Efficiency Indoor Packaged Units
- **ECM #5:** High-Efficiency Air conditioning Units (Indoor Packaged system)
- **ECM#6:** Domestic Water Heater Replacement
- **ECM#7:** Boiler Replacement – High Efficiency

Concord Engineering Group has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. This solar energy system is viable for the Public Library building. CEG recommends the Owner review the implementation in addition to the funding options noted in Section X. The simple payback for either of the two funding options is 11.44 years.

II. INTRODUCTION

This comprehensive energy audit covers the 6,575 square foot Hoboken, Public Library facility that includes the office, boiler room, storage room, kitchen hall, elevator lobby, rest room and library areas, etc. The building was built in 1895.

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

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/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

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. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

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

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment 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 SmartStart 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 costs and savings are applied and a simple payback and simple return on investment (ROI) is calculated. The simple payback is based on the years that it takes for the savings to pay back the net installation cost (Net Installation divided by Net Savings.) A simple return on investment is calculated as the percentage of the net installation cost that is saved in one year (Net Savings divided by Net Installation.)

A simple life-time calculation is shown for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The energy savings is extrapolated throughout the life-time of the ECM. The total energy savings is calculated as the total life-time multiplied by the yearly savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Electric

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from August-06 to July-07. The utility bill for May-07 and July-07 were not available and an average of the adjacent months was assumed for these cases. Public Service Electric and Gas Company (PSE&G) provides electricity to the facility under the General Lighting and Power Service (GLP) 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.

Natural Gas

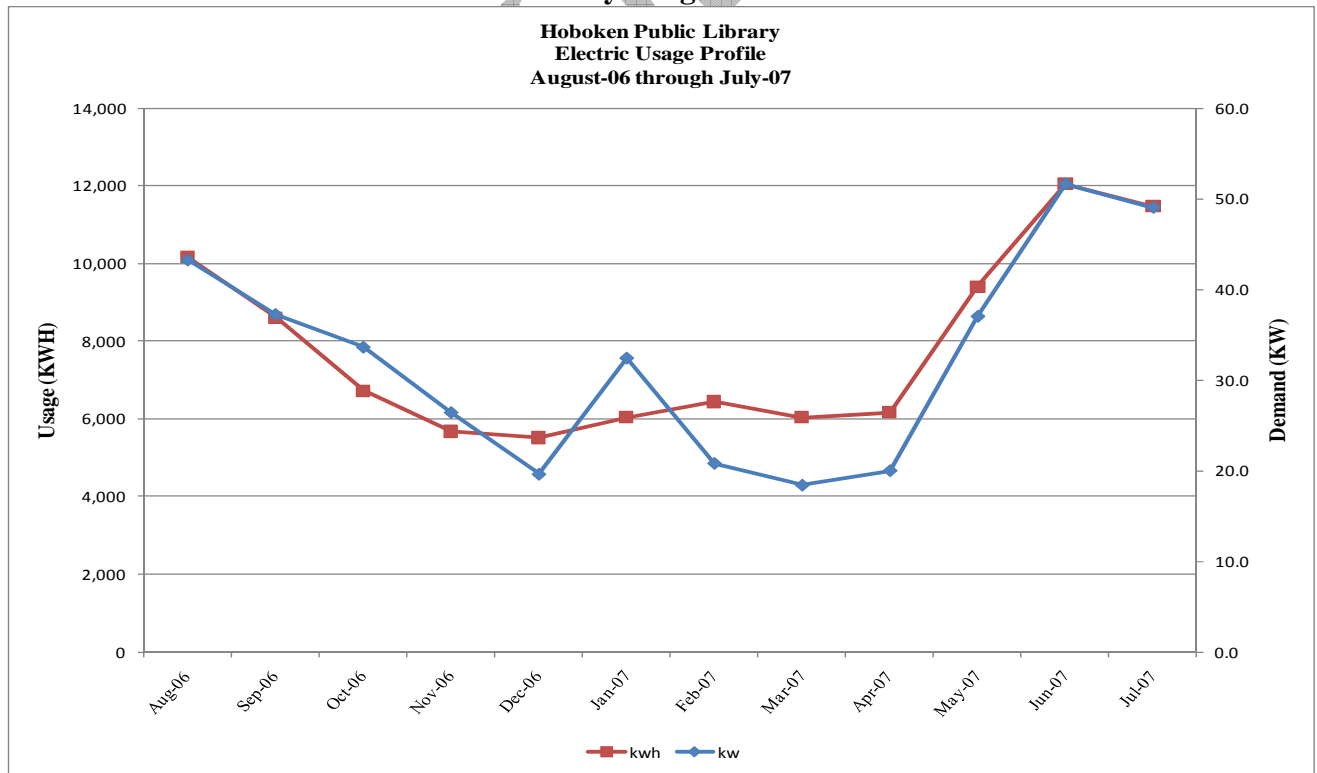
Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from August-06 to July-07. The utility bill for May-07 and July-07 were not available and an average of the adjacent months was assumed for these cases. PSE&G provides the natural gas to the facility under their Large Volume Gas (LVG) rate.

<u>Description</u>	<u>Average</u>
Electricity	15.4¢ /kWh
Natural Gas	\$1.36 /Therm

**Table 3
Electricity Billing Data**

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-07	6,040	20.8	\$789
Feb-07	6,440	18.4	\$768
Mar-07	6,040	20.0	\$731
Apr-07	6,160	37.0	\$748
May-08	9,403	51.6	\$1,457
Jun-07	12,040	49.0	\$2,072
Jul-08	11,470	43.2	\$2,039
Aug-06	10,160	37.2	\$1,874
Sep-06	8,600	33.6	\$1,619
Oct-06	6,720	26.4	\$978
Nov-06	5,680	19.6	\$739
Dec-06	5,520	20.8	\$696
Totals	94,273	MAX 51.6	\$14,509

**Figure 1
Electricity Usage Profile**

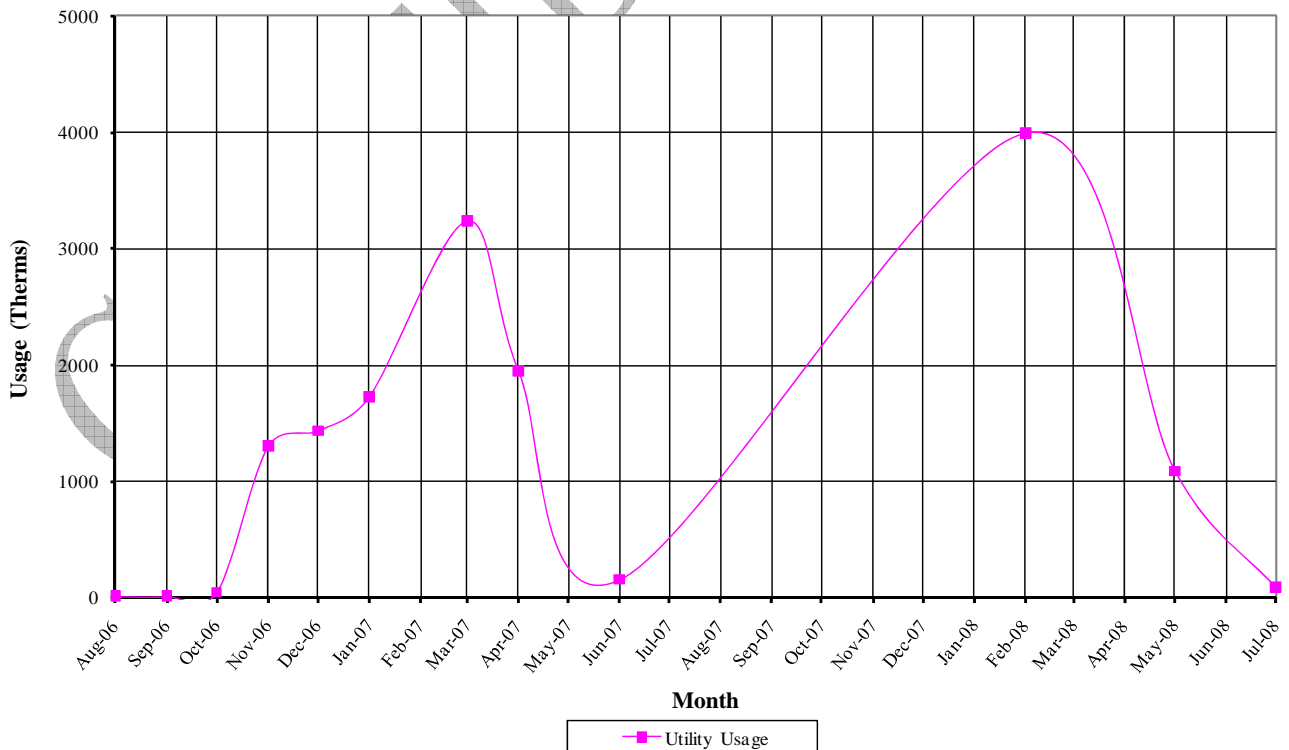


**Table 4
Natural Gas Billing Data**

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jan-07	1,729.29	\$2,618.84
Feb-08	3,994.14	\$4,888.12
Mar-07	3,238.64	\$4,418.32
Apr-07	1,952.60	\$2,312.81
May-07	1,090.48	\$1,334.85
Jun-07	158.01	\$271.29
Jul-07	88.10	\$189.74
Aug-06	12.62	\$95.94
Sep-06	12.62	\$96.91
Oct-06	49.32	\$127.68
Nov-06	1,302.36	\$1,746.58
Dec-06	1,436.35	\$2,339.67
TOTALS	15064.52	\$20,440.75

**Figure 2
Natural Gas Usage Profile**

Hoboken Public Library
Gas Usage Profile
January through December of 2008



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's energy utilization per square foot of building. This calculation is completed by converting all utility usage (gas, electric, oil) consumed by a building over a specified time period, typically 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 amongst building of similar type. The EUI for this facility is calculated as follows:

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

$$\begin{aligned} \text{Electric} &= ((94,273 \text{ kWh}) * (1000 \text{ W/kW}) * (3.414 \text{ Btu/h} / 1 \text{ W})) / (1000 \text{ Btu/h} / 1 \text{ kBtu/h}) \\ &= 321,848 \text{ kBtu} \end{aligned}$$

$$\text{Natural Gas} = (15,064 \text{ Therms}) * (100,000 \text{ Btu/Therm}) / 1000 \text{ BTU} / \text{kBTU} = 1,506,452 \text{ kBtu}$$

$$\text{Building EUI} = \frac{(321,848 \text{ kBtu} + 1,506,452 \text{ kBtu})}{6,575 \text{ SF}} = \frac{1,828,300 \text{ kBtu}}{6,575 \text{ SF}}$$

$$\text{Public Library EUI} = \underline{278 \text{ kBtu/SF}}$$

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 Star 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 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>

Username: hobokencity

Password: lgeaceg2009

Security Question: What is your birth city?

Security answer: hoboken city

Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an “Other” category. The Hoboken, Public Library falls under this “Other” category. The “Other” category is used if your building type or a section of the building is not represented by one of the specific categories. An Energy Performance Rating cannot be calculated if more than 10% of a building is classified as “Other.” The majority of the Public Library would be classified as “Other” and therefore cannot be given an Energy Performance Rating. Despite this Portfolio Manager calculates the building EUI. The EUI is an important tool that can be used to track the energy efficiency of the building. Baselines for improvement can be set that the municipality can strive to meet. CEG strongly urges Hoboken to keep their Portfolio Manager account up to monitor the performance of the building.

Refer to Appendix D for detailed energy benchmarking report entitled “STATEMENT OF ENERGY PERFORMANCE.”

V. FACILITY DESCRIPTION

The Hoboken Public Library consists of the office, boiler room, storage room, kitchen hall, elevator lobby, rest room and library areas; totaling approximately 6,575 SF. The brick/block facility was built in 1895. The facility is occupied 58 hours a week.

Heating System

The Public Library building is mainly heated by a natural gas-fired H.B Smith 350 Mills boiler with a 2,400,000 BTUH maximum input. This is a steam boiler located in the basement with a rated efficiency of 75%. This boiler appears to be approximately thirty (30) plus years of age and is at the end of its useful service life. The steam that is produced via this boiler provides heating to many spaces within the library through cast-iron radiators.

A second boiler, also located in the basement, provides heating to other areas in the building not served by the steam boiler. The second boiler is manufactured by Peerless Boiler Co. and is a natural gas-fired heating hot water boiler with a 130,000 BTUH maximum input and an 82% rated efficiency. This boiler appears to be approximately fifteen (15) years of age and has an estimated nine (9) years of remaining service life. From discussions with the maintenance staff it was noted that both boilers are manually operated on and off. This method of control is not the most efficient and the review of control upgrades for the boilers are highly recommended.

Domestic Hot Water

Domestic hot water for the restrooms is provided by a State, natural gas fired domestic water heater, 50-gallon capacity rated at 40,000 Btuh input. The heater was manufactured in 2000 and has an estimated three (3) years remaining service life.

Cooling System

Cooling is provided by three (3) Carrier Room Top Horizontal indoor single packaged cooling units, utilizing R-22 refrigerant cooling with 2 units having electric heating coils. Two units are 5 Ton nominal and one is 7 Ton nominal. There are four (4) Trane, 1 Ton nominal Packaged Terminal air conditioners; one serving the Main Office, two serving the First Floor Stack area and one serving the First Floor Lobby.

Lighting

The Boiler room, Kitchen Hall, and Storage rooms are lit via 2-tube, 8 foot long fluorescent T12 lamps and magnetic ballasts. The Front Office and partial First and Second Floors are lit via 4-tube, 8 foot long fluorescent T12 lamps and magnetic ballasts. The Bathroom is lit via wall mounted 2 foot long fluorescent T12 lamps and magnetic ballast. The Third floor is lit by 2-foot by 4-foot lay-in fixtures containing T12 fluorescent lamps and magnetic ballasts. The elevator Lobby and some second floor fixtures are lit via 2-foot by 2-foot lay-in fixtures containing T8 fluorescent lamps and electronic ballasts. Part of the second floor is lit via 4-foot by 1-foot fluorescent T-8 lamps and electronic ballasts. Some of the Boiler room, Library and First floor areas are lit via

incandescent lamps. Standard switching is utilized and there are no other types of lighting controls present. The exit signs throughout the facility contain incandescent lamps and consume an estimated 30 watts of electricity per exit sign.

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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.

**Table 4 thru 6
Existing Equipment Listing**

Cooling Equipment							
Description	Qty	Cooling Capacity (Tons)	Cooling Capacity (BTUH)	Fuel Type	Approx. Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
CARRIER Model 50BH-008-520	1	7	81,900	ELECTRIC	20	15	(-5)
CARRIER Model 50AH060500	1	5	58,500	ELECTRIC	20	15	(-5)
CARRIER Model 50AH060500	1	5	58,500	ELECTRIC	20	15	(-5)
TRANE Model PTED1201WAA	1	1	11,700	ELECTRIC	20	15	(-5)
TRANE Model PTED1201JAA	1	1	11,700	ELECTRIC	20	15	(-5)
TRANE Model PTED1201JAA	1	1	11,700	ELECTRIC	20	15	(-5)
TRANE Model PTED1201JAA	1	1	11,700	ELECTRIC	20	15	(-5)

HEATING EQUIPMENT						
Description	Qty	Rated Capacity(BTUH)	Fuel Type	Approx. Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
H.B.SMITH 350 MILLS	1	1,394	NATURAL GAS	30 *	30	0
PEERLESS MCB-130	1	-	NATURAL GAS	10 *	24	14
* - Manufacture date estimated due to information is unavailable.						

DOMESTIC WATER HEATING SYSTEM						
Description	Qty	Capacity	Fuel Type	Approx. Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
State PR650NBRT Water Heater	1	50 gallon	Natural Gas 40 MBH Input	9 *	12	3
* - Manufacture date estimated due to information is unavailable.						

Note: Equipment noted as having a negative (#) remaining life is considered past its standard service life as described in 2007 ASHRAE Applications Handbook and is most likely a good candidate for replacement.

Refer to Appendix E for the Major Equipment List.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Interior Lighting Upgrades

Description:

Replacing the 1 foot x 8 foot, two T12 lamp fluorescent fixtures with new is a simple change that can provide substantial savings. A typical 1 foot x 8 foot, two T12 lamp fluorescent fixture has a total wattage of about 222 Watts. By replacing with two (2) new 1 foot x 4 foot fixture that have T8 lamps, reflector and electronic ballasts the total wattage would be reduced to 48 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 facility, the owner will be changing approximately 33% less lamps per year.

This ECM shall replace all T12 fixtures throughout the facility with new T8 lay-in type fixtures where there are ceilings and pendant type where it is exposed to structure.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in Appendix F 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.

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

$$\text{Smart Start}^{\circledR} \text{ Incentive} = (122 \times \$ 25) + (17 \times \$ 30) = \$3,560$$

Maintenance Savings are calculated as follows:

$$\text{Maintenance Savings} = (\# \text{ of lamps} \times \% \text{ reduction} \times \$ \text{ per lamp})$$

$$\text{Maintenance Savings} = (312 \times 33\% \text{ reduction} \times \$ 2.00) = \$206$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$16,480
NJ Smart Start Equipment Incentive (\$):	(\$3,560)
Net Installation Cost (\$):	\$12,714
Maintenance Savings (\$ / yr):	\$206
Energy Savings (\$ / yr):	\$2,820
Net Savings (\$ / yr):	\$3,026
Simple Payback (yrs):	4.3
Simple Return On Investment (%):	23.2%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$45,390

ECM #2: Install Compact Fluorescent Lamps

Description:

Compact fluorescent lamps (CFL's) were created to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 40-Watt incandescent lamp, a 15-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 23-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures.

This ECM involves replacing all incandescent lamps in the facility with energy efficient compact fluorescent lamps.

Energy Savings Calculations:

There are twenty-four (24) 40-Watt, twenty-four (24) 60-Watt and three (3) 100-Watt incandescent lamps in the facility that can be upgraded to 13, 15 and 23 Watt CFL units respectively. The average operating hours for these lamps is estimated to be 3016.

Energy cost savings:

$[24 \text{ units} * (40\text{W} - 13\text{W}) + 24 \text{ units} * (60\text{W} - 15\text{W}) + 3 \text{ units} * (100\text{W} - 23\text{W})] 3016 \text{ hours} * 1 \text{ kW}/1,000 \text{ W} * \$0.16/\text{kWh}] = \$945.00/\text{yr}$

The installed cost of twenty-four (24) 13-Watt, twenty-four (24) 15-Watt and three (3) 23-Watt CFL's is \$210.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$210
NJ Smart Start Equipment Incentive (\$):	-
Net Installation Cost (\$):	\$210
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	\$945
Net Savings (\$ / yr):	\$945
Simple Payback (yrs):	0.2
Simple Return On Investment (%):	500%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$14,175

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ECM #3: Interior Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. Many times this is due to the idea that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was found that the best option is to turn the lights off whenever possible. Although this does reduce the lamp life, the energy savings far outweigh the lamp replacement costs. The cutoff for when to turn the lights off is around two minutes. If the lights can be off for only a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is all it would take. 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 of the referenced standard, 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 office, boiler room, storage room, kitchen hall and rest room areas, etc. in the Public Library facility (5 spaces approximately 1,000 square feet).

CEG would recommend wall switches for individual rooms, ceiling mount sensors for large office areas or restrooms, and fixture mount box sensors for some applications as manufactured by Sensorswitch, Watt Stopper, etc.

Energy Savings Calculations:

From Appendix F of this report, we calculated the lighting power density (Watts/ft²) of the private offices, conference rooms, restrooms, storage rooms; file rooms, etc. the facility to be ±1.48 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

$$\text{Savings} = 10\% \times 1.48 \text{ Watts/SF} \times 1,000 \text{ SF} \times 3,016 \text{ hrs/yr.} = 446 \text{ kWh} \times \$0.154/\text{kWh}$$

$$\text{Savings} = \underline{\$69} \text{ per year}$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is \$75/unit including material and labor.

The SmartStart Buildings® incentive is \$20 per control which equates to an installed cost of \$55/unit. Total number of spaces to be retrofitted is 5.

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

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$375
NJ Smart Start Equipment Incentive (\$):	(\$100)
Net Installation Cost (\$):	\$275
Maintenance Savings (\$ / yr):	\$0
Energy Savings (\$ / yr):	\$69
Net Savings (\$ / yr):	\$69
Simple Payback (yrs):	4
Simple Return On Investment (%):	25%
Estimated ECM Lifetime (yr):	25
Simple Lifetime Savings (\$):	\$1,725

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ECM #4: High-Efficiency Air conditioning Units (Indoor Packaged system)

Description:

The direct expansion (DX) cooling with electric heating horizontal indoor packaged systems are excellent candidates for replacement. These units are 19 years old and have approximately one (1) year of service life remaining as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. Due to escalating owning and maintenance costs, these units should be replaced.

This measure would replace each horizontal indoor packaged system with energy-efficient variable air volume air handler with DX cooling and electric heating, variable air volume zone control dampers and an energy efficient condensing unit, by Trane or approved equivalent.

Energy Savings Calculations:

$$EnergySavings = \frac{[CoolingTons \times 12,000 Btu / ton]}{[1000W / kW]} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}} \right) \times Avg.LoadFactor \times Hrs.ofCooling$$

Existing Carrier 5-Ton Horizontal indoor package Cooling w/ Electric Heat (2 units)

Rated Capacity = 5 Tons per unit

Condenser Section Efficiency = 7.1 EER

Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity - \$0.154/kWh

Proposed High-Efficiency 5-Ton Horizontal indoor package Cooling w/ Electric Heat (2 units)

Rated Capacity = 5 Tons per Unit

New Cooling Unit Efficiency = 10.1 EER

$$EnergySavings = \frac{[5Tons \times 12,000 Btu / ton]}{[1000W / kW]} \times \left(\frac{1}{7.1} - \frac{1}{10.1} \right) \times 0.8 \times 1800 = 3614.6 kWh / yr \text{ per unit}$$

Total Energy Cost Savings = 3614.6 kWh/yr. x \$0.154/kWh = \$557 per year per unit

= \$557 x 2 Units = \$1,113 per year.

Installation costs for the two (2) horizontal indoor packaged system replacements are estimated at \$15,000. It is pertinent to note that this estimate includes the demolition of the existing units and dunnage modifications (if required).

NJ Smart Start[®] Program Incentives are calculated as follows:

From Appendix C, the rooftop unit replacement falls under the category “Unitary HVAC” and warrants an incentive based on efficiency (EER) at a certain cooling tonnage.

$$\begin{aligned} \text{Smart Start}^{\circledR} \text{ Incentive (RTU - 5 Tons)} &= (\text{Cooling Tons} \times \text{RTU Incentive}) \\ &= 2(5\text{Tons} \times \$40/\text{Ton}) = \$400 \end{aligned}$$

$$\text{Smart Start}^{\circledR} \text{ Incentive DualEnthalpyEconomizerControls} = \$250 \times 2 \text{ units} = \$500$$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$15,000
NJ Smart Start Equipment Incentive (\$):	(\$900)
Net Installation Cost (\$):	\$14,100
Maintenance Savings (\$ / yr):	\$0
Energy Savings (\$ / yr):	\$1,113
Net Savings (\$ / yr):	\$1,113
Simple Payback (yrs):	12.7
Simple Return On Investment (%):	7.87%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$16,695

ECM #5: High-Efficiency Rooftop Air Conditioning Unit

Description:

The direct expansion (DX) cooling with electric heating rooftop system is an excellent candidate for replacement. This unit is 19 years old and is four (4) years past its useful service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. Due to escalating owning and maintenance costs, this unit should be replaced.

This measure would replace the rooftop unit with energy-efficient variable air volume air handler with DX cooling and electric heating, variable air volume zone control dampers and an energy efficient condensing unit, by Trane or approved equivalent.

Energy Savings Calculations:

$$EnergySavings = \frac{[CoolingTons \times 12,000 Btu / ton]}{[1000W / kW]} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}} \right) \times Avg.LoadFactor \times Hrs.ofCooling$$

Existing Carrier 5-Ton Rooftop Cooling w/ Electric Heat

Rated Capacity = 5 Tons per unit

Condenser Section Efficiency = 8.0 EER

Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity - \$0.154/kWh

Proposed High-Efficiency 5-Ton Rooftop Single Zone Variable Speed Cooling w/ Electric Heat

Rated Capacity = 5 Tons per Unit

New Cooling Unit Efficiency = 12.2 EER

$$EnergySavings = \frac{[5Tons \times 12,000 Btu / ton]}{[1000W / kW]} \times \left(\frac{1}{7.1} - \frac{1}{12.2} \right) \times 0.8 \times 1800 = 5,087 kWh / yr \text{ per unit}$$

Total Energy Cost Savings = 5,087 kWh/yr. x \$0.154/kWh = \$783 per year per unit

Installation costs for the one (1) rooftop system replacements are estimated at \$7,500. It is pertinent to note that this estimate includes the demolition of the existing units and roof curb modifications (if required).

NJ Smart Start[®] Program Incentives are calculated as follows:

From Appendix C, the rooftop unit replacement falls under the category “Unitary HVAC” and warrants an incentive based on efficiency (EER) at a certain cooling tonnage.

$$\begin{aligned} \text{Smart Start}^{\circledR} \text{ Incentive (RTU - 5 Tons)} &= (\text{Cooling Tons} \times \text{RTU Incentive}) \\ &= 1(5 \text{ Tons} \times \$40 / \text{Ton}) = \$200 \end{aligned}$$

$$\text{Smart Start}^{\circledR} \text{ Incentive DualEnthalpyEconomizerControls} = \$250 \times 1 \text{ unit} = \$250$$

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$7,500
NJ Smart Start Equipment Incentive (\$):	(\$450)
Net Installation Cost (\$):	\$7,050
Maintenance Savings (\$ / yr):	\$0
Energy Savings (\$ / yr):	\$783
Net Savings (\$ / yr):	\$783
Simple Payback (yrs):	9
Simple Return On Investment (%):	11.1%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$11,745

ECM #6: Domestic Water Heater Replacement

Description:

The existing domestic hot water heater is a State Industries 40,000 BTUH input Natural Gas Heater and has a 80% thermal efficiency. The nameplate recovery rate is 41 gallons per hour at 75% thermal efficiency.

This energy conservation measure will replace the existing natural gas 50-gallon capacity residential grade domestic water heater with a 90% thermal efficient State Industries model SHE5076NE commercial grade gas fired domestic hot water heater with 50-gallon storage capacity or equivalent. This ECM requires coordination with the utility due to increase in natural gas demand for the facility. CEG advises the owner to contact the utility provider regarding the installation of this ECM.

Energy Savings Calculations:

Existing Natural Gas DW Heater

Rated Capacity = 40 MBH input; 50 gallons storage

Combustion Efficiency = 80%

Age & Radiation Losses = 5%

Thermal Efficiency = 75%

Proposed Natural Gas-Fired, High-Efficiency DW Heater

Rated Capacity = 76 MBH input; 50 gallons storage

Thermal Efficiency = 90%

Radiation Losses = 0.5%

Net Efficiency = 89.5%

Operating Data for DW Heater

Estimated Daily DWH Load = (78 occupants x 1.0 gal/day) / 8 hr/day = 9.75 gal/h

DW Heater Operating Hrs/Yr. = 735 Hrs.

Natural Gas Consumption = 735 hrs x 76,000 BTU/Hr x 1 Therm/ 100,000 BTU/Hr

Natural Gas Consumption = 558.6 Therms

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

$$\text{Energy Savings} = 558.6 \text{ Therms} \times \frac{(89.5\% - 75\%)}{(89.5\%)} = 90.5 \text{ Therms}$$

$$\text{Average Cost of Natural Gas} = \$1.36/\text{Therm}$$

$$\text{Yearly Savings} = 90.5 \text{ Therm} \times \$1.37/\text{Therm} = \$123/\text{year}$$

$$\text{Cost of the Commercial Domestic Water Heater and Installation} = \$4,088$$

$$\text{Simple Payback} = \$4,088 / \$123 = 33 \text{ years}$$

$$\text{Smart Start Incentive} = \$2.00/\text{MBh} \times \$76 / \text{installed MBh} = \$152.$$

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$4,088
NJ Smart Start Equipment Incentive (\$):	(\$152)
Net Installation Cost (\$):	\$3,936
Maintenance Savings (\$ / yr):	\$0
Energy Savings (\$ / yr):	\$124
Net Savings (\$ / yr):	\$124
Simple Payback (yrs):	32
Simple Return On Investment (%):	3.1%
Estimated ECM Lifetime (yr):	12
Simple Lifetime Savings (\$):	\$1,488

ECM #7: Boiler Replacement – High Efficiency Upgrade

Description:

This ECM replaces the steam boiler with a high efficiency condensing steam boiler. The Hoboken Public Library is heated by one (1) HB Smith 350 Series Natural Gas-fired, 10 sections, 2,352 MBh input steam boiler which presently is about 70% efficient. As an energy conservation measure, the Concord team recommends this boiler be replaced by one (1) HB Smith model 28HE-S-10 steam boiler or equivalent with an efficiency of 83.5%.

Existing Heating Hot Water Boiler:

Rated Capacity = 2,352 MBh (Natural Gas)

Combustion Efficiency = 75%

Age & Radiation Losses = 5%

Thermal Efficiency = 70%

Replacement Boiler:

High-Efficiency Condensing Boiler

Rated Capacity = 2,513 MBh (Natural Gas)

Combustion Efficiency = 83.5%

Radiation Losses = 0.8%

Thermal Efficiency = 82.7%

Operating Data:

Annual Fuel Consumption of Natural Gas is calculated as:

$$2,352,000 \text{ BTU} \times 4935 \text{ HDD65} \times 0.15 \text{ diversity} / (100,000 \text{ Btu/1 Therm of natural gas}) \\ = 17,410.7 \text{ Therms}$$

Average Cost of Natural Gas = \$1.38/Therm

Energy Savings Calculations:

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

$$\text{Energy Savings} = 17,410.7 \text{ Therms} \times \frac{(82.7\% - 70\%)}{(82.7\%)} = 2,673.7 \text{ Therms}$$

Energy Cost Savings = Annual Energy Savings x \$/Therm

$$\text{Energy Cost Savings} = 2,673.7 \text{ Therms} \times \$1.36/\text{Therm} = \$3,636/\text{yr.}$$

Installed cost of one (1) HB Smith model 28HE-S-10 steam boiler including removal of existing unit, all piping changes and controls = \$46,000.

Smart Start Incentive = \$1.00/MBh x 2,352/installed MBh = \$2,352

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$46,000
NJ Smart Start Equipment Incentive (\$):	(\$2,352)
Net Installation Cost (\$):	\$43,648
Maintenance Savings (\$ / yr):	\$0
Energy Savings (\$ / yr):	\$3,636
Net Savings (\$ / yr):	\$3,636
Simple Payback (yrs):	12
Simple Return On Investment (%):	8.33%
Estimated ECM Lifetime (yr):	35
Simple Lifetime Savings (\$):	\$127,260

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 Hoboken, 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 building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 990 S.F. can be utilized for a PV system on Public Library. A depiction of the area utilized is shown in Appendix G. Using this square footage it was determined that a system size of 15.64 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 24,407 KWh annually, reducing the overall utility bill by 26% percent. A detailed financial analysis can be found in Appendix E. 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 7% interest rate over 25 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	INTERNAL RATE OF RETURN
Self-Finance	11.44 Years	10.7%
Direct Purchase	11.44 Years	7.8%

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 the Public Library and has determined it is not a viable option. There is not enough free land available on the site to accommodate the installation of a wind turbine.

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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 June 2007 through May 2008.

Electricity:

Section IV, Figure 1 demonstrates a steady (base-load) profile. There is a slight increase throughout the summer (June-September) standard with a cooling or air-conditioning load profile. The load profile gradually increases as the summer progresses to the peak in July. The steady (base-load) electric profile will allow for lower energy costs when procuring from a Third Party Supplier.

Natural Gas:

Section IV, Figure 2 demonstrates a typical heating load (January-March, November, and December). The peak takes place in January which is consistent with heating profiles. There is a clear separation between summer and winter loads consistent with energy commodities traded on the New York Mercantile Exchange. Heating loads carry a much higher average cost because of the higher demand for natural gas to heat during the winter. This facility is heated by natural gas fired systems.

Tariff Analysis:

Electricity:

The Library receives electrical service through Public Service Electric and Gas Company (PSE&G) on a GLP (General Lighting and Power Service) rate. This utility tariff is for delivery service for general purposes at secondary distribution voltages. The Delivery Schedule has the following charges: 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:

This facility receives natural gas service through Public Service Electric and Gas Company (PSE&G) on a GSGH (General Service Gas-Heating) rate when not receiving commodity by a Third Party Supplier. The utility tariff rate (GSGH) is for General Service. This is a firm delivery service for general purposes where 1) customer does not qualify for RSG (residential) and 2) customers usage does not exceed 3,000 therms in any month. Customers may either purchase gas supply from a Third Party (TPS) or from Public Services Basic Gas Supply Service default service as detailed in the rate schedule.

This rate schedules have a Delivery Charge Mechanism which includes: 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 Supply Charge (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.

From review of the information provided, it appears that Hoboken can improve its average natural gas costs by between 20-25%.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within City of Hoboken. CEG's primary observation is seen in the electric costs. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical costs is \$.15/kWh (kWh is the common unit of electric measure). The average price per decatherm for natural gas is \$ 13.71dth (dth, is the common unit of measure). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. Hoboken could see significant savings if it were to take advantage of these current market prices quickly, before energy increases. Based on annual historical consumption (January through December 2007) and current electric rates, an annual savings of over \$100,000 per year (Note: Savings were calculated using Hoboken's Average Annual Consumption of kWh and a variance to a fixed one-year commodity contract). CEG recommends aggregating the entire electric 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 Hoboken's natural gas costs. Based on the current market, Hoboken could improve its natural gas costs by approximately 25% annually. CEG recommends further advisement on these prices. The City should also consider procuring energy (natural gas) through alternative supply sources. CEG recommends energy advisory services.

CEG also recommends that the city 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), the city will learn more about the competitive supply process. Hoboken 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, they 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.

Finally, if Hoboken frequently changes or plans on changing its supplier for energy (natural gas), it needs to closely monitor balancing, particularly when the contract is close to termination.

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. *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.
- 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. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for 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.

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.

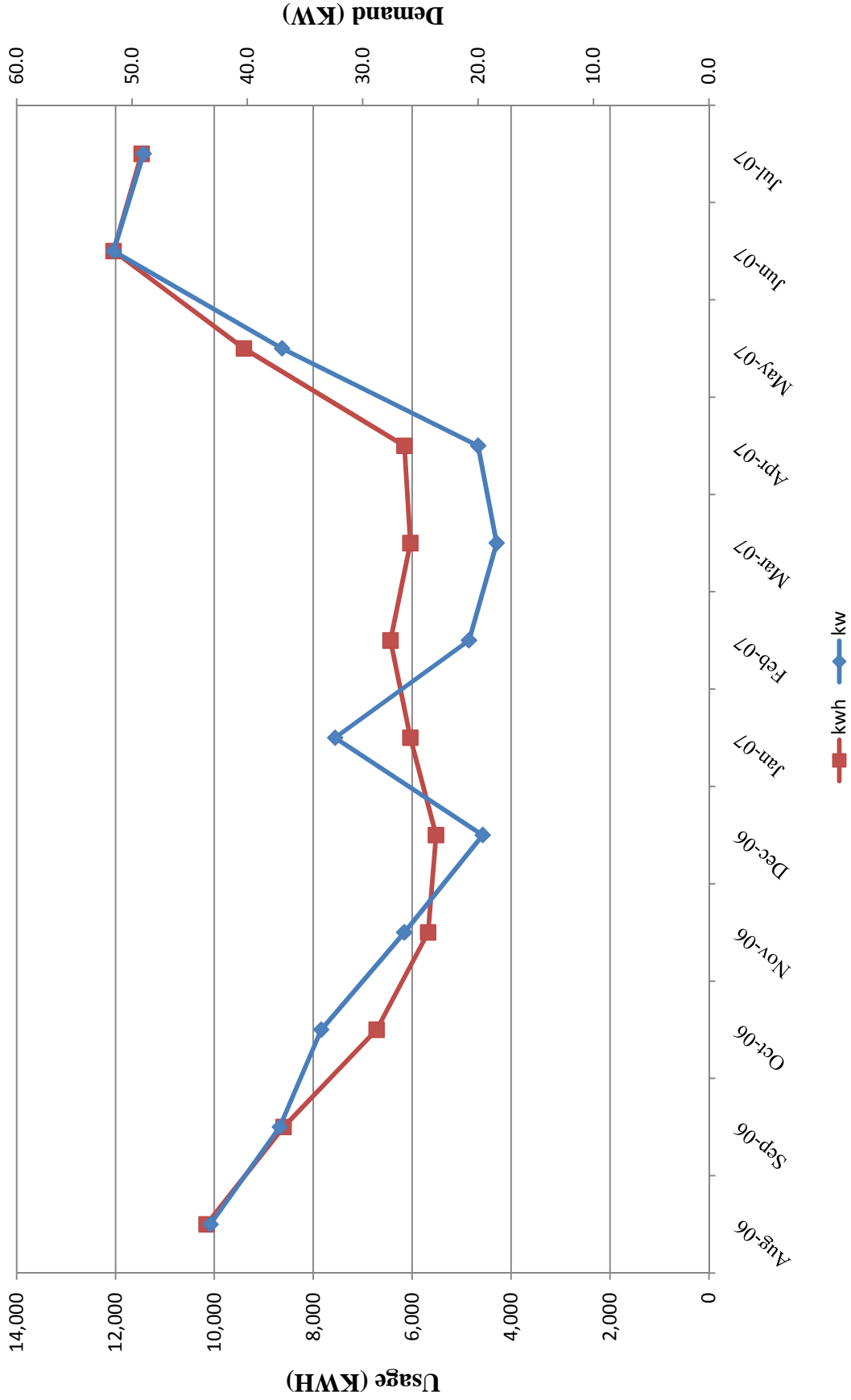
XI. ADDITIONAL RECOMMENDATIONS

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.

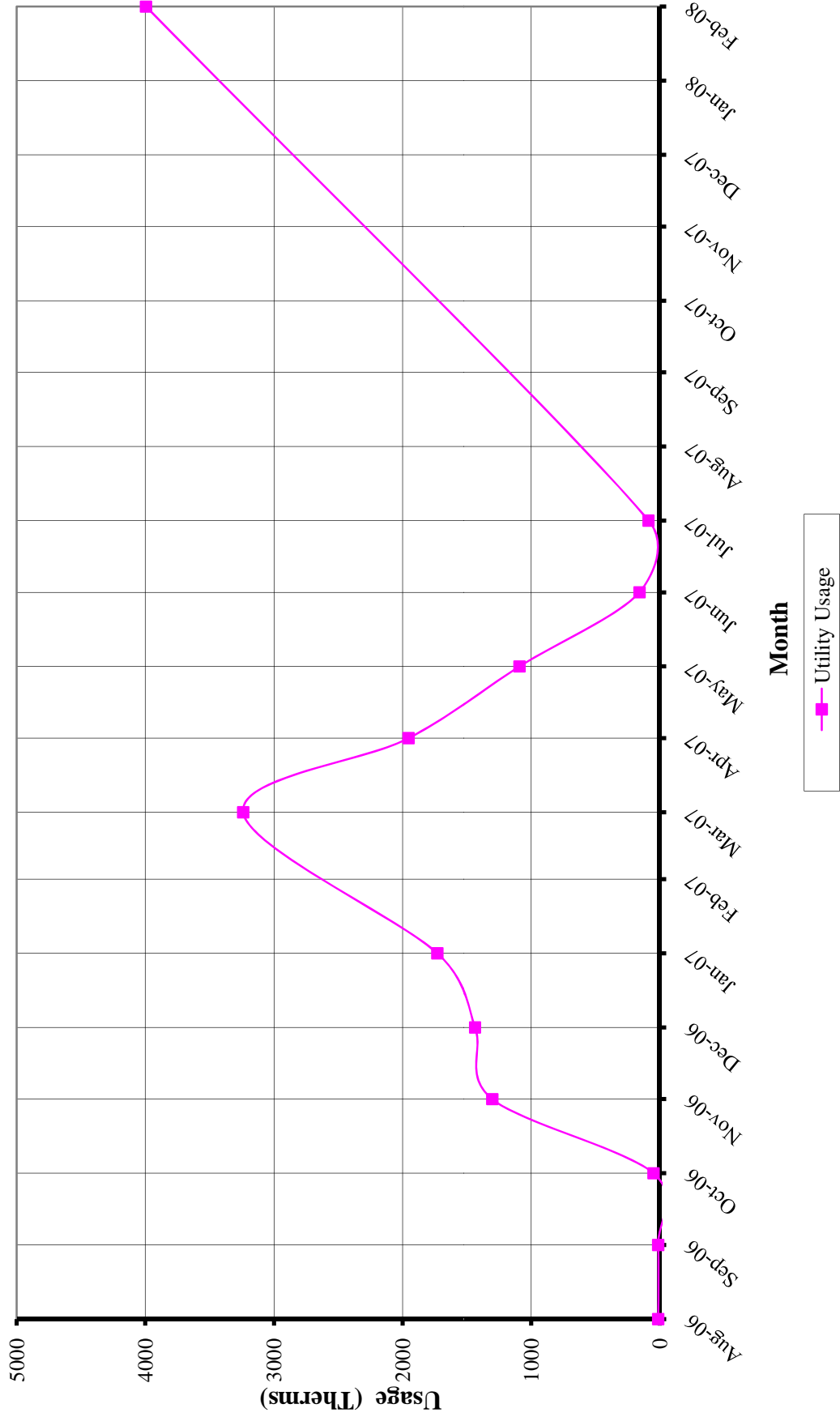
- A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
- B. Maintain all weather stripping on windows and doors.
- C. Use cog-belts instead of v-belts on all belt-driven fans, etc. These can reduce electrical consumption of the motor by 2-5%.
- D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.
- E. Recalibrate temperature sensors to provide more accurate control.
- F. Clean all light fixtures to maximize light output.

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Hoboken Public Library Electric Usage Profile August-06 through Jul



Hoboken Public Library Gas Usage Profile January through December of 2008



DETAILED COST BREAKDOWN PER ECM

CONCORD ENGINEERING GROUP

Hoboken Public Library

ECM 1 Interior Lighting Upgrade

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
Lighting Retrofit	LS	\$16,480	<u>\$0</u>	<u>\$0</u>	<u>\$16,480</u>
Total Cost			\$0	\$0	\$16,480
Utility Incentive - NJ Smart Start (1-2 lamp fixture \$25, 3-4 lamp fixture \$30)					<u>(\$3,766)</u>
Total Cost Less Incentive					\$12,714

ECM 2 Compact Fluorescent Lighting

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
Lighting Retrofit	LS	\$210	<u>\$0</u>	<u>\$0</u>	<u>\$210</u>
Total Cost			\$0	\$0	\$210

ECM 3 Interior Lighting Controls

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
Dual - Technology Sensor	5	\$75	<u>\$150</u>	<u>\$225</u>	<u>\$375</u>
Total Cost			\$150	\$225	\$375
Utility Incentive - NJ Smart Start (\$20 per Sensor)					<u>(\$100)</u>
Total Cost Less Incentive					\$275

ECM 4 High-Efficiency Condensing Units

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
5 Ton Split System	2	\$7,500	<u>\$0</u>	<u>\$0</u>	<u>\$15,000</u>
Total Cost			\$0	\$0	\$15,000
Smart Start® Incentive (\$40/Ton)	10				<u>(\$400)</u>
Smart Start® Incentive Dual Enthalpy Economizer	2.00				<u>(\$500)</u>
Utility Incentive - N/A					<u>\$0</u>
Total Cost Less Incentive					\$14,100

ECM 5 High Efficiency Split System AC Upgrade

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
5 Ton Split System	1	\$7,500	<u>\$0</u>	<u>\$0</u>	<u>\$7,500</u>
Total Cost			\$0	\$0	\$7,500
Smart Start® Incentive (\$40/Ton)	5				<u>(\$200)</u>
Smart Start® Incentive Dual Enthalpy Economizer	1.00				<u>(\$250)</u>
Controls (\$250/unit)					<u>\$0</u>
Utility Incentive - N/A					<u>\$0</u>
Total Cost Less Incentive					\$7,050

ECM 6 Domestic Hot Water Heater Replacement

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
76 MBH Domestic Hot Water Heater	1	\$4,088	<u>\$0</u>	<u>\$0</u>	<u>\$4,088</u>
Total Cost			\$0	\$0	\$4,088
Smart Start® Incentive (\$2/MBH)	76				<u>\$152</u>
Utility Incentive - N/A					<u>\$0</u>
Total Cost Less Incentive					\$3,936

ECM 7 Boiler Replacement - High Efficiency

	Qty	Unit Cost \$	Material \$	Labor \$	Total \$
High Efficiency Condensing Boiler	1	\$46,000	<u>\$0</u>	<u>\$0</u>	<u>\$46,000</u>
Total Cost			\$0	\$0	\$46,000
Smart Start® Incentive (\$2/MBH)	76				<u>\$2,352</u>
Utility Incentive - N/A					<u>\$0</u>
Total Cost Less Incentive					\$43,648



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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
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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
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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
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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



STATEMENT OF ENERGY PERFORMANCE

Hoboken Library

Building ID: 1835860
For 12-month Period Ending: July 31, 2007¹
Date SEP becomes ineligible: N/A

Date SEP Generated: August 24, 2009

Facility

Hoboken Library
 250 - 254 5Th Street
 Hoboken, NJ 07030

Facility Owner

City of Hoboken
 94 Washington Street
 Hoboken, NJ 07030

Primary Contact for this Facility

John Pope
 94 Washington Street
 Hoboken, NJ 07030

Year Built: 1895

Gross Floor Area (ft²): 6,575

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Natural Gas (kBtu) ⁴	1,506,453
Electricity (kBtu)	321,659
Total Energy (kBtu)	1,828,112

Energy Intensity⁵

Site (kBtu/ft ² /yr)	278
Source (kBtu/ft ² /yr)	403

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	129
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Electric Distribution Utility

PSE&G - Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	246
% Difference from National Average Source EUI	64%
Building Type	Library

Meets Industry Standards⁶ for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

Stamp of Certifying Professional
Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Certifying Professional

Raymond Johnson
 520 S. Burnt Mill Rd
 Voorhees, NJ 08043

Notes:

1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.

NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Building Name	Hoboken Library	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
Type	Library	Is this an accurate description of the space in question?		<input type="checkbox"/>
Location	250 - 254 5Th Street, Hoboken, NJ 07030	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		<input type="checkbox"/>
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		<input type="checkbox"/>

Hoboken Library (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	6,575 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		<input type="checkbox"/>
Number of PCs	36 (Optional)	Is this the number of personal computers in the space?		<input type="checkbox"/>
Weekly operating hours	40 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		<input type="checkbox"/>
Workers on Main Shift	26 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		<input type="checkbox"/>

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: PSE&G - Public Service Elec & Gas Co

Fuel Type: Electricity		
Meter: electric (kWh (thousand Watt-hours)) Space(s): Entire Facility		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
07/01/2007	07/31/2007	11,470.00
06/01/2007	06/30/2007	12,040.00
05/01/2007	05/31/2007	9,403.00
04/01/2007	04/30/2007	6,160.00
03/01/2007	03/31/2007	6,040.00
02/01/2007	02/28/2007	6,440.00
01/01/2007	01/31/2007	6,040.00
12/01/2006	12/31/2006	5,520.00
11/01/2006	11/30/2006	5,680.00
10/01/2006	10/31/2006	6,720.00
09/01/2006	09/30/2006	8,600.00
08/01/2006	08/31/2006	10,160.00
electric Consumption (kWh (thousand Watt-hours))		94,273.00
electric Consumption (kBtu)		321,659.48
Total Electricity Consumption (kBtu)		321,659.48
Is this the total Electricity consumption at this building including all Electricity meters?		<input type="checkbox"/>

Fuel Type: Natural Gas		
Meter: gas (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
07/01/2007	07/31/2007	88.10
06/01/2007	06/30/2007	158.01
05/01/2007	05/31/2007	1,090.48
04/01/2007	04/30/2007	1,952.60
03/01/2007	03/31/2007	3,238.64
02/01/2007	02/28/2007	3,994.14
01/01/2007	01/31/2007	1,729.29
12/01/2006	12/31/2006	1,436.35
11/01/2006	11/30/2006	1,302.36

10/01/2006	10/31/2006	49.32
09/01/2006	09/30/2006	12.62
08/01/2006	08/31/2006	12.62
gas Consumption (therms)		15,064.53
gas Consumption (kBtu)		1,506,453.00
Total Natural Gas Consumption (kBtu)		1,506,453.00
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		<input type="checkbox"/>

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	<input type="checkbox"/>

Certifying Professional

(When applying for the ENERGY STAR, this must be the same PE that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Hoboken Library
250 - 254 5Th Street
Hoboken, NJ 07030

Facility Owner
City of Hoboken
94 Washington Street
Hoboken, NJ 07030

Primary Contact for this Facility
John Pope
94 Washington Street
Hoboken, NJ 07030

General Information

Hoboken Library	
Gross Floor Area Excluding Parking: (ft ²)	6,575
Year Built	1895
For 12-month Evaluation Period Ending Date:	July 31, 2007

Facility Space Use Summary

Hoboken Library	
Space Type	Other - Library
Gross Floor Area(ft ²)	6,575
Number of PCs ^o	36
Weekly operating hours ^o	40
Workers on Main Shift ^o	26

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 07/31/2007)	Baseline (Ending Date 07/31/2007)	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft ²)	278	278	0	N/A	104
Source (kBtu/ft ²)	403	403	0	N/A	246
Energy Cost					
\$/year	\$ 34,950.75	\$ 34,950.75	N/A	N/A	\$ 13,073.22
\$/ft ² /year	\$ 5.32	\$ 5.32	N/A	N/A	\$ 1.99
Greenhouse Gas Emissions					
MtCO ₂ e/year	129	129	0	N/A	48
kgCO ₂ e/ft ² /year	20	20	0	N/A	7

More than 50% of your building is defined as Library. This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Library. This building uses X% less energy per square foot than the CBECS national average for Library.

Notes:

- o - This attribute is optional.
- d - A default value has been supplied by Portfolio Manager.

MAJOR EQUIPMENT LIST

Concord Engineering Group

Hoboken Public Library

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Minimum Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement Boiler Room	-	H.B.SMITH	1	350 MILLS	921669-H 921670-H	2,400	1,394.30	75	NATURAL GAS	30	30	0	
Basement Boiler Room	-	PEERLESS	1	MCB-130	-	-	-	-	NATURAL GAS	10	24	14	

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Vintage	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement Boiler Room	350 Mills Boiler	GORDON-PIAT	1	RO-G-15	AG775843	2,400 MAX	-	-	NATURAL GAS	20	21	1	

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Volts	Phase	Approx. Age	ASHRAE Service Life	Notes
Basement Boiler Room	Peerless Boiler	Bell & Gossett	1	-	-	1/2	-	-	-	-	-	-	-	Controlled by single zone honeywell T-stat

Domestic Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery at 90°F Rise (gal/hr)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	Service Life	Remaining Life	Notes
BSMT MECH ROOM	-	STATE	1	PR650NBRT	M00130104	40	41	50	80%	NATURAL GAS	9 YEARS 12/2000	10	1	had 6 yr warranty

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
3RD FL LIBRARY	-	CARRIER	1	50BH-006-520	-	8	60,000	Electrik 22.1 kW	75.4	-	-	ELECTRIC	230	3	-	19	15	-4	NOT OPERATIONAL
2ND FLOOR READING AREA	-	CARRIER	1	50AH060500	0590G14128	7.1	58,500	-	-	-	-	ELECTRIC	230	3	-	19	20	1	mfg: 1990
2ND FLOOR READING AREA TOILET RM CEILING	-	CARRIER	1	50AH060500	0590G14128	7.1	58,500	-	-	-	-	ELECTRIC	230	3	-	19	20	1	mfg: 1990, NOT WORKING, NO NAME PLATE IS BEING REPAIRED, ASSUMED DATA

Unit Heaters and Cabinet Unit Heaters

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Type	Heating Capacity (MBH)	CFM	RPM / HP	GPM	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
stairwell	stairwell	-	-	-	-	-	-	-	-	-	-	13	-	electric wall heater

PTAC - Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity - DX	Heating Capacity - HW	Fan HP	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
MAIN OFFICE	MAIN OFFICE	TRANE	1	PTED1201WAA	F02K22762A	1 TON	N/A	-	208/230	1	4.6/5.2	18	10	-8	1070/1045 W COOLING INPUT, 11.2 EER
1ST FLOOR LIBRARY STACK	1ST FLOOR LIBRARY STACK	TRANE	2	PTED1201JAA	F04E01940A	1 TON	5045/4140 WATTS	-	208/230	1	4.6/5.2	18	10	-8	1070/1045 W COOLING INPUT, 11.2 EER, 5045/4140 WATTS HEATING
1ST FLOOR LOBBY	1ST FLOOR LOBBY	TRANE	1	PTED1201JAA	F04E01897A	1 TON	5045/4140 WATTS	-	208/230	1	4.6/5.2	18	10	-8	1070/1045 W COOLING INPUT, 11.2 EER, 5045/4140 WATTS HEATING

GENERAL NOTES

1. ALL EQUIPMENT IS MANUALLY OPERATED (ON/OFF).
2. THERE ARE LEAKS AROUND PTAC UNITS AT FLASHING.
3. BOILERS ARE CONTROLLED BY HEAT ???? PANEL BUY MAINTENANCE USSUALLY TURNS ON/OFF.

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENGINEERING GROUP

CEG Job #: 9C08143
 Project: Hoboken Energy Audit
 Address: 250 - 254 5th st
 Hoboken, NJ 07030
 Building SF: 6575

"Hoboken Public Library"

DATE: 07/03/2009
 KWH COST: \$0.154

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
Line No.	CEG Type	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. rFixts	Repro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback		
1	A	Front Office	2	8' 4 lamp T-12, No lens, Magnetic Ballast	3016	444	0.89	2678.208	\$412.44	2	8' 4 Lamp T-8, no lens, Electronic Ballast Cooper Metalux	236	0.472	1423.552	\$219.23	\$200.00	\$400.00	0.42	1254.656	\$193.22	2.07		
2	D	Boiler Rooms	1	8' 2 Lamp T-12, No lens, Magnetic Ballast	3016	222	0.22	669.552	\$103.11	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N	48	0.096	289.536	\$44.59	\$160.00	\$320.00	0.13	380.016	\$58.52	5.47		
4	D	Kitchen Hall	3	8' 2 Lamp T-12, No lens, Magnetic Ballast	3016	222	0.67	2008.656	\$309.33	6	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N	48	0.288	868.608	\$133.77	\$160.00	\$960.00	0.38	1140.048	\$175.57	5.47		
5	D	Storage	1	8' 2 Lamp T-12, No lens, Magnetic Ballast	3016	222	0.22	669.552	\$103.11	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N	48	0.096	289.536	\$44.59	\$160.00	\$320.00	0.13	380.016	\$58.52	5.47		
7	E	3rd Floor Front Room	9	2' x 4' 2 Lamp T-12, Prism Lens, Magnetic Ballast	3016	80	0.72	2171.52	\$334.41	9	2'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N	61	0.549	1655.784	\$254.99	\$120.00	\$1,080.00	0.17	515.736	\$79.42	13.60		
8	E	3rd Floor Back Room	6	2' x 4' 2 Lamp T-12, Prism Lens, Magnetic Ballast	3016	80	0.48	1447.68	\$222.94	6	2'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N	61	0.366	1103.856	\$169.99	\$120.00	\$720.00	0.11	343.824	\$52.95	13.60		
9	F	Elevator Lobby	4	2' x 2' 2 Lamp, U-tube T-8, No lens, Electronic Ballast	3016	73	0.29	880.672	\$135.62		No Replacement		0	0	\$0.00		\$0.00	0.29	880.672	\$135.62	0.00		
10	A		9	8' 4 lamp T-12, No lens, Magnetic Ballast	3016	444	4.00	12051.936	\$1,856.00	9	8' 4 Lamp T-8, no lens, Electronic Ballast Cooper Metalux	236	2.124	6405.984	\$986.52	\$200.00	\$1,800.00	1.87	5645.952	\$869.48	2.07		
11	F	2nd Floor	3	2' x 2' 2 Lamp, U-tube T-8, No lens, Electronic Ballast	3016	73	0.22	660.504	\$101.72		No Replacement		0	0	\$0.00		\$0.00	0.22	660.504	\$0.00	0.00		
12	G		5	4' x 1' 4 Lamp T-8, Prism Reflection, Electronic Ballast	3016	28	0.14	422.24	\$65.02		No Replacement		0	0	\$0.00		\$0.00	0.14	422.24	\$65.02	0.00		
13	I	Bathroom	1	2' 2 Lamp T-12	3016	70	0.07	211.12	\$32.51	1	2' 2-Lamp T-8, 17W wall Mid.	34	0.034	102.544	\$15.79	\$80.00	\$80.00	0.04	108.576	\$16.72	4.78		
14	A		6	8' 4 lamp T-12, No lens, Magnetic Ballast	3016	444	2.66	8034.624	\$1,237.33	6	8' 4 Lamp T-8, no lens, Electronic Ballast Cooper Metalux	236	1.416	4270.656	\$657.68	\$200.00	\$1,200.00	1.25	3763.968	\$579.65	2.07		
15	B	1st Floor	96	4' 1 Lamp T-12, No lens, Magnetic Ballast	3016	42	4.03	12160.512	\$1,872.72	96	1'x4' 1-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N	30	2.88	8686.08	\$1,337.66	\$100.00	\$9,600.00	1.15	3474.432	\$555.06	17.94		
Totals			146			14.61	44066.78	6786.28		139		8.32	25096.14	3864.80		\$16,480.00	6.29	18,970.64	\$2,819.76	5.84			

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENGINEERING GROUP

"Hoboken Public Library"

CEG Job #: 9C08143
 Project: Hoboken Energy Audit
 Address: 250 - 254 5th St
 Hoboken, NJ 07030
 Building SF: 6575

DATE: 07/03/2009
 KWH COST: \$0.154

ECM #3: Lighting Upgrade - Multi-Purpose Room

EXISTING LIGHTING										PROPOSED LIGHTING					SAVINGS						
Line No.	CEG Type	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. eFixts	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 Simple Payback
1	K	Boiler Room	3	100 W Incandescent	3016	100	0.30	904.8	\$139.34	3	Eiko-30w mini spiral	23	0.069	208.104	\$32.05	\$6.00	\$18.00	0.23	696.696	\$107.29	0.17
2	H	Library 1st Floor	24	40 W Incandescent	3016	40	0.96	2895.36	\$445.89	24	Eiko-13w mini spiral	13	0.312	940.992	\$144.91	\$3.99	\$95.76	0.65	1954.368	\$300.97	0.32
3	J		24	60 W Incandescent	3016	60	1.44	4343.04	\$668.83	24	Eiko-15w mini spiral	15	0.36	1085.76	\$167.21	\$3.99	\$95.76	1.08	3257.28	\$501.62	0.19
Totals			51				2.70	8143.20	1254.05	51			0.74	2234.86	344.17		\$209.52	1.96	5,908.34	\$909.88	0.23

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

Project Name: LGEA Solar PV Project - Hoboken Public Library Location: Hoboken, NJ Description: Photovoltaic System 95% Financing - 20 year											
Simple Payback Analysis Total Construction Cost: \$140,760 Annual kWh Production: 24,407 Annual Energy Cost Reduction: \$3,759 Annual SREC Revenue: \$8,542 First Cost Premium: \$140,760 Simple Payback: 11.44 Years											
Life Cycle Cost Analysis Analysis Period (years): 25 Financing Term (mths): 240 Average Energy Cost (\$/kWh): \$0.154 Financing Rate: 7.00%											
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Maintenance Escalation Rate:	Financing %:	Cumulative Cash Flow
0	\$7,038	0	0	0	\$0	0	0	(7,038)		95%	0
1	\$0	24,407	\$3,759	\$0	\$8,542	\$9,260	\$3,181	(\$140)		3.0%	(\$7,178)
2	\$0	24,285	\$3,871	\$0	\$8,500	\$9,030	\$3,411	(\$70)		3.0%	(\$7,248)
3	\$0	24,163	\$3,988	\$0	\$8,457	\$8,783	\$3,658	\$4		3.0%	(\$7,244)
4	\$0	24,043	\$4,107	\$0	\$8,415	\$8,519	\$3,922	\$81		3.0%	(\$7,163)
5	\$0	23,922	\$4,230	\$246	\$8,373	\$8,235	\$4,206	(\$84)		3.0%	(\$7,247)
6	\$0	23,803	\$4,357	\$245	\$8,331	\$7,931	\$4,510	\$2		3.0%	(\$7,244)
7	\$0	23,684	\$4,488	\$244	\$8,289	\$7,605	\$4,836	\$92		3.0%	(\$7,152)
8	\$0	23,565	\$4,623	\$243	\$8,248	\$7,256	\$5,185	\$187		3.0%	(\$6,965)
9	\$0	23,448	\$4,761	\$242	\$8,207	\$6,881	\$5,560	\$286		3.0%	(\$6,679)
10	\$0	23,330	\$4,904	\$240	\$8,166	\$6,479	\$5,962	\$389		3.0%	(\$6,291)
11	\$0	23,214	\$5,051	\$239	\$8,125	\$6,048	\$6,393	\$496		3.0%	(\$5,795)
12	\$0	23,098	\$5,203	\$238	\$8,084	\$5,586	\$6,855	\$608		3.0%	(\$5,187)
13	\$0	22,982	\$5,359	\$237	\$8,044	\$5,090	\$7,351	\$725		3.0%	(\$4,462)
14	\$0	22,867	\$5,520	\$236	\$8,004	\$4,559	\$7,882	\$847		3.0%	(\$3,615)
15	\$0	22,753	\$5,685	\$234	\$7,964	\$3,989	\$8,452	\$974		3.0%	(\$2,641)
16	\$0	22,639	\$5,856	\$233	\$7,924	\$3,378	\$9,063	\$1,105		3.0%	(\$1,536)
17	\$0	22,526	\$6,032	\$232	\$7,884	\$2,723	\$9,718	\$1,243		3.0%	(\$293)
18	\$0	22,413	\$6,213	\$231	\$7,845	\$2,020	\$10,421	\$1,385		3.0%	\$1,092
19	\$0	22,301	\$6,399	\$230	\$7,805	\$1,267	\$11,174	\$1,534		3.0%	\$2,626
20	\$0	22,190	\$6,591	\$229	\$7,766	\$459	\$11,982	\$1,688		3.0%	\$4,314
21	\$0	22,079	\$6,789	\$227	\$7,728	\$389	\$11,015	\$2,885		3.0%	\$7,198
22	\$0	21,968	\$6,992	\$226	\$7,689	\$266	\$9,064	\$5,124		3.0%	\$12,322
23	\$0	21,859	\$7,202	\$225	\$7,650	\$0	\$0	\$14,627		3.0%	\$26,950
24	\$0	21,749	\$7,418	\$224	\$7,612	\$0	\$0	\$14,806		3.0%	\$41,756
25	\$0	21,640	\$7,641	\$223	\$7,574	\$0	\$0	\$14,992		3.0%	\$56,748
Totals:		465,633	\$100,997	\$3,798	\$162,972	\$115,097	\$133,722	\$153,801			\$59,067
										Net Present Value (NPV)	\$6,524
										Internal Rate of Return (IRR)	10.7%

Project Name: LGEA Solar PV Project - Hoboken Public Library Location: Hoboken, NJ Description: Photovoltaic System - Direct Purchase									
Simple Payback Analysis									
Photovoltaic System - Direct Purchase									
Total Construction Cost	\$140,760								
Annual kWh Production	24,407								
Annual Energy Cost Reduction	\$3,759								
Annual SREC Revenue	\$8,542								
First Cost Premium	\$140,760								
Simple Payback:	11.44 Years								
Life Cycle Cost Analysis									
Analysis Period (years):	25								
Financing Term (mths):	0								
Average Energy Cost (\$/kWh)	\$0.154								
Financing Rate:	0.00%								
	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Financing %	Maintenance Escalation Rate:	0%
Period								Energy Cost Escalation Rate:	3.0%
0	\$140,760	0	0	0	\$0	(140,760)		SREC Value (\$/kWh)	\$0.350
1	\$0	24,407	\$3,759	\$0	\$8,542	\$12,301			
2	\$0	24,285	\$3,871	\$0	\$8,500	\$12,371			
3	\$0	24,163	\$3,988	\$0	\$8,457	\$12,445			
4	\$0	24,043	\$4,107	\$0	\$8,415	\$12,522			
5	\$0	23,922	\$4,230	\$246	\$8,373	\$12,557			
6	\$0	23,803	\$4,357	\$245	\$8,331	\$12,443			
7	\$0	23,684	\$4,488	\$244	\$8,289	\$12,533			
8	\$0	23,565	\$4,623	\$243	\$8,248	\$12,628			
9	\$0	23,448	\$4,761	\$242	\$8,207	\$12,727			
10	\$0	23,330	\$4,904	\$240	\$8,166	\$12,830			
11	\$0	23,214	\$5,051	\$239	\$8,125	\$12,937			
12	\$0	23,098	\$5,203	\$238	\$8,084	\$13,049			
13	\$0	22,982	\$5,359	\$237	\$8,044	\$13,166			
14	\$0	22,867	\$5,520	\$236	\$8,004	\$13,288			
15	\$0	22,753	\$5,685	\$234	\$7,964	\$13,414			
16	\$0	22,639	\$5,856	\$233	\$7,924	\$13,546			
17	\$0	22,526	\$6,032	\$232	\$7,884	\$13,684			
18	\$0	22,413	\$6,213	\$231	\$7,845	\$13,826			
19	\$0	22,301	\$6,399	\$230	\$7,805	\$13,975			
20	\$0	22,190	\$6,591	\$229	\$7,766	\$14,129			
21	\$1	22,079	\$6,789	\$227	\$7,728	\$14,289			
22	\$2	21,968	\$6,992	\$226	\$7,689	\$14,455			
23	\$3	21,859	\$7,202	\$225	\$7,650	\$14,627			
24	\$4	21,749	\$7,418	\$224	\$7,612	\$14,806			
25	\$5	21,640	\$7,641	\$223	\$7,574	\$14,992			
Totals:		465,633	\$100,997	\$3,798	\$162,972	\$333,340			
						Net Present Value (NPV)	\$192,605		
						Internal Rate of Return (IRR)	7.8%		

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
Police Station	990	Sunpower SPR230	68	14.7	1,000	15.64	24,407	2,244	15.64



Notes:

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