



ENERGY AUDIT – FINAL REPORT

HOBOKEN CLINTON STREET GARAGE

324-326 Clinton 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 Utility
302-330 Clinton 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 energy costs at this facility are as follows:

Electricity \$156,057

The potential annual energy cost savings for each of the alternative lighting retrofits and solar project 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	Outdoor Lighting Upgrades to LED	\$130,162	\$35,702	3.6	27.7%
2	Replace HID Fixtures with T5 Technology	\$135,725	\$30,913	4.4	22.7%
3	Replace HID Fixtures with T8 Technology	\$114,973	\$47,237	2.4	41.7%
4	Replace Top Parking Deck Pole Lighting with Solar Lighting	\$106,434	\$3,388	31.4	3.2%
5	Install Solar Carports on Top Parking Deck	\$1,446,162	\$30,497	12.4	7.3%

Note A: Includes applicable incentive, SREC revenue or 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	Outdoor Lighting Upgrades to LED	11.6	42,322
2	Replace HID Fixtures with T5 Technology	27.2	237,790
3	Replace HID Fixtures with T8 Technology	41.5	363,365
4	Replace Top Parking Deck Pole Lighting with Solar Lighting	7.1	26,060
5	Install Solar Carports on Top Parking Deck	64	234,594

Recommendations:

The following Energy Conservation Measures are recommended for the 302-330 Clinton Street Parking Garage Facility:

- **ECM #2:** Replace HID Fixtures with T5 Technology **OR**
- **ECM #3:** Replace HID Fixtures with T8 Technology

II. INTRODUCTION

This comprehensive energy audit covers the 21,860 square foot parking garage facility at 302-330 Clinton Street that includes the parking garage building, manager's office, storage room, and restroom. The parking garage was constructed in 2003 of pre-fabricated concrete sections.

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 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 entire parking garage and medical office complex 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.

The total connected load for the parking garage only is estimated to be approximately 75 kW with an estimated usage of 657,000 kWh or 54.5% of the total usage for the entire complex (657,000 kWh ÷ 1,205,800 kWh).

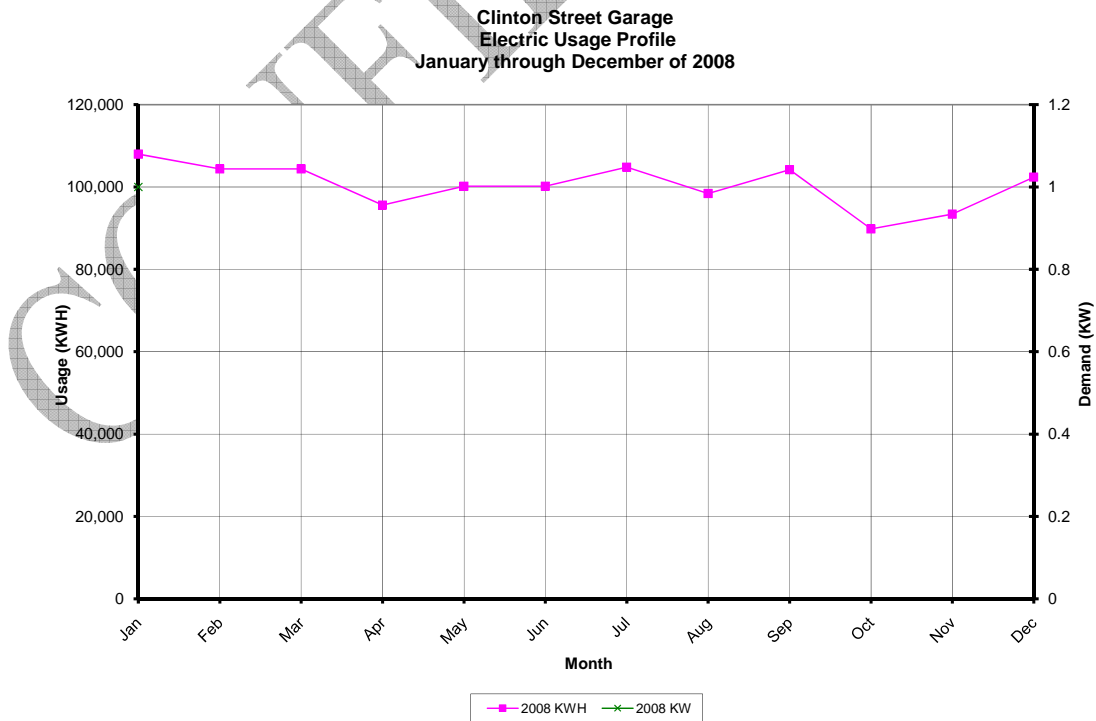
<u>Description</u>	<u>Average</u>
Electricity	13¢ / kWh

Table 3
Electricity Billing (Data for the Entire Complex)

MONTH OF USE	CONSUMPTION KWH	DEMAND**	TOTAL BILL
1/08	108,000		\$12,127
2/08	104,400		\$11,916
3/08	104,400		\$11,916
4/08	95,600		\$10,797
5/08	100,200		\$13,065
6/08	100,200		\$13,065
7/08	104,800		\$16,103
8/08	98,400		\$15,769
9/08	104,200		\$15,942
10/08	89,800		\$11,627
11/08	93,400		\$11,514
12/08	102,400		\$12,216
Totals	1,205,800		\$156,057

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

Figure 1
Electricity Usage Profile for the Entire Complex



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 (including medical offices) is calculated as follows:

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

Electric Usage for Entire Complex = $((1,205,800 \text{ kWh}) * (1000 \text{ W/kW}) * (3.414 \text{ Btu/h} / 1 \text{ W})) \div (1000 \text{ Btu/h} / 1 \text{ kBtu/h}) = 4,116,600 \text{ kBtu}$

$$\text{Building EUI} = \frac{4,116,600 \text{ kBtu}}{\text{Entire Complex SF}}$$

302-330 Clinton Street Parking Garage and Medical Offices Complex EUI = 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
Clinton Street Garage	N/A	50

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

V. FACILITY DESCRIPTION

The 21,860 square foot parking garage at 302-330 Clinton Street includes the 6-level parking garage structure, manager's office, storage room, and restroom. The parking garage is constructed of pre-fabricated concrete sections and was constructed in 2003. The garage is open 24/7 all year round. The garage is attached to a Medical Office Building (MOB) and the existing electric meter feeds both the parking garage and the MOB.

Heating System

The manager's office is heated by a Berko electric wall-hung unit heater that is six (6) years old.

Domestic Hot Water

Domestic hot water for the parking garage restrooms is provided by a 20-gallon capacity electric hot water heater that is six years old.

Cooling System

A 12,000 BTUH Carrier split system cools the office space and is also six (6) years old.

Lighting

The parking decks are lit by High Intensity Discharge (HID) fixtures mounted on the concrete pre-cast planks with 175-Watt Metal Halide (MH) lamps. These lamps are rated for 10,000 hours, have an initial average lumen output of 8,000 and consume 210 Watts per fixture. The top parking deck is lit by 175-Watt MH fixtures mounted on poles.

The Manager's office is lit by five 2-foot x 4-foot lay-in fixtures containing three T8 lamps and electronic ballast. The storage room is lit by four 2-foot x 4-foot lay-in fixtures containing three T8 lamps and electronic ballast. Standard switching is utilized and there are not other types of lighting controls present.

The stairwells are lit by seventeen 1-foot x 4-foot fixtures containing two T8 lamps and electronic ballast. The outside of the building is lit by 41 wall packs with 70-Watt MH lamps. The outside canopy is lit by 42 high-hat light fixtures with 100-Watt MH lamps.

All exit signs are new LED technology units.

VI. MAJOR EQUIPMENT LIST

302-330 Clinton Street Parking Garage Lighting (175-Watt MH)

<u>Location</u>	<u>No. of Fixtures</u>
1st Level (Entrances)	23
2nd Level	62
3rd Level	62
4th Level	62
5th Level	62
Basement	34
TOTAL:	305 Fixtures
Top Parking Deck	(34) Pole Lights (175-Watt MH)
Exterior Building Lights	(41) Wall Packs (70-Watt MH)
Exterior Canopy Lights	(42) Hi-Hats (100-Watt MH)
Front Office	(5) 3-lamp 2' x 4' T-8 fixtures
Stairwells	(17) 2-lamp 2' x 4' T-8 fixtures

VII. ENERGY CONSERVATION MEASURES

ECM #1: Outdoor Lighting Upgrades to LED

Description:

During CEG's site survey, it was noted that in numerous outdoor lighting fixtures metal halide lamps are being used throughout the facility. There are (75) total fixtures with 70-Watt Metal Halide (MH) lamps, (42) fixtures with 100-Watt MH lamps, and (34) fixtures on the top parking deck with 175-Watt MH lamps. Due to the electrical circuitry, these fixtures are on 24/7. Using light sensors, hours that these lights are on could be reduced to 3,650 hours per year. CEG recommends a replacement of these lamps with energy-efficient LED lamps. LED is an acronym for light-emitting-diode. LED's are small light sources that are readily associated with electronic equipment. The 70-Watt MH lamp uses 84 Watts while a LED equivalent uses only 27 Watts. The 100-Watt MH lamp uses 120 Watts while the LED equivalent uses only 55 Watts. In addition the 175-Watt MH lamp uses 210 Watts while the LED equivalent uses 75 Watts.

This ECM involves replacing the MH lamps in the outdoor fixtures with new energy efficient fixtures containing LED lamps, new ballasts and daylight sensor controls to turn the lights off during daylight hours. The basis of design is Beta LED, Lighting Science, Nexxus Lighting, or equivalent.

Energy Savings Calculations:

There are 151 outdoor lighting fixtures that are good candidates for this new LED lighting technology with daylight sensors. Due to the electrical circuitry, these fixtures are on 8,760 hours per year and will need to be controlled by daylight sensors. Energy cost savings = $[75 \times (84-27) \text{ watts} + 42 \times (120-55) \text{ watts} + 34 \times (210-75) \text{ Watts}] \times 3,650 \text{ hrs} \times \$0.13 = 42,322 \text{ kWh} \times \$0.13/\text{kWh} = \$5,502$. Demand (kW) savings equates to $42,322 \text{ kWh} \div 3,650 \text{ hrs} = 11.6 \text{ kW}$.

The average cost of new LED fixtures with lamp, ballast and photo sensor controls including labor to install is \$925 per outdoor fixture. $151 \text{ units} \times \$925/\text{unit} = \$139,675$.

Maintenance savings is from the cost of replacement lamps and labor to install. LED lamps last 50,000 hours while MH lamps last 10,000 hours. Therefore there is a savings of not having to replace lamps four times during the life of a LED lamp.

Maintenance savings = $4 \times [151 \text{ lamps} (\$30 \text{ lamp cost} + \$20 \text{ labor cost})] = \$30,200$

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

From Appendix B, the incentive for LED fixture and lighting control is \$63 per unit.

Total incentive = $151 \times \$63 = \$9,513$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$139,675
NJ Smart Start Equipment Incentive (\$):	(\$9,513)
Net Installation Cost (\$):	\$130,162
Maintenance Savings (\$ / yr):	\$30,200
Energy Savings (\$ / yr):	\$5,502
Net Savings (\$ / yr):	\$35,702
Simple Payback (yrs):	3.6
Simple Return On Investment (%):	27.7%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$535,530

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). The 175-Watt metal halide light fixtures presently in the parking garage have a Mean Fixture Lumens/Watt of 35 to 42 L/W.

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 metal halide 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 Metal Halide (MH) lamp will have declined to 65% 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 MH fixtures with a twin lamp, vapor tight, 4-foot T5 light fixtures with T5HO lamps and a Mean Fixture Lumens/Watt of 72+. 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 (\$):	\$144,875
NJ Smart Start Equipment Incentive (\$):	(\$9,150)
Net Installation Cost (\$):	135,725
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	30,913
Net Savings (\$ / yr):	\$30,913
Simple Payback (yrs):	4.4
Simple Return On Investment (%):	22.7%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$463,695

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

Description:

T8HO fluorescent lamps provide a lumen per watt ration of 75+, 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 metal halide fixtures with a 2-lamp, vapor tight, 4-foot T8 light fixture 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% uplight 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 (\$):	\$124,123
NJ Smart Start Equipment Incentive (\$):	(\$9,150)
Net Installation Cost (\$):	135,725
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	\$47,237
Net Savings (\$ / yr):	\$47,237
Simple Payback (yrs):	2.4
Simple Return On Investment (%):	41.7%
Estimated ECM Lifetime (yr):	15
Simple Lifetime Savings (\$):	\$708,555

ECM #4: Replace Top Deck Pole Lighting with Solar Lighting Systems

Description:

The top deck of this parking garage consists of (34) Metal Halide lighting fixtures with 175-Watt lamps. The light fixture is mounted on a pole and due to the electrical circuitry are on 8,760 hours per year. These 175-Watt lamps consume 210 watts/hour for a yearly average of 10 daylight hours per day when they should be shut off.

This ECM would replace each of the existing MH fixtures with a solar array, chargeable battery, inverter, and LED light fixture. These new solar lighting systems would be controlled by daylight sensors. The CEG audit team used the Solar Outdoor Lighting, Inc. solar LED lighting system for our analysis. The system features a fixed angle bracket that mounts on the side of the pole to optimize the capture of the sun's energy for a particular geographic location.

Energy Savings Calculations:

Energy Cost Savings = 34 fixtures x 210 watts x 3,650 hrs/year x \$0.13 / kWh = \$3,388

The demand savings (kW) is 26,060 kWh ÷ 3,650 hours = 7.1 kW

The total installed cost of a solar lighting system mounted on each pole with brackets, fixture, solar array, battery, light sensor, high reach, etc. is \$3,700 per unit (budget cost provided by Solar Outdoor Lighting).

Total Installation Cost = 34 fixtures x \$3,700 = \$125,800

Maintenance savings is from the cost of replacement lamps and labor to install. LED lamps last 50,000 hours while MH lamps last 10,000 hours. Therefore there is a savings for not having to replace lamps four times during the life of a LED lamp.

Maintenance savings = 4 x [34 lamps (\$30 lamp cost + \$20 labor cost)] = \$6,800

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

From Appendix B, the incentive for LED fixture and lighting control is \$63 per unit.

Total incentive = 34 x \$63 = \$2,142

The annual SREC revenue = \$0.40/kWh x 26,060 kWh = \$10,424/year

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$125,800
NJ Smart Start Equipment Incentive (\$):	(\$2,142)
Net Installation Cost (\$):	\$123,658
Maintenance Savings (\$ / yr):	\$6,800
Energy Savings (\$ / yr):	\$3,388
Net Savings (\$ / yr):	\$10,188
Simple Payback (yrs):	31.4
Simple Return On Investment (%):	3.2%
Estimated ECM Lifetime (yr):	25
Simple Lifetime Savings (\$):	\$91,500

ECM #5: Install Solar Carports on Top Parking Deck

Description:

The parking areas on the top uncovered deck can be covered by solar carports that consist of a lightweight support structure, PV modules affixed within the structure, electrical feed to the parking garage lighting power system, inverter, etc. The enclosed parking deck lights would be feed approximately 10 hours per day by these PV modules.

Energy Savings Calculations:

The total present connected lighting load for the enclosed parking decks that are lit 24/7 is 64 kW (64,000 Watts). Because of the estimated full output of a module of only 4.68 hours full output per 350 days per year and 93% availability factor, it is necessary to install 154 kW PV system to obtain 64 kW of full output. Each parking space can have a carport PV module system that produces 792 watts of electricity. This equates to 154,000 Watts divided by 792 Watts = 195 parking spaces with solar carports.

The energy savings is the electricity that is produced by the PV modules and not purchased from the utility = $154 \text{ kW} \times 4.68 \text{ hrs/day} \times 350 \text{ days/year} \times 0.93 = 234,594 \text{ kWh}$.

Annual Energy Cost Savings = $234,594 \text{ kWh} \times \$0.13/\text{kWh} = \$30,497$

The total installed cost of the solar carport systems is approximately \$10/Watt (budget pricing provided by SolarIntegrated®). $154,000 \text{ Watts} \times \$10/\text{Watt} = \$1,540,000$

The annual SREC revenue = $\$0.40/\text{kWh} \times 234,594 \text{ kWh} = \$93,838/\text{year}$

Appendix G outlines the solar carport system option cost/savings analysis and LCC analysis.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$1,540,000
NJ Smart Start Equipment Incentive (\$):	-
Annual SREC Revenue(\$):	(\$93,838)
Net Installation Cost (\$):	1,446,162
Maintenance Savings (\$ / yr):	-
Energy Savings (\$ / yr):	\$30,497
Net Savings (\$ / yr):	\$30,497
Simple Payback (yrs):	13.7
Simple Return On Investment (%):	7.3%
Estimated ECM Lifetime (yr):	25
Simple Lifetime Savings (\$):	\$762,425

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's Clinton Street Garage, and concluded the following:

- *Photovoltaic System:* Refer to ECM #5 and Appendix G for the detailed description and financial analysis for the proposed roof-top carport photovoltaic system.
- *Wind Energy:* CEG does not recommend the installation of a wind system because of lack of open spaces for such a system in the Hoboken area. The afore-mentioned characteristic does not lend itself to a successful wind energy application.

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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 January 2008 through December 2008.

Electricity:

Section IV, Figure 1 demonstrates a very typical Parking Garage load profile, which is very 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-Clinton Street receives electrical service through Public Service Electric and Gas Company (PSE&G) on a LPLP (Large Power and Lighting Service) rate. This utility tariff is for delivery service for general purposes at secondary distribution voltages where the customer's measured peak demand exceeds 150 kilowatts in any month and also at primary distribution charges. 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 dekatherm 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 - LPLS)

Clinton Street Garage
Account # 21 701 013 0 6

2008

Meter #	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Total
Month	31	28	31	30	31	30	31	31	30	31	30	31	0
Billing Days	108,000	104,400	104,400	95,600	100,200	100,200	104,800	98,400	104,200	89,800	93,400	102,400	1,205,800
KWH	\$12,127	\$11,916	\$11,916	\$10,797	\$13,065	\$13,065	\$16,103	\$15,769	\$15,942	\$11,627	\$11,514	\$12,216	\$156,057
Total Cost, \$	\$0.1123	\$0.1141	\$0.1141	\$0.1129	\$0.1304	\$0.1304	\$0.1537	\$0.1602	\$0.1530	\$0.1295	\$0.1233	\$0.1193	\$0.1294

Average value, usage billed for two months.



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
--------------------	------------------------

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 Clinton Street

Building ID: 1801556
For 12-month Period Ending: December 31, 2008¹
Date SEP becomes ineligible: N/A

Date SEP Generated: July 27, 2009

Facility
Parking Garage Clinton Street
302-330 Clinton 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: 2003
Gross Floor Area (ft²): 0

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity (kBtu)	4,114,190
Natural Gas (kBtu) ⁴	0
Total Energy (kBtu)	4,114,190

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)	627
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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 Clinton Street	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	302-330 Clinton 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 Clinton Street (Parking)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	131,160 Sq. Ft.	Is this the total square footage of the entire parking area (enclosed + nonenclosed + open floor area)?		<input type="checkbox"/>
Enclosed Floor Area	109,300 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)	0 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)	21,860 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))
12/01/2008	12/31/2008	102,400.00
11/01/2008	11/30/2008	93,400.00
10/01/2008	10/31/2008	89,800.00
09/01/2008	09/30/2008	104,200.00
08/01/2008	08/31/2008	98,400.00
07/01/2008	07/31/2008	104,800.00
06/01/2008	06/30/2008	100,200.00
05/01/2008	05/31/2008	100,200.00
04/01/2008	04/30/2008	95,600.00
03/01/2008	03/31/2008	104,400.00
02/01/2008	02/29/2008	104,400.00
01/01/2008	01/31/2008	108,000.00
Electricity Consumption (kWh (thousand Watt-hours))		1,205,800.00
Electricity Consumption (kBtu)		4,114,189.60
Total Electricity Consumption (kBtu)		4,114,189.60
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 Clinton Street
 302-330 Clinton 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 Clinton Street	
Gross Floor Area Excluding Parking: (ft ²)	0
Year Built	2003
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Parking Garage Clinton Street	
Space Type	Parking
Gross Floor Area(ft ²)	131,160
Enclosed Floor Area	109,300
Non-Enclosed Floor Area (w/roof)	0
Open Floor Area (w/o roof)	21,860
Weekly Hours of Access	168

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 12/31/2008)	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	\$ 156,057.00	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	627	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 Clinton Street Parking Garage

Clinton Street Garage ECM #2 HID to 2L54T5HO VT	
Quantity of Lighting Fixtures/Lamps	305
Existing KW	64.1
Proposed KW	36.9
KW Saved	27.1
Annual KWH Saved	237,790
\$/KWH	\$0.130
Annual Energy Savings \$	\$30,913
Estimated Construction Cost \$	\$144,875
Utility Rebate \$	<u>\$9,150</u>
Net Construction Cost After Rebate \$	\$135,725
Simple Payback	4.37
Analysis Period	10.00
Energy Cost Escalation	2%
Discount Rate	7%
Net Present Value	\$56,127
Internal Rate of Return	13.04%

Clinton Street Garage ECM #3 HID to 2L32T8HO VT	
Quantity of Lighting Fixtures/Lamps	305
Existing KW	64.1
Proposed KW	22.6
KW Saved	41.5
Annual KWH Saved	363,365
\$/KWH	\$0.130
Annual Energy Savings \$	\$47,237
Estimated Construction Cost \$	\$124,123
Utility Rebate \$	<u>\$9,150</u>
Net Construction Cost After Rebate \$	\$114,973
Simple Payback	2.42
Analysis Period	10.00
Energy Cost Escalation	2%
Discount Rate	5%
Net Present Value	\$222,031
Internal Rate of Return	36.75%

Clinton Avenue Parking Garage Lighting
ECM #2 Retrofit

Location	Existing Fixtures					Proposed Fixtures					Total Watts	Qty of Fixtures	Total Watts	
	Description	Avg. Rated Fixture Life, Hours	Lamps per Fixture	Present Avg. Lumens/Fixture	Watts	Description	Avg. Rated Fixture Life, Hours	Lamps per Fixture	Avg. Lumens per Fixture	Watts				Qty of Fixtures
1st Level Parking	175 W Metal Halide Low Bay	10,000	1	8,000	210	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T5 HO Fixtures	Sylvania Lamps FP54/841/HO/ECCO Sylvania Ballast QTP2X34T5HO/UNV PSN La Mar Lighting Enclosure DV254H5UPCSS	25,000	2	7,500	121	23	2,783	
2nd Level Parking	175 W Metal Halide Low Bay	10,000	1	8,000	210	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T5 HO Fixtures	Sylvania Lamps FP54/841/HO/ECCO Sylvania Ballast QTP2X34T5HO/UNV PSN La Mar Lighting Enclosure DV254H5UPCSS	25,000	2	7,500	121	62	7,502	
3rd Level Parking	175 W Metal Halide Low Bay	10,000	1	8,000	210	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T5 HO Fixtures	Sylvania Lamps FP54/841/HO/ECCO Sylvania Ballast QTP2X34T5HO/UNV PSN La Mar Lighting Enclosure DV254H5UPCSS	25,000	2	7,500	121	62	7,502	
4th Level Parking	175 W Metal Halide Low Bay	10,000	1	8,000	210	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T5 HO Fixtures	Sylvania Lamps FP54/841/HO/ECCO Sylvania Ballast QTP2X34T5HO/UNV PSN La Mar Lighting Enclosure DV254H5UPCSS	25,000	2	7,500	121	62	7,502	
5th Level Parking	175 W Metal Halide Low Bay	10,000	1	8,000	210	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T5 HO Fixtures	Sylvania Lamps FP54/841/HO/ECCO Sylvania Ballast QTP2X34T5HO/UNV PSN La Mar Lighting Enclosure DV254H5UPCSS	25,000	2	7,500	121	62	7,502	
Basement	175 W Metal Halide Low Bay	10,000	1	8,000	210	Remove Existing HID Low Bay Fixtures, Replace OFO with Vapor Tight 4' T5 HO Fixtures	Sylvania Lamps FP54/841/HO/ECCO Sylvania Ballast QTP2X34T5HO/UNV PSN La Mar Lighting Enclosure DV254H5UPCSS	25,000	2	7,500	121	34	4,114	
TOTALS:												305	64,050	36,905

Clinton Avenue Parking
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
1st Level Parking	2,047	8760	\$0.1300	\$4.58	17,932	\$2,331	2.05	\$9	23	\$225.00	\$250.00	\$475.00	\$5,175.00	\$5,750.00	\$10,925.00	\$690.00	\$10,235.00	4.37
2nd Level Parking	5,518	8760	\$0.1300	\$4.58	48,338	\$6,284	5.52	\$25	62	\$225.00	\$250.00	\$475.00	\$13,950.00	\$15,500.00	\$29,450.00	\$1,860.00	\$27,590.00	4.37
3rd Level Parking	5,518	8760	\$0.1300	\$4.58	48,338	\$6,284	5.52	\$25	62	\$225.00	\$250.00	\$475.00	\$13,950.00	\$15,500.00	\$29,450.00	\$1,860.00	\$27,590.00	4.37
4th Level Parking	5,518	8760	\$0.1300	\$4.58	48,338	\$6,284	5.52	\$25	62	\$225.00	\$250.00	\$475.00	\$13,950.00	\$15,500.00	\$29,450.00	\$1,860.00	\$27,590.00	4.37
5th Level Parking	5,518	8760	\$0.1300	\$4.58	48,338	\$6,284	5.52	\$25	62	\$225.00	\$250.00	\$475.00	\$13,950.00	\$15,500.00	\$29,450.00	\$1,860.00	\$27,590.00	4.37
Basement	3,026	8760	\$0.1300	\$4.58	26,508	\$3,446	3.03	\$14	34	\$225.00	\$250.00	\$475.00	\$7,650.00	\$8,500.00	\$16,150.00	\$1,020.00	\$15,130.00	4.37
TOTALS:	27,145				237,790	\$30,913	27.15								\$144,875.00	\$9,150.00	\$135,725.00	

ECM #2		Project Name: Clinton Street Garage ECM #2 HID to 2L54T5HO VT							
		Location: Hoboken, NJ							
		Description: Parking Garage Lighting Retrofit							
Simple Payback Analysis									
	Parking Garage Lighting Retrofit	Existing							
Total Construction Cost	\$144,875	\$0							
Annual Maintenance Cost	\$1,922	\$10,208							
Annual Cost of Operation (Energy)	\$42,027	\$72,940							
Utility Incentives or Credits	\$9,150	\$0							
First Cost Premium	\$135,725								
Simplified Payback Calculation:									
	4.37	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	\$135,725	0	0	0	0	0	0	(135,725)	0
1	\$0	\$30,913	(\$8,286)	\$3,480	\$6,543	\$29,177	\$10,732	\$21,925	\$21,925
2	\$0	\$31,593	(\$8,452)	\$3,480	\$5,993	\$30,572	\$11,281	\$22,770	\$44,695
3	\$0	\$32,288	(\$8,621)	\$3,480	\$5,416	\$32,013	\$11,859	\$23,634	\$68,329
4	\$0	\$32,998	(\$8,794)	\$3,480	\$4,810	\$33,502	\$12,465	\$24,517	\$92,847
5	\$0	\$33,724	(\$8,970)	\$3,480	\$4,172	\$35,042	\$13,103	\$25,419	\$118,266
6	\$0	\$34,466	(\$9,149)	\$3,480	\$3,501	\$36,634	\$13,773	\$26,340	\$144,606
7	\$0	\$35,225	(\$9,332)	\$3,480	\$2,797	\$38,280	\$14,478	\$27,282	\$171,888
8	\$0	\$36,000	(\$9,519)	\$3,480	\$2,056	\$39,982	\$15,219	\$28,243	\$200,131
9	\$0	\$36,792	(\$9,709)	\$3,480	\$1,277	\$41,743	\$15,998	\$29,226	\$229,357
10	\$0	\$37,601	(\$9,903)	\$3,480	\$459	\$43,565	\$16,816	\$30,229	\$259,586
Totals:		\$341,600	(\$90,735)	\$34,801	\$37,024	\$360,510	\$16,816	\$259,586	\$1,351,629
		Net Present Value (NPV)				\$56,127			
		Internal Rate of Return (IRR)				13.0%			

ECM #3 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
1st Level Parking	3,128	8760	\$0.1300	\$4.58	27,401	\$3,562	3.13	\$14	23	\$156.96	\$250.00	\$406.96	\$3,610.08	\$5,750.00	\$9,360.08	\$690.00	\$8,670.08	2.42
2nd Level Parking	8,432	8760	\$0.1300	\$4.58	73,864	\$9,602	8.43	\$39	62	\$156.96	\$250.00	\$406.96	\$9,731.52	\$15,500.00	\$25,231.52	\$1,860.00	\$23,371.52	2.42
3rd Level Parking	8,432	8760	\$0.1300	\$4.58	73,864	\$9,602	8.43	\$39	62	\$156.96	\$250.00	\$406.96	\$9,731.52	\$15,500.00	\$25,231.52	\$1,860.00	\$23,371.52	2.42
4th Level Parking	8,432	8760	\$0.1300	\$4.58	73,864	\$9,602	8.43	\$39	62	\$156.96	\$250.00	\$406.96	\$9,731.52	\$15,500.00	\$25,231.52	\$1,860.00	\$23,371.52	2.42
5th Level Parking	8,432	8760	\$0.1300	\$4.58	73,864	\$9,602	8.43	\$39	62	\$156.96	\$250.00	\$406.96	\$9,731.52	\$15,500.00	\$25,231.52	\$1,860.00	\$23,371.52	2.42
Basement	4,624	8760	\$0.1300	\$4.58	40,506	\$5,266	4.62	\$21	34	\$156.96	\$250.00	\$406.96	\$5,336.64	\$8,500.00	\$13,836.64	\$1,020.00	\$12,816.64	2.42
TOTALS:	41,480				363,365	\$47,237	41.48								\$124,122.80	\$9,150.00	\$114,972.80	

ECM #3		Project Name: Clinton Street Garage ECM #3 HID to 2L32T8HO VT							
		Location: Hoboken, NJ							
		Description: Parking Garage Lighting Retrofit							
Simple Payback Analysis									
	Parking Garage Lighting Retrofit	Existing							
Total Construction Cost	\$124,123	\$0							
Annual Maintenance Cost	\$1,482	\$10,208							
Annual Cost of Operation (Energy)	\$25,703	\$72,940							
Utility Incentives or Credits	\$9,150	\$0							
First Cost Premium	\$114,973								
Simplified Payback Calculation:									
	2.42	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	\$114,973	0	0	0	0	0	0	(114,973)	0
1	\$0	\$47,237	(\$8,726)	\$2,948	\$5,542	\$47,472	\$9,091	\$41,329	\$41,329
2	\$0	\$48,276	(\$8,900)	\$2,948	\$5,077	\$49,151	\$9,557	\$42,543	\$83,872
3	\$0	\$49,338	(\$9,078)	\$2,948	\$4,588	\$50,880	\$10,045	\$43,783	\$127,655
4	\$0	\$50,424	(\$9,260)	\$2,948	\$4,074	\$52,661	\$10,559	\$45,050	\$172,705
5	\$0	\$51,533	(\$9,445)	\$2,948	\$3,534	\$54,496	\$11,100	\$46,344	\$219,049
6	\$0	\$52,667	(\$9,634)	\$2,948	\$2,966	\$56,387	\$11,668	\$47,667	\$266,716
7	\$0	\$53,825	(\$9,827)	\$2,948	\$2,369	\$58,335	\$12,264	\$49,018	\$315,734
8	\$0	\$55,010	(\$10,023)	\$2,948	\$1,742	\$60,343	\$12,892	\$50,399	\$366,133
9	\$0	\$56,220	(\$10,224)	\$2,948	\$1,082	\$62,413	\$13,552	\$51,810	\$417,943
10	\$0	\$57,457	(\$10,428)	\$2,948	\$389	\$64,548	\$14,245	\$53,251	\$471,194
Totals:		\$521,987	(\$95,544)	\$29,480	\$31,363	\$556,687		\$471,194	\$2,482,331
		Net Present Value (NPV)				\$222,031			
		Internal Rate of Return (IRR)				36.8%			

Project Name: LGEA Solar PV Project - Clinton Street Garage									
Location: Hoboken, NJ									
Description: Photovoltaic System 95% Financing - 20 year									
Simple Payback Analysis									
		Photovoltaic System 95% Financing - 20 year							
Total Construction Cost		\$1,540,000							
Annual kWh Production		234,594							
Annual Energy Cost Reduction		\$30,497							
Annual SREC Revenue		\$82,108							
First Cost Premium		\$1,540,000							
Simple Payback:		13.68 Years							
Life Cycle Cost Analysis									
Analysis Period (years):	25							Financing %:	95%
Financing Term (mths):	240							Maintenance Escalation Rate:	3.0%
Average Energy Cost (\$/kWh):	\$0.130							Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%							SREC Value (\$/kWh):	\$0.350
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	\$77,000	0	0	0	\$0	0	0	(77,000)	0
1	\$0	234,594	\$30,497	\$0	\$82,108	\$101,307	\$34,804	(\$23,506)	(\$100,506)
2	\$0	233,421	\$31,412	\$0	\$81,697	\$98,791	\$37,320	(\$23,002)	(\$123,508)
3	\$0	232,254	\$32,355	\$0	\$81,289	\$96,094	\$40,018	(\$22,468)	(\$145,976)
4	\$0	231,093	\$33,325	\$0	\$80,883	\$93,201	\$42,911	(\$21,904)	(\$167,880)
5	\$0	229,938	\$34,325	\$2,368	\$80,478	\$90,099	\$46,013	(\$23,677)	(\$191,556)
6	\$0	228,788	\$35,355	\$2,357	\$80,076	\$86,772	\$49,339	(\$23,038)	(\$214,594)
7	\$0	227,644	\$36,415	\$2,345	\$79,675	\$83,206	\$52,906	(\$22,366)	(\$236,959)
8	\$0	226,506	\$37,508	\$2,333	\$79,277	\$79,381	\$56,730	(\$21,660)	(\$258,619)
9	\$0	225,373	\$38,633	\$2,321	\$78,881	\$75,280	\$60,831	(\$20,919)	(\$279,538)
10	\$0	224,246	\$39,792	\$2,310	\$78,486	\$70,883	\$65,229	(\$20,143)	(\$299,681)
11	\$0	223,125	\$40,986	\$2,298	\$78,094	\$66,167	\$69,944	(\$19,330)	(\$319,012)
12	\$0	222,009	\$42,215	\$2,287	\$77,703	\$61,111	\$75,001	(\$18,480)	(\$337,491)
13	\$0	220,899	\$43,482	\$2,275	\$77,315	\$55,689	\$80,422	(\$17,590)	(\$355,081)
14	\$0	219,795	\$44,786	\$2,264	\$76,928	\$49,875	\$86,236	(\$16,661)	(\$371,742)
15	\$0	218,696	\$46,130	\$2,253	\$76,544	\$43,641	\$92,470	(\$15,691)	(\$387,433)
16	\$0	217,602	\$47,514	\$2,241	\$76,161	\$36,957	\$99,155	(\$14,678)	(\$402,111)
17	\$0	216,514	\$48,939	\$2,230	\$75,780	\$29,789	\$106,323	(\$13,622)	(\$415,733)
18	\$0	215,432	\$50,407	\$2,219	\$75,401	\$22,103	\$114,009	(\$12,522)	(\$428,255)
19	\$0	214,355	\$51,920	\$2,208	\$75,024	\$13,861	\$122,251	(\$11,376)	(\$439,631)
20	\$0	213,283	\$53,477	\$2,197	\$74,649	\$5,023	\$131,088	(\$10,182)	(\$449,813)
21	\$0	212,217	\$55,081	\$2,186	\$74,276	\$4,259	\$120,510	\$2,403	(\$447,410)
22	\$0	211,155	\$56,734	\$2,175	\$73,904	\$2,915	\$99,169	\$26,380	(\$421,031)
23	\$0	210,100	\$58,436	\$2,164	\$73,535	\$0	\$0	\$129,807	(\$291,224)
24	\$0	209,049	\$60,189	\$2,153	\$73,167	\$0	\$0	\$131,203	(\$160,021)
25	\$0	208,004	\$61,995	\$2,142	\$72,801	\$0	\$0	\$132,654	(\$27,367)
Totals:	4,475,569	\$819,473	\$819,473	\$36,505	\$1,566,449	\$1,259,230	\$1,463,000	\$1,682,679	(\$7,272,173)
Net Present Value (NPV)								(\$179,794)	
Internal Rate of Return (IRR)								#DIV/0!	

Project Name: LGEA Solar PV Project - Clinton Street Garage							
Location: Hoboken, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
	Photovoltaic System - Direct Purchase						
Total Construction Cost	\$1,540,000						
Annual kWh Production	234,594						
Annual Energy Cost Reduction	\$30,497						
Annual SREC Revenue	\$82,108						
First Cost Premium	\$1,540,000						
Simple Payback:	13.68						Years
Life Cycle Cost Analysis							
Analysis Period (years):	25			Financing %:	0%		
Financing Term (mths):	0			Maintenance Escalation Rate:	3.0%		
Average Energy Cost (\$/kWh)	\$0.130			Energy Cost Escalation Rate:	3.0%		
Financing Rate:	0.00%			SREC Value (\$/kWh)	\$0.350		
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	\$1,540,000	0	0	0	\$0	(1,540,000)	0
1	\$0	234,594	\$30,497	\$0	\$82,108	\$112,605	(\$1,427,395)
2	\$0	233,421	\$31,412	\$0	\$81,697	\$113,110	(\$1,314,285)
3	\$0	232,254	\$32,355	\$0	\$81,289	\$113,644	(\$1,200,641)
4	\$0	231,093	\$33,325	\$0	\$80,883	\$114,208	(\$1,086,434)
5	\$0	229,938	\$34,325	\$2,368	\$80,478	\$112,435	(\$973,999)
6	\$0	228,788	\$35,355	\$2,357	\$80,076	\$113,074	(\$860,925)
7	\$0	227,644	\$36,415	\$2,345	\$79,675	\$113,746	(\$747,179)
8	\$0	226,506	\$37,508	\$2,333	\$79,277	\$114,452	(\$632,727)
9	\$0	225,373	\$38,633	\$2,321	\$78,881	\$115,192	(\$517,535)
10	\$0	224,246	\$39,792	\$2,310	\$78,486	\$115,968	(\$401,567)
11	\$0	223,125	\$40,986	\$2,298	\$78,094	\$116,781	(\$284,785)
12	\$0	222,009	\$42,215	\$2,287	\$77,703	\$117,632	(\$167,153)
13	\$0	220,899	\$43,482	\$2,275	\$77,315	\$118,521	(\$48,632)
14	\$0	219,795	\$44,786	\$2,264	\$76,928	\$119,451	\$70,819
15	\$0	218,696	\$46,130	\$2,253	\$76,544	\$120,421	\$191,240
16	\$0	217,602	\$47,514	\$2,241	\$76,161	\$121,433	\$312,673
17	\$0	216,514	\$48,939	\$2,230	\$75,780	\$122,489	\$435,162
18	\$0	215,432	\$50,407	\$2,219	\$75,401	\$123,590	\$558,751
19	\$0	214,355	\$51,920	\$2,208	\$75,024	\$124,736	\$683,487
20	\$0	213,283	\$53,477	\$2,197	\$74,649	\$125,929	\$809,417
21	\$1	212,217	\$55,081	\$2,186	\$74,276	\$127,171	\$936,588
22	\$2	211,155	\$56,734	\$2,175	\$73,904	\$128,463	\$1,065,052
23	\$3	210,100	\$58,436	\$2,164	\$73,535	\$129,807	\$1,194,858
24	\$4	209,049	\$60,189	\$2,153	\$73,167	\$131,203	\$1,326,061
25	\$5	208,004	\$61,995	\$2,142	\$72,801	\$132,654	\$1,458,715
Totals:	4,475,569	4,475,569	\$819,473	\$36,505	\$1,566,449	\$2,998,715	\$2,349,417
Net Present Value (NPV)						\$1,458,740	
Internal Rate of Return (IRR)						5.8%	

Building	Parking Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (9.7 lbs)	W/SQFT	SREC Revenue	Avoided Electric Cost	Construction Cost
Clinton Street Garage	7680	SolarCarport PV Module	1422	5.4	7,680	154.00	234,594	13,796	20.05	\$93,838	\$30,497	\$1,540,000

SREC Value \$0.400 per kWh
 Electric Cost \$0.130 per kWh

Notes:

1. Estimated kWh based on 4.68 hours full output per day per 350 day year. Actual kWh will vary day to day.

2. Estimated Inverter Efficiency of 95% and additional Electrical Losses of 2% (System Efficiency 93%)