



ENERGY AUDIT – FINAL REPORT

HOBOKEN PARKING GARAGE “G”

310-322 River Street
Hoboken, NJ 07030
ATTN: John Pope

CEG PROJECT NO. 9C08143

CONCORD ENGINEERING GROUP



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I. EXECUTIVE SUMMARY

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

Hoboken Parking Garage "G"
310-322 River Street
Hoboken, NJ 07030

Municipal Contact Person: John Pope

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 electrical energy cost at this facility is as follows:

Electricity \$51,697

The potential annual energy cost savings for each of the alternative lighting retrofits are shown below in Table 1. 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 ^A	ANNUAL SAVINGS	SIMPLE PAYBACK	SIMPLE RETURN ON INVESTMENT
1	Lighting Upgrade in Office, Restrooms, and Elevators	\$1,036	\$220	4.7	21.3%
2	Replace HID Fixtures with T5 Technology	\$98,790	\$17,658	5.6	17.9%
3	Replace HID Fixtures with T8 Technology	\$84,318	\$20,030	4.2	23.8%
4	Stairwell Lighting Upgrade	\$3,880	\$851	4.6	21.7%

Note A: Includes applicable incentive and maintenance savings

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)
1	Lighting Upgrade in Office, Restrooms, and Elevators	0.2	1,629
2	Replace HID Fixtures with T5 Technology	14.9	130,296
3	Replace HID Fixtures with T8 Technology	16.9	147,799
4	Stairwell Lighting Upgrade	0.7	6,307

Recommendations:

The following Energy Conservation Measures are recommended for the Hoboken Parking Garage "G" Facility:

- **ECM #1:** Office/Maintenance Shops Lighting Upgrade
- **ECM #2:** Replace HID Fixtures with T5 Technology **OR**
- **ECM #3:** Replace HID Fixtures with T8 Technology
- **ECM #4:** Stairwell Lighting Upgrade

II. INTRODUCTION

This comprehensive energy audit covers the 30,700 square foot parking garage “G” facility complex that includes the parking garage decks, stairwells, office, restrooms, and elevators. This parking garage is identical to Parking Garage “D” in number of lighting fixtures in the parking decks, office, restrooms, stairwells, and elevators. The parking garage is constructed of pre-fabricated concrete sections and was constructed in 1973 along with Parking Garage “D”.

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.

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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 base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment 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

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 General Lighting and Power Service (GLP) Rate Schedule. 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.

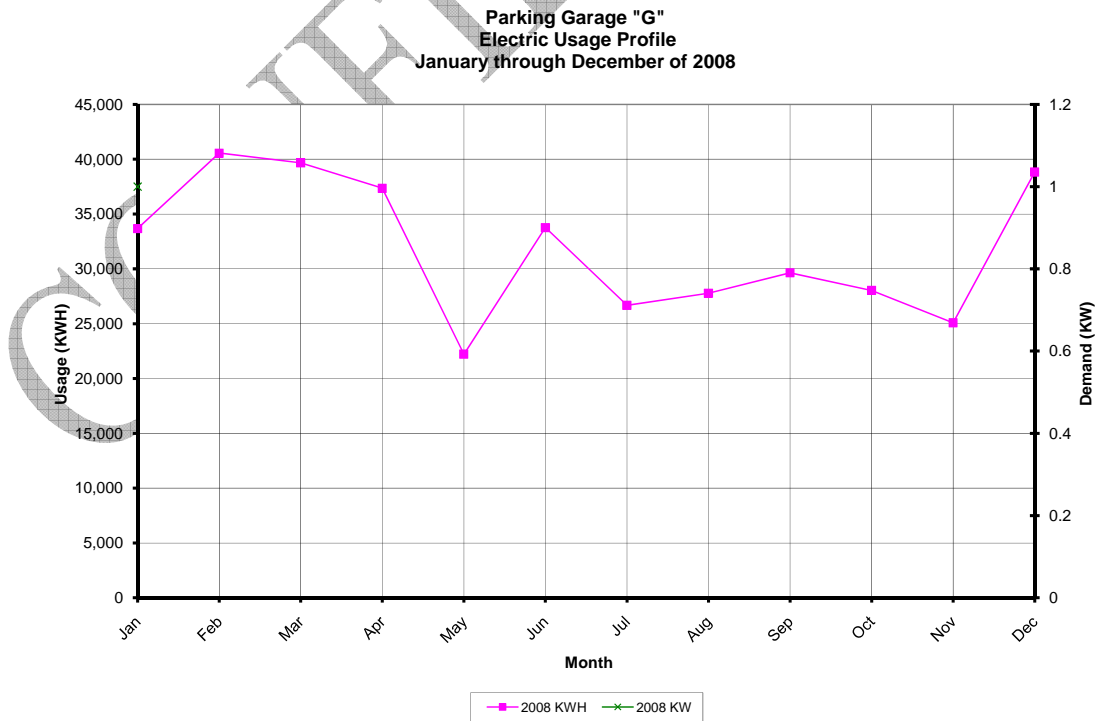
<u>Description</u>	<u>Average</u>
Electricity	13.5¢ / kWh

**Table 3
Electricity Billing Data**

MONTH OF USE	CONSUMPTION KWH	DEMAND**	TOTAL BILL
1/08	33,675		\$3,912
2/08	40,560		\$4,725
3/08	39,675		\$4,690
4/08	37,350		\$4,342
5/08	22,215		\$2,684
6/08	33,765		\$4,825
7/08	26,670		\$4,510
8/08	27,780		\$4,745
9/08	29,640		\$5,098
10/08	28,035		\$4,074
11/08	25,080		\$3,293
12/08	38,835		\$4,799
Totals	383,280		\$51,697

** Electric Demand (kW) not provided by Owner.

**Figure 1
Electricity Usage Profile**



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:

$$\text{Building EUI} = \frac{\text{Electric Usage in kBtu}}{\text{Building Square Footage}}$$

$$\begin{aligned} \text{Electric} &= ((383,280 \text{ kWh}) * (1000 \text{ W/kW}) * (3.414 \text{ Btu/h} / 1 \text{ W})) / (1000 \text{ Btu/h} / 1 \text{ kBtu/h}) \\ &= 1,308,518 \text{ kBtu} \end{aligned}$$

$$\text{Building EUI} = \frac{1,308,518 \text{ kBtu}}{30,700 \text{ SF}}$$

$$\text{Parking Garage "G" EUI} = 42.6 \text{ kBtu/SF}$$

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 tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

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

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility’s yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

User Name: hobokencity
 Password: lgeaceg2009
 Security Question: What city were you born in?
 Security Answer: “hoboken city”

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

Table 6
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Garage “G”	N/A	50

See the Statement of Energy Performance appendix for the detailed energy summary.

V. FACILITY DESCRIPTION

The 30,700 square foot parking garage "G" facility complex includes the parking garage decks, office, elevators, and restrooms. Parking garage "G" is identical to parking garage "D" in number of lighting fixtures. The parking garage is constructed of pre-fabricated concrete sections and was constructed in 1973 along with parking garage "D". Garage "G" is not a public garage since users pay on a monthly basis. The garage is open 24/7 all year round.

Heating System

The parking facility office and pay booths are heated by Berko electric wall-hung unit heaters.

Domestic Hot Water

Domestic hot water for the parking garage restrooms is provided by a 30-gallon capacity electric hot water heater.

Cooling System

Cooling in the parking facility office is performed by a thru-the-wall air conditioning unit rated at 12,000 BTUH.

Lighting

The parking decks are lit by High Intensity Discharge (HID) fixtures with 150-Watt HPS lamps. These lamps are rated for 24,000 hours, have an initial average lumen output of 14,400, and consume 188 Watts per fixture. The lenses are yellowed from heat, age, and dust in the parking decks. Light output has steadily decreased as the optical components became coated with a film of pollutants. The lighting fixtures are delivering substantially less than the rated average lumens for this type of fixture (estimated at 70% of 14,400 = 10,000 lumens per fixture).

The office is lit by four 2-foot x 4-foot lay-in fixtures containing two T-12 lamps and a magnetic ballast. The restrooms contain two 2-foot x 4-foot lay-in fixtures containing two T-12 lamps and a magnetic ballast. The elevators contain a total of eight 2-foot x 4-foot lay-in fixtures containing one T-12 lamp and a magnetic ballast. The two stairwells contain a total of twenty (20) 70-Watt high pressure sodium wall-mounted fixtures.

Standard switching is utilized and there are not other types of lighting controls present.

The exit signs are the latest LED type.

VI. MAJOR EQUIPMENT LIST**Hoboken Parking Garage "G" Lighting (150-Watt HPS)**

<u>Location</u>	<u>No. of Fixtures</u>
Basement	22
1st Level	56
2nd Level	48
3rd Level	48
4th Level	48
TOTAL:	222 Fixtures

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VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrades in Office, Restrooms, and Elevators

Description:

New fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A typical fixture with two, 4-foot lamps (34-Watt lamps) has a total wattage of 74 Watts. By retrofitting with new lamps and electronic ballast, the total wattage would be reduced to about 55 Watts per fixture and the space light levels and light quality would increase by about 15% and 35%, respectively. CEG recommends a retrofit of the existing fixtures containing T12 lamps and magnetic ballasts with T8 lamps and electronic ballasts.

Energy Savings Calculations:

There are six 2-lamp fixtures and eight 1-lamp fixtures to be retrofitted which equate to energy cost savings as follows:

$$[(74-55) \text{ Watts} \times 6 \text{ Fixtures} + (37-28) \text{ Watts} \times 8] \times 8,760 \text{ hrs/yr} \times \$0.135/\text{kWh} = 1,629 \text{ kWh} \times \$0.135 = \$220/\text{yr}$$

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

From Appendix B, the retrofit of T-12 fixtures to T-8 with electronic ballasts warrants the following incentive: T-8 (1-2 lamp) = \$10 per fixture

$$\text{Smart Start}^{\text{®}} \text{ Incentive} = (\# \text{ of } 1-2 \text{ lamp fixtures} \times \$10)$$

$$\text{Smart Start}^{\text{®}} \text{ Incentive} = (14 \times \$10) = \$140$$

The retrofit labor/material cost is \$84 / fixture which equals a total cost of $14 \times \$84 = \$1,176$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$1,176
NJ Smart Start Equipment Incentive (\$):	(\$140)
Net Installation Cost (\$):	\$1,036
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	\$220
Net Savings (\$ / yr):	\$220
Simple Payback (yrs):	4.7
Simple Return On Investment (%):	21.3%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$3,300

Parking Deck Lighting

The purpose of the balance of this section is to outline the lighting analysis performed to assist Hoboken with the selection of a lamp fixture for this public parking garage. CEG evaluated many lamp options and summarized below are the optimum lamp types balancing quality of illumination, efficiency, and cost. LED and induction lighting technologies were not considered due to their unfavorable payback periods (expensive lighting technologies). Metal Halide and Metal Halide Pulse Technology were not considered due to their low Mean Fixture Lumens/Watt (40 to 60 L/W). The high pressure sodium light fixtures presently in the parking garage have a Mean Fixture Lumens/Watt of 60 to 70 L/W. Parking Garage "B" was used as the model for the analysis since it represents a typical layout for the other parking garages.

ECM #2: Replace Parking Garage Fixtures with T5 Technology

Description:

The newest family of linear fluorescent lamps is the T5 line of lamps, which consist of standard and high-output (HO) T5 lamps. The high output T5 lamps are a form of 4-foot fluorescent lamps that give off roughly twice the light output of T8 lamps. The intense brightness of the T5HO lamp is ideal as a replacement for any High Intensity Discharge (HID) lighting source (such as the existing high-pressure sodium lamps). In addition, the T5HO lamp offers increased energy efficiency and better lumen maintenance. Lumen maintenance defines the extent to which the full light output of a lamp is retained over the life of the lamp. After one year of continuous burn, the output of a standard High-Pressure Sodium (HPS) lamp will have declined to 88% of full light output. A T5HO lamp with the same burn time will have retained 95% of full light output.

HID lamps can take several minutes to "re-strike" or come up to full brightness once energized (such as after a power failure). As such, they do not lend themselves to control by light sensors, occupancy sensors, or other on/off controls. The perimeter of each parking deck closest to the daylight openings should be put on daylight harvesting controls to save additional energy.

This ECM would replace each of the existing HPS fixtures with a twin lamp, vapor tight, 4-foot T5 light fixtures with T5HO lamps and a Mean Fixture Lumens/Watt of 75+. The perimeter fixtures near the daylight openings would be controlled by light sensors and have dimming ballasts. The CEG audit team used the Zumtobel Chiaro vapor tight fixture for our fluorescent lighting layout. The fixture has an option for 20% uplight and has a Cold Spot Optimizer to address cold weather performance.

Energy Savings Calculations:

Appendix E outlines the T5 System option cost/savings analysis.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$105,450
NJ Smart Start Equipment Incentive (\$):	(\$6,660)
Net Installation Cost (\$):	\$98,790
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	\$17,658
Net Savings (\$ / yr):	\$17,658
Simple Payback (yrs):	5.6
Simple Return On Investment (%):	17.9%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$264,870

ECM #3: Replace Parking Garage Fixtures with T-8 Technology

Description:

T8HO fluorescent lamps provide a lumen per watt ration of 70+, good lamp life, and many options for color rendering properties. Caution must be used in using linear fluorescent lamps in outdoor applications. They operate best in the range of 40-80°F. Below this range, there is a decrease in light output and difficulty in starting. CEG recommends the Zumtobel Cold Spot Optimizer (CSO) to address cold weather performance. The CSO is an aluminum sleeve that regulates the temperature at the electrode end of the lamp.

This ECM would replace each of the existing HPS fixtures with a 3-lamp, vapor tight, 4-foot T8 light fixtures with T8HO lamps and a Mean Fixture Lumens/Watt of 70+. The perimeter fixtures near the daylight openings would be controlled by light sensors and have dimming ballasts. The CEG audit team used the Zumtobel Chiaro vapor tight fixture for our fluorescent lighting layout. The fixture has an option for 20% upright and has a Cold Spot Optimizer to address cold weather performance.

Energy Savings Calculations:

Appendix F outlines the T8 System option cost/savings analysis.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$90,978
NJ Smart Start Equipment Incentive (\$):	(\$6,660)
Net Installation Cost (\$):	\$85,837
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	\$20,030
Net Savings (\$ / yr):	\$20,030
Simple Payback (yrs):	4.2
Simple Return On Investment (%):	23.8%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$300,450

ECM #4: Stairwell Lighting Upgrade

Description:

The stairwells contain a total of twenty (20) 70-Watt High Pressure Sodium wall-mounted fixtures that light the stairs/landings. The lenses are yellowed from heat, age, and dust in the parking decks. Light output has steadily decreased as the optical components became coated with a film of pollutants. These lamps use 78 Watts of electricity and are very inefficient.

For the stairwells, the CEG energy audit team recommends replacing the existing fixtures with radial wrap fixtures and automated controls. These energy efficient radial wrap luminaries have a single low wattage 2-foot fluorescent lamp which is constantly on while the 4-foot lamp is controlled by an occupancy sensor. The basis of design is the RWS luminaire by Precision Fluorescent or equal. A 70-Watt HPS lighting fixture has a total of 78 full input watts while the RWS luminaire draws a total of 42 input watts.

Energy Savings Calculations:

Energy Cost Savings = 20 fixtures x [(78-42) Watts x 8,760 hrs/yr x \$0.135] =

6,307 kWh x \$0.135 = \$851

Smart Start® Incentive = 20 fixtures x \$16/fixture = \$320

The total cost of the new RWS luminaire installed is \$210/fixture x 20 fixtures = \$4,200

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$4,200
NJ Smart Start Equipment Incentive (\$):	(\$320)
Net Installation Cost (\$):	\$3,880
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	\$851
Net Savings (\$ / yr):	\$851
Simple Payback (yrs):	4.6
Simple Return On Investment (%):	21.7%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$12,765

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 Garage G, and concluded the following:

- *Photovoltaic System:* CEG does not recommend the installation of a PV system for this facility due to the fact that the facility has much taller apartment buildings on two sides that cast a shadow upon the roof area throughout most of the day. In addition, the roof is utilized as a recreation and swimming pool area for the adjacent apartment buildings.
- *Wind Energy:* CEG does not recommend the installation of a wind system because of lack of open space for such a system in the Hoboken area. The afore-mentioned characteristic does not lend itself to a successful wind energy application.

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 III, 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 fairly typical Parking Garage load profile, which is consistent or flat (base-loaded). Lighting tends to be the main source of consumption. Lighting is generally on most if not all of the day.

Natural Gas:

This facility does not use natural gas service.

Tariff Analysis:

Electricity:

The Parking Garage-G receives electrical service through Public Service Electric and Gas Company (PSE&G) on a GLP (General Lighting and Power Service) rate on Measured Demand. This utility tariff is for delivery service for general purposes at secondary distribution. 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 does not use natural gas service.

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.
- iv. *Lease/Purchase Agreement* – Investigate the possibility of a lease/purchase or lease/maintenance agreement with the manufacturer and/or installing contractor.

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 RECOMMENDATION

CEG recommends an application of a reflective white paint on the ceiling and vertical beam surfaces to increase the horizontal illumination levels by approximately two footcandles. The practical benefit to applying the paint system is increased ceiling illumination and increased vertical surface illumination above 5-feet. Both of these elements will increase the sense of personal security.

CONFIDENTIAL

Electric Cost Summary
PSE&G (Rate - MD)

Parking Garage "G"
Account # 2715806018

Meter #

Month	Jan-09	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	33,675	40,560	39,675	37,350	22,215	33,765	26,670	27,780	29,640	28,035	25,080	38,835	383,280
Total Cost, \$	\$3,912	\$4,725	\$4,690	\$4,342	\$2,684	\$4,825	\$4,510	\$4,745	\$5,098	\$4,074	\$3,293	\$4,799	\$51,697
\$/KWH	\$0.1162	\$0.1165	\$0.1182	\$0.1162	\$0.1208	\$0.1429	\$0.1691	\$0.1708	\$0.1720	\$0.1453	\$0.1313	\$0.1236	\$0.1349

2008



Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

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

Parking Garage G

Building ID: 1801681
For 12-month Period Ending: January 31, 2009¹
Date SEP becomes ineligible: N/A

Date SEP Generated: July 27, 2009

Facility
Parking Garage G
310-322 River 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: 1973
Gross Floor Area (ft²): 0

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity (kBtu)	1,307,751
Natural Gas (kBtu) ⁴	0
Total Energy (kBtu)	1,307,751

Energy Intensity⁵

Site (kBtu/ft ² /yr)	
Source (kBtu/ft ² /yr)	N/A

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	199
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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	213
% Difference from National Average Source EUI	
Building Type	Other

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.

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

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	Parking Garage G	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
Type	Other	Is this an accurate description of the space in question?		<input type="checkbox"/>
Location	310-322 River 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"/>

Parking Garage G (Parking)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	184,200 Sq. Ft.	Is this the total square footage of the entire parking area (enclosed + nonenclosed + open floor area)?		<input type="checkbox"/>
Enclosed Floor Area	153,500 Sq. Ft.	Is this the total square footage of the enclosed garage space? An enclosed garage is defined as having both sides and a roof.		<input type="checkbox"/>
Non-Enclosed Floor Area (w/roof)	30,700 Sq. Ft.	Is this the total square footage of the nonenclosed garage space? This is typically defined as the portion of the garage above ground (contains no sides but is under a roof).		<input type="checkbox"/>
Open Floor Area (w/o roof)	0 Sq. Ft.	Is this the total square footage of the nonenclosed parking area without a roof? This is typically defined as open parking lots or the very top level of an above ground parking garage.		<input type="checkbox"/>
Weekly Hours of Access	168 Hours	Is this the total number of hours per week when it is possible for a vehicle to enter or exit?		<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: Electricity (kWh (thousand Watt-hours)) Space(s): Entire Facility		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
01/01/2009	01/31/2009	33,675.00
12/01/2008	12/31/2008	38,835.00
11/01/2008	11/30/2008	25,080.00
10/01/2008	10/31/2008	28,035.00
09/01/2008	09/30/2008	29,640.00
08/01/2008	08/31/2008	27,780.00
07/01/2008	07/31/2008	26,670.00
06/01/2008	06/30/2008	33,765.00
05/01/2008	05/31/2008	22,215.00
04/01/2008	04/30/2008	37,350.00
03/01/2008	03/31/2008	39,675.00
02/01/2008	02/29/2008	40,560.00
Electricity Consumption (kWh (thousand Watt-hours))		383,280.00
Electricity Consumption (kBtu)		1,307,751.36
Total Electricity Consumption (kBtu)		1,307,751.36
Is this the total Electricity consumption at this building including all Electricity 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
 Parking Garage G
 310-322 River 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

Parking Garage G	
Gross Floor Area Excluding Parking: (ft ²)	0
Year Built	1973
For 12-month Evaluation Period Ending Date:	January 31, 2009

Facility Space Use Summary

Parking Garage G	
Space Type	Parking
Gross Floor Area(ft ²)	184,200
Enclosed Floor Area	153,500
Non-Enclosed Floor Area (w/roof)	30,700
Open Floor Area (w/o roof)	0
Weekly Hours of Access	168

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 01/31/2009)	Baseline	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft ²)	N/A	N/A	N/A	N/A	104
Source (kBtu/ft ²)	N/A	N/A	N/A	N/A	213
Energy Cost					
\$/year	\$ 51,697.00	N/A	N/A	N/A	N/A
\$/ft ² /year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
MtCO ₂ e/year	199	N/A	N/A	N/A	N/A
kgCO ₂ e/ft ² /year	N/A	N/A	N/A	N/A	N/A

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

Notes:

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

DETAILED COST BREAKDOWN PER ECM
CONCORD ENGINEERING GROUP

Hoboken Parking Garage "G"

Hoboken Garage "G" ECM #2 HID to 2L54T5HO VT	
Quantity of Lighting Fixtures/Lamps	222
Existing KW	41.7
Proposed KW	26.9
KW Saved	14.9
Annual KWH Saved	130,296
\$/KWH	\$0.135
Annual Energy Savings \$	\$17,658
Estimated Construction Cost \$	\$105,450
Utility Rebate \$	<u>\$6,660</u>
Net Construction Cost After Rebate \$	\$98,790
Simple Payback	5.59
Analysis Period	10.00
Energy Cost Escalation	2%
Discount Rate	5%
Net Present Value	\$15,595
Internal Rate of Return	8.40%

Hoboken Garage "G" ECM #3 HID to 2L32T8HO VT	
Quantity of Lighting Fixtures/Lamps	222
Existing KW	41.7
Proposed KW	24.9
KW Saved	16.9
Annual KWH Saved	147,799
\$/KWH	\$0.135
Annual Energy Savings \$	\$20,030
Estimated Construction Cost \$	\$90,978
Utility Rebate \$	<u>\$6,660</u>
Net Construction Cost After Rebate \$	\$84,318
Simple Payback	4.21
Analysis Period	10.00
Energy Cost Escalation	2%
Discount Rate	5%
Net Present Value	\$61,923
Internal Rate of Return	19.23%

Parking Garage "G" Lighting
ECM #2 Retrofit

Location	Fixtures Retrofitted										Unit Installation Cost					Total Cost Less Rebate	Simple Payback	
	Wattage Reduction	Average Burn Hours	Ave \$/kwh	Ave. \$/KW	Energy Savings, kWh	Energy Savings, \$	Energy Savings, kW	Energy Savings, \$	Qty	Material Each	Labor Each	Total Each	Total Materials	Total Labor	Total All			Rebate Estimate
Basement	1,474	8760	\$0.1350	\$4.58	12,912	\$1,743	1.47	\$7	22	\$225.00	\$250.00	\$475.00	\$4,950.00	\$5,500.00	\$10,450.00	\$660.00	\$9,790.00	5.59
1st Level Parking	3,752	8760	\$0.1350	\$4.58	32,868	\$4,437	3.75	\$17	56	\$225.00	\$250.00	\$475.00	\$12,600.00	\$14,000.00	\$26,600.00	\$1,680.00	\$24,920.00	5.59
2nd Level Parking	3,216	8760	\$0.1350	\$4.58	28,172	\$3,803	3.22	\$15	48	\$225.00	\$250.00	\$475.00	\$10,800.00	\$12,000.00	\$22,800.00	\$1,440.00	\$21,360.00	5.59
3rd Level Parking	3,216	8760	\$0.1350	\$4.58	28,172	\$3,803	3.22	\$15	48	\$225.00	\$250.00	\$475.00	\$10,800.00	\$12,000.00	\$22,800.00	\$1,440.00	\$21,360.00	5.59
4th Level Parking	3,216	8760	\$0.1350	\$4.58	28,172	\$3,803	3.22	\$15	48	\$225.00	\$250.00	\$475.00	\$10,800.00	\$12,000.00	\$22,800.00	\$1,440.00	\$21,360.00	5.59
TOTALS:	14,874				130,296	\$17,590	14.87								\$105,450.00	\$6,660.00	\$98,790.00	

ECM #2		Project Name: Hoboken Garage "G" ECM #2 HID to 2L54T5HO VT							
		Location: Hoboken, NJ							
		Description: Parking Garage Lighting Retrofit							
Return on Investment Analysis									
		Parking Garage Lighting Retrofit	Existing						
Total Construction Cost		\$105,450	\$0						
Annual Maintenance Cost		\$1,399	\$7,430						
Annual Cost of Operation (Energy)		\$31,767	\$49,357						
Utility Incentives or Credits		\$6,660	\$0						
First Cost Premium		\$98,790							
Simplified Payback Calculation:		5.59	Years						
Life Cycle Cost Analysis									
Analysis Period (years):	10	Financing Term (mths):	120						
Depreciation Period (years):	39	Financing %:	5%						
Tax Rate:	0.0%	Inflation Rate:	2.0%						
Financing Rate:	5.00%	Energy Cost Escalation Rate:	2.2%						
		Cost of Capital:	5.0%						
Period	Additional Cash Outlay	Energy Savings	Additional Maint Costs	Additional Depreciation	Interest Expense	Pretax Income	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	\$93,851	0	0	0	0	0	0	(93,851)	0
1	\$0	\$17,590	(\$6,031)	\$2,533	\$4,333	\$16,755	\$7,108	\$12,180	\$12,180
2	\$0	\$17,977	(\$6,152)	\$2,533	\$3,969	\$17,627	\$7,472	\$12,688	\$24,868
3	\$0	\$18,372	(\$6,275)	\$2,533	\$3,587	\$18,527	\$7,854	\$13,207	\$38,075
4	\$0	\$18,777	(\$6,401)	\$2,533	\$3,185	\$19,459	\$8,256	\$13,736	\$51,811
5	\$0	\$19,190	(\$6,529)	\$2,533	\$2,763	\$20,422	\$8,678	\$14,277	\$66,088
6	\$0	\$19,612	(\$6,659)	\$2,533	\$2,319	\$21,419	\$9,122	\$14,830	\$80,919
7	\$0	\$20,043	(\$6,792)	\$2,533	\$1,852	\$22,450	\$9,589	\$15,395	\$96,313
8	\$0	\$20,484	(\$6,928)	\$2,533	\$1,362	\$23,518	\$10,079	\$15,972	\$112,285
9	\$0	\$20,935	(\$7,067)	\$2,533	\$846	\$24,623	\$10,595	\$16,561	\$128,846
10	\$0	\$21,396	(\$7,208)	\$2,533	\$304	\$25,767	\$11,137	\$17,163	\$146,008
Totals:		\$194,376	(\$66,043)	\$25,331	\$24,521	\$210,567	\$146,008	\$146,008	\$757,394
		Net Present Value (NPV)		\$15,595					
		Internal Rate of Return (IRR)		8.4%					

Hoboken Parking Garage "C" Lighting
ECM #3 Retrofit

Location	Existing Fixtures						Proposed Fixtures						Total Watts	
	Description	Avg. Rated Fixture Life, Hours	Lamps per Fixture	Present Avg. Lumens/Fixture	Watts	Qty of Fixtures	Total Watts	Description	Avg. Rated Fixture Life, Hours	Lamps per Fixture	Avg. Lumens per Fixture	Watts		Qty of Fixtures
Basement	150 W High Pressure Sodium - Low Bay	24,000	1	10,000	188	22	4,136	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T8 HO Fixtures	36,000	3	8,600	112	22	2,464
1st Level Parking	150 W High Pressure Sodium - Low Bay	24,000	1	10,000	188	56	10,528	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T8 HO Fixtures	36,000	3	8,600	112	56	6,272
2nd Level Parking	150 W High Pressure Sodium - Low Bay	24,000	1	10,000	188	48	9,024	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T8 HO Fixtures	36,000	3	8,600	112	48	5,376
3rd Level Parking	150 W High Pressure Sodium - Low Bay	24,000	1	10,000	188	48	9,024	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T8 HO Fixtures	36,000	3	8,600	112	48	5,376
4th Level Parking	150 W High Pressure Sodium - Low Bay	24,000	1	10,000	188	48	9,024	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T8 HO Fixtures	36,000	3	8,600	112	48	5,376
TOTALS:						222	41,736						222	24,864

Hoboken Parking Garage
ECM #3 Retrofit

Location	Fixtures Retrofitted						Unit Installation Cost						Rebate Estimate	Total Cost Less Rebate	Simple Payback			
	Wattage Reduction	Average Burn Hours	Ave \$/kwh	Ave. \$/kW	Energy Savings, kWh	Energy Savings, \$	Energy Savings, \$/kW	Energy Savings, \$	Qty	Material Each	Labor Each	Total Each				Total Materials	Total Labor	Total All
Basement	1,672	8760	\$0.1350	\$4.58	14,647	\$1,977	1.67	\$8	22	\$159.81	\$250.00	\$409.81	\$3,515.82	\$5,500.00	\$9,015.82	\$660.00	\$8,355.82	4.21
1st Level Parking	4,256	8760	\$0.1350	\$4.58	37,283	\$5,033	4.26	\$19	56	\$159.81	\$250.00	\$409.81	\$8,949.36	\$14,000.00	\$22,949.36	\$1,680.00	\$21,269.36	4.21
2nd Level Parking	3,648	8760	\$0.1350	\$4.58	31,956	\$4,314	3.65	\$17	48	\$159.81	\$250.00	\$409.81	\$7,670.88	\$12,000.00	\$19,670.88	\$1,440.00	\$18,230.88	4.21
3rd Level Parking	3,648	8760	\$0.1350	\$4.58	31,956	\$4,314	3.65	\$17	48	\$159.81	\$250.00	\$409.81	\$7,670.88	\$12,000.00	\$19,670.88	\$1,440.00	\$18,230.88	4.21
4th Level Parking	3,648	8760	\$0.1350	\$4.58	31,956	\$4,314	3.65	\$17	48	\$159.81	\$250.00	\$409.81	\$7,670.88	\$12,000.00	\$19,670.88	\$1,440.00	\$18,230.88	4.21
TOTALS:	16,872				147,799	\$19,953	16.87								\$90,977.82	\$6,660.00	\$84,317.82	

ECM #3 **Project Name: Hoboken Garage "G" ECM #3 HID to 3L32T8HO VT**
Location: Hoboken, NJ
Description: Parking Garage Lighting Retrofit

Simple Payback Analysis

	Parking Garage Lighting Retrofit	Existing
Total Construction Cost	\$90,978	\$0
Annual Maintenance Cost	\$7,430	\$13,986
Annual Cost of Operation (Energy)	\$29,404	\$49,357
Utility Incentives or Credits	\$6,660	\$0
First Cost Premium	\$84,318	
Simplified Payback Calculation:	4.21	Years

Life Cycle Cost Analysis

Period	Additional Cash Outlay	Energy Savings	Additional Maint Costs	Additional Depreciation	Interest Expense	Pretax Income	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	\$80,102	0	0	0	0	0	0	(80,102)	0
1	\$0	\$19,953	(\$6,556)	\$2,162	\$3,698	\$20,649	\$6,067	\$16,744	\$16,744
2	\$0	\$20,392	(\$6,687)	\$2,162	\$3,388	\$21,529	\$6,377	\$17,314	\$34,058
3	\$0	\$20,841	(\$6,821)	\$2,162	\$3,062	\$22,438	\$6,703	\$17,896	\$51,954
4	\$0	\$21,299	(\$6,957)	\$2,162	\$2,719	\$23,376	\$7,046	\$18,491	\$70,445
5	\$0	\$21,768	(\$7,096)	\$2,162	\$2,358	\$24,344	\$7,407	\$19,099	\$89,544
6	\$0	\$22,247	(\$7,238)	\$2,162	\$1,979	\$25,344	\$7,786	\$19,720	\$109,264
7	\$0	\$22,736	(\$7,383)	\$2,162	\$1,581	\$26,376	\$8,184	\$20,354	\$129,618
8	\$0	\$23,236	(\$7,531)	\$2,162	\$1,162	\$27,443	\$8,603	\$21,002	\$150,620
9	\$0	\$23,747	(\$7,681)	\$2,162	\$722	\$28,545	\$9,043	\$21,664	\$172,283
10	\$0	\$24,270	(\$7,835)	\$2,162	\$259	\$29,683	\$9,506	\$22,340	\$194,623
Totals:		\$220,488	(\$71,786)	\$21,620	\$20,929	\$249,725		\$194,623	\$1,019,154
									Net Present Value (NPV)
									\$61,923
									Internal Rate of Return (IRR)
									19.2%