ENERGY AUDIT – FINAL REPORT

BOROUGH OF OLD TAPPAN

DEPARTMENT OF PUBLIC WORKS- STORAGE BUILDING
25 RUSSELL AVENUE
OLD TAPPAN, NJ 07675
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CEG PROJECT NO. 9C09017

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I. EXECUTIVE SUMMARY

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

Borough of Old Tappan
Department of Public Works- Storage Building
25 Russell Avenue
Old Tappan, NJ 07675

Municipal Contact Person: Patrick O'Brien

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	\$1,406
Natural Gas	\$2,512
Total	\$3,918

The potential annual energy cost savings are shown below in Table 1. <u>Be aware that the measures are not additive because of the interrelation of several of the measures.</u> The cost of each measure for this level of auditing is ± 20% until detailed engineering, specifications, and hard proposals are obtained.

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST[A]	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)	SIMPLE RETURN ON INVESTMENT
1	Lighting Upgrades	\$3,827	\$335	11.4	119 %
2	LED Exit Signs	\$180	\$165	1.1	2,190 %
3	Lighting Controls	\$385	\$75	5.1	192 %
4	Domestic Hot Water Heater Replacement	\$2,950	\$366	8.1	48.8 %
5	Bus Bay Heater Replacement	\$4,500	\$120	37.5	-65.3 %

<u>Note A</u>: Includes applicable incentive 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)	NAT GAS (THERMS)
1	Lighting Upgrades	1.98	1942	-
2	LED Exit Signs	-	657	-
3	Lighting Controls	-	442	-
4	Domestic Hot Water Heater Replacement	-	3799	-
5	Bus Bay Heater Replacement	-	350	48

Recommendation:

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

- **ECM #2: LED Exit Signs**
- **ECM #3: Lighting Controls**

CEG also has a secondary recommendation that the owner review moving forward with the implementation of ECM's #1, and 4 with paybacks of 11.4 and 8.1 years respectively. These ECM's should provide an overall benefit to the facility operation.

II. INTRODUCTION

This comprehensive energy audit covers the 6,240 square foot Storage Building that includes a separate bus bay, four (4) bays of vehicle storage, a toilet room, and a storage loft.

The first task was to collect and review one year's worth of utility energy data for electricity and natural gas. This information was used to analyze operational characteristics, calculate energy benchmarks for comparison to industry averages, estimate savings potential, and establish a baseline to monitor the effectiveness of implemented measures. A computer spreadsheet was used to enter, sum, and calculate benchmarks and to graph utility information (see Table 3 and Table 4).

The Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year ($BTU/ft^2/yr$) and can be used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting annual consumption of all fuels to BTU's then dividing by the area (gross square footage) of the building. EUI is a good indicator of the relative potential for energy savings. A comparatively low EUI indicates less potential for large energy savings. Blueprints (where available) were obtained from the municipality and were utilized to calculate/verify the gross area of the facility.

After gathering the utility data and calculating the EUI, the next step in the audit process is obtaining Architectural and Engineering drawings (where available). By reviewing the Architectural and Engineering drawings, questions regarding the building envelope, lighting systems/controls, HVAC equipment and controls are noted. These questions are then compared to the energy usage profiles developed during the utility data gathering step. Furthermore, 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. After this information is gathered the next step in the process is the site visit.

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

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

III. METHOD OF ANALYSIS

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 Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

$$Simple\ Payback = \left(\frac{Net\ Cost}{Yearly\ Savings} \right)$$

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime \right)$$

$$Simple\ Lifetime\ ROI = \frac{(Simple\ Lifetime\ Savings - Net\ Cost)}{Net\ Cost}$$

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Electric

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from June-08 to May-09. Rockland Electric Company provides electricity to the facility under the Electric Small C & I General Service Secondary rate. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the most current rate structure available.

Natural Gas

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from June-08 to May-09. Public Service Electric and Gas Company (PSE&G) supplies the natural gas commodity from the wellhead to the PSE&G pipelines. PSE&G charges a rate per therm for delivery of the natural gas via their pipelines to the burners under their Basic Gas Supply Service (BGSS) rate.

Utility	Average Cost
Electricity	17.0¢ /kWh
Natural Gas	$1.27 /Therm

Table 3
Electricity Billing Data

Rockland Electric Acct. No.: 29310-17008		Utility Rate: Electric Small C & I General Service Secondary	
MONTH OF USE	**CONSUMPTION KWH**	**DEMAND**	**TOTAL BILL**
Jun-08	565	6.3	$110.69
Jul-08	844	6.8	$166.89
Aug-08	476	4.5	$93.76
Sep-08	550	4.0	$96.59
Oct-08	639	4.8	$98.75
Nov-08	755	5.8	$120.91
Dec-08	994	7.7	$172.72
Jan-09	808	6.7	$137.61
Feb-09	597	5.4	$76.81
Mar-09	737	6.4	$122.46
Apr-09	616	5.8	$92.53
May-09	680	6.3	$116.12
Totals	**8,261**	**7.7 Max**	**$1,405.84**

AVERAGE DEMAND	**5.8**	**KW average**
AVERAGE RATE	**$0.170**	**$/kWh**

Figure 1
Electricity Usage Profile

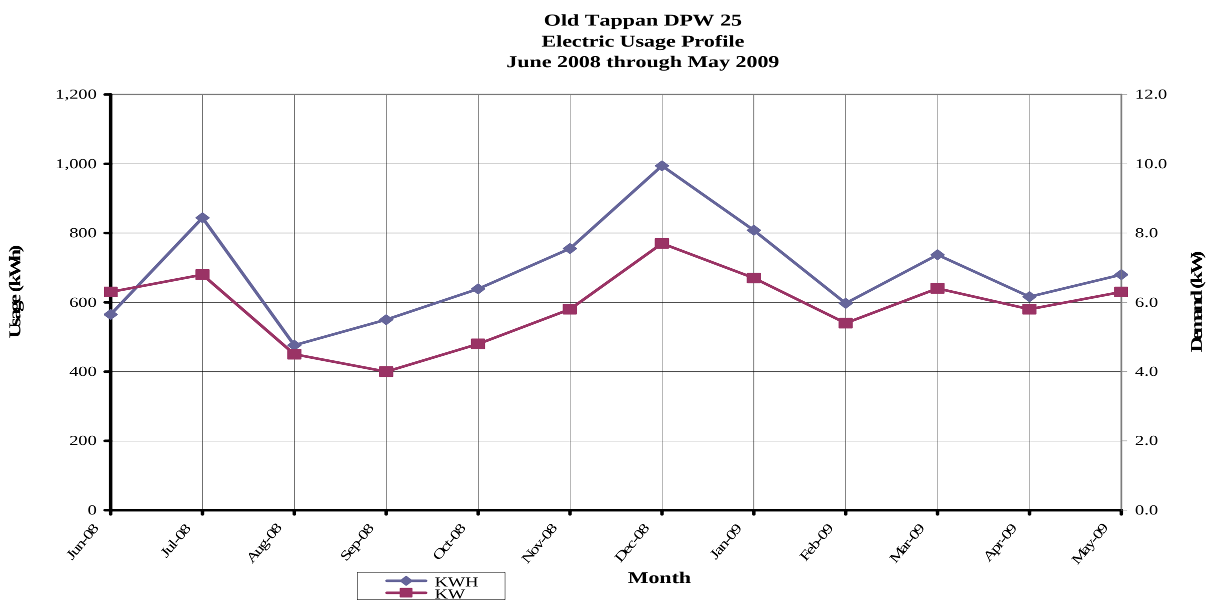
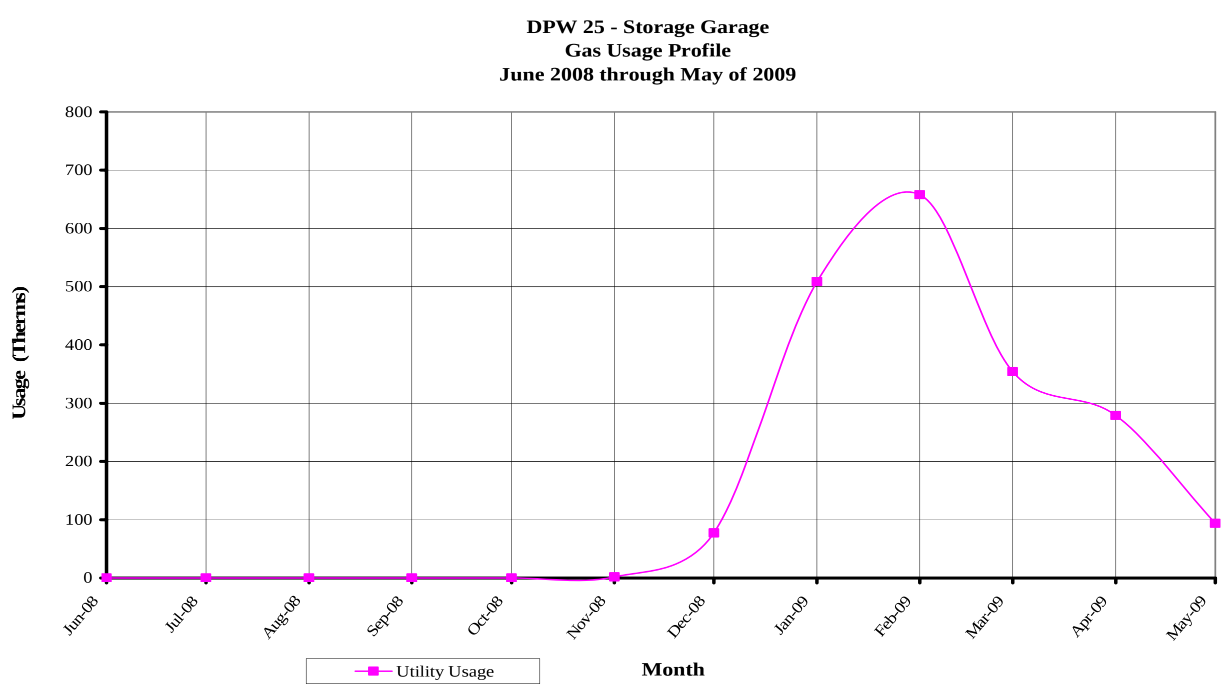


Table 4
Natural Gas Billing Data

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jun-08	0.00	$9.93
Jul-08	0.00	$9.93
Aug-08	0.00	$9.93
Sep-08	0.00	$9.93
Oct-08	0.00	$9.93
Nov-08	2.09	$12.83
Dec-08	77.43	$112.99
Jan-09	508.62	$701.29
Feb-09	657.96	$854.16
Mar-09	354.03	$405.89
Apr-09	279.12	$280.83
May-09	93.90	$94.62
TOTALS	**1973.15**	**$2,512.26**
AVERAGE RATE:	**$1.27**	**$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

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

$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

Table 5
DPW 25 Storage Building EUI Calculations

ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	8,261			28,203	3.340	94,198
NATURAL GAS		1,973.15		197,315	1.047	206,589
TOTAL				225,518		300,787
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
Bldg. Area		6,240		SQUARE FEET		
BUILDING SITE EUI		36.14		kBtu/SF/YR		
BUILDING SOURCE EUI		**48.20**		**kBtu/SF/YR**		

C. EPA Energy Benchmarking System

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

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. Therefore, it is vital that local government municipalities assess their energy usage, benchmark this usage utilizing Portfolio Manager, set priorities and goals to lessen their energy usage and move forward with these priorities and goals. Saving energy will in-turn save the environment.

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

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

Username: oldtappan
Password: lgeaceg2009

Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an “Other” category. The “Other” category is used if your building type or a section of the building is not represented by one of the specific categories. An Energy Performance Rating cannot be calculated if more than 10% of a building is classified as “Other.” DPW 25 Storage Building would be classified as “Other” and therefore cannot be given an Energy Performance Rating. However, Portfolio Manager can still be used to track the buildings energy use index.

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

Table 6

Energy Star Performance Rating		
Facility Name	Energy Performance Rating	National Average
DPW 25- Storage	N/A	N/A

V. FACILITY DESCRIPTION

Old Tappan's Storage Building, also known as DPW 25, consists of a bus bay, four (4) large vehicle storage bays, and a wood platform storage loft totaling approximately 6,240 square feet. The building is a two story structure; however, there is no second floor except for the area with the free standing storage loft. The facility was constructed in 2001 and is a pre-fabricated, insulated, metal building known as a "pole barn".

Heating System

The bus bay is heated by a natural gas-fired unit heater having an estimated capacity of 60,000 Btu/Hr. The remaining 4-bay storage/maintenance area is heated with three (3) natural gas-fired infrared radiant heaters. Each heater is manufactured by GordonRay and has an input of 125, 000 Btu/Hr.

Domestic Hot Water

Domestic hot water for the toilet room and utility sink is provided by a Bradford White electric hot water heater, with a 19 gallon capacity having a 4500 Watt upper heating element and a 3500 Watt lower heating element.

Controls System

Local thermostats control the various heating apparatus throughout the facility.

Lighting

The bus bay and 4-bay storage/maintenance area are lit by 1' x 8' industrial fluorescent strip lights with T12 type lamps. The lights are switched via standard wall switching. No other lighting controls were being used.

VI. MAJOR EQUIPMENT LIST

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

Refer to Appendix D for the Major Equipment List.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrades

Description:

New fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple change from the old to the new can provide substantial savings. A typical drop-ceiling lay in fixture with four, 4-foot lamps (40 Watt lamps) has a total wattage of about 154 Watts. By retrofitting with new lamps, reflector and electronic ballasts the total wattage would be reduced to 91 Watts per fixture and the space light levels and light quality would increase by about 15% and 35%, respectively.

CEG recommends a replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the Owner on electrical costs due to the better performance of the electronic ballasts. In addition to functional cost savings, the fixture replacement will also provide operational cost savings. The operational cost savings will be realized through the lesser number of lamps that will be required to be replaced per year. The expected lamp life of a T8 lamp, approximately 30,000 burn-hours, in comparison to the existing T12 lamps, approximately 20,000 burn-hours, will provide the Owner with fewer lamps to replace per year. Based on the operating hours of this facility, approximately 1460 hours per year, the Owner will be changing approximately 33% less lamps per year.

This ECM replaces all T12 lighting fixtures with energy efficient T8 lighting, Cooper Metalux or equivalent fixture.

Energy Savings Calculations:

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

NJ Smart Start® Program Incentives are calculated as follows:

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

$$\text{Smart Start® } Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\,25) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\,30)$$
$$\text{Smart Start® } Incentive = (21 \times\ \$\,25) + (0 \times\ \$\,30) = \$525$$

Maintenance Savings are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ \ per\ \ year) \times (repacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$

$$Savings = (0.7\ lamps\ per\ year) \times (\$2.00 + \$5.00) = \$4.90 / yr$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$4,352*
NJ Smart Start Equipment Incentive ($):	*($525)*
Net Installation Cost ($):	*$3,827*
Annual Maintenance Savings ($ / yr):	*$5*
Annual Energy Savings ($ / yr):	*$330*
Annual Net Savings ($ / yr):	*$335*
Simple Payback (yrs):	*11.4*
Simple Lifetime Return On Investment:	*119 %*
Estimated ECM Lifetime (yr):	*25*
Simple Lifetime Energy Savings ($):	*$8,250*
Simple Lifetime Maintenance Savings ($):	*$125*

ECM #2: Install LED Exit Signs

Description:

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

This ECM replaces the existing exit signs, three (3) total, throughout the building with highly energy efficient LED exit signs. A Pegasus Associates Lighting LED exit sign or equivalent was used for the basis of design.

Energy Savings Calculations:

<u>Existing exit sign energy costs</u>:

3 units x 30 watts/unit ÷ 1000 watts/kW x 8,760 hrs/yr x $0.17/kWh = $134.03

<u>New LED exit sign energy costs</u>:

3 units x 5 watts/unit ÷ 1000 watts/kW x 8,760 hrs x $0.17/kWh = $22.39

Net energy savings = $134 - $22 = <u>$112/yr.</u>

Installed cost of new LED exit signs = $80 x 3 = <u>$240</u>

NJ Smart Start® Program Incentives are calculated as follows:

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

$$\text{Smart Start® } Incentive = (\#\ of\ \ exit\ signs \times\ \$\ 20) = (3 \times \$20) = \$60$$

Maintenance Savings are calculated as follows:

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

$$Maintenance\ Savings = (3 \times \$4.50) + (3 \times \$14) = \$53\ /\text{yr.}$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$240*
NJ Smart Start Equipment Incentive ($):	*($60)*
Net Installation Cost ($):	*$180*
Annual Maintenance Savings ($/yr):	*$53*
Annual Energy Savings ($ / yr):	*$112*
Annual Net Savings ($ / yr):	*$165*
Simple Payback (yrs):	*1.1*
Simple Lifetime Return on Investment:	*2,190 %*
Estimated ECM Lifetime (yr):	*25*
Simple Lifetime Energy Savings ($):	*$2,800*
Simple Lifetime Maintenance Savings ($):	*$1,325*

ECM #3: Lighting Controls

Description:

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

Lighting controls come in many forms. Sometimes an additional switch is all it will take. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G of the referenced standard, states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all areas of the facility.

Energy Savings Calculations:

Appendix E of this report indicates the energy usage of the existing office, locker rooms, storage rooms, break room, etc. to be 4423 kWh/yr. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Energy Savings = 10% x 4423 kWh/yr

Energy Savings = 442.3 kWh/yr

Cost Savings = 442.3 kWh/yr x $0.17/ kWh = $75 / yr

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is $75/unit including material and labor. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $55/unit. Total number of switches to be retrofitted is 7. Total cost to install sensors is $55/unit x 7 units = $385.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$525*
NJ Smart Start Equipment Incentive ($):	*($140)*
Net Installation Cost ($):	*$385*
Annual Maintenance Savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$75*
Annual Net Savings ($ / yr):	*$75*
Simple Payback (yrs):	*5.1*
Simple Lifetime Return on Investment:	*192 %*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Energy Savings ($):	*$1125*
Simple Lifetime Maintenance Savings ($):	*$0*

ECM #4: Domestic Hot Water Heater Replacement

Description:

This energy conservation measure will replace the existing electric, 20-gallon capacity domestic hot water heater with a gas-fired, tankless water heater. Tankless water heaters heat water directly without the use of a storage tank. Therefore, they avoid the standby heat losses associated with storage water heaters. In a gas-fired tankless water heater, a gas burner heats the water and provides a constant supply of hot water. Therefore, you do not need to wait for the storage tank to fill up with enough hot water as is typical with storage-type hot water heaters.

Energy Savings Calculations:

<u>Existing Electric DHW Heater</u>
20 gallons storage Energy Factor (EF) = 0.94 Efficiency = 97.6 %
Rated Capacity = 4,500 Watt Upper element, 3,500 Lower element

<u>Proposed High-Efficiency Gas-Fired Tankless Water Heater</u>
Rated Capacity = 3.87 gallons per minute Natural Gas-Fired
Energy Factor (EF) = 0.81

<u>Operating Data for Existing Electric DHW Heater:</u>
Average cost of electricity = $.17/kWh

Operating Hrs/Yr. = 824 Hrs.

Electric Use = (824 Hrs x 4,500) ÷ 1,000 Watts/kW ÷ 97.6 % = 3799 kWh

Operating Cost = $.17/kWh x 3799 kWh = $645

<u>Operating Data for new tankless gas-fired DHW heater:</u>

Average cost of natural gas = $1.27/Therm

Annual gas usage for tankless gas-fired unit = 220 Therms

Operating Cost = 220 Therms x $ 1.27 /Therm = $279

Cost Savings = $645 - $279 = <u>$366</u>

Installed cost of tankless water heaters = <u>$3000</u>

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix B, a natural gas-fired domestic hot water heater less than 50 gallons warrants the following incentive:

$$\text{Smart Start® } Incentive = (Quantity \times \text{ \$50 } per\ \ DHW\ \ Heater) = (1 \times \$50) = \underline{\$50}$$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$3,000*
NJ Smart Start Equipment Incentive ($):	*($50)*
Net Installation Cost ($):	*$2,950*
Annual Maintenance Savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$366*
Annual Net Savings ($ / yr):	*$366*
Simple Payback (yrs):	*8.1*
Simple Lifetime Return On Investment	*48.8 %*
Estimated ECM Lifetime (yr):	*12*
Simple Lifetime Energy Savings ($):	*$4,390*
Simple Lifetime Maintenance Savings ($):	*$0*

ECM #5: Bus Bay Heater Replacement - Infrared Heaters

Description:

The Bus Bay is heated by a Reznor gas-fired unit heater. Whenever the large overhead doors are opened, all heated air in the bay is lost and replaced with unconditioned, outdoor air. The unit heater is not the best type of heater in this application because of the high ceilings and heat loss when the garage door is open.

Our team recommends replacing the existing unit heater with low intensity infrared (IR) tube heaters. When compared to convective heating systems, IR heaters provide more efficient heating in large, open areas and warehouses for two reasons: they heat all objects in the "line of sight" of the infrared rays and, their heating capabilities are not influenced by airflow or air temperature. Furthermore, they can be conveniently located and "aimed" to provide heat only where desired.

This ECM replaces the existing unit heater with a Roberts-Gordon GordonRay BH Infrared Heater or equivalent.

Energy Savings Calculations:

Based on the existing unit heater data, thermostat settings and natural gas bills, the total energy consumed by this unit is approximately 24.2 MBtu/year (241.5 Therms/Year). The total rated heat capacity of the IR tubes is 80% of the current load or 0.8 x 241.5 Therms = 193.2 Therms/Year. The total amount of IR heaters and their size can be estimated based on the current heat load and building layout. In general, the bus bay will require two rows of tubes. Heat output of each 10-foot section is approximately 30,000 Btu/hr.

<u>Estimated Fan Energy Savings</u>:

The Reznor gas-fired unit heater has a ¼ HP fan that runs each time the unit calls for heating. Assuming that these motors are 80% efficient and the total run hours is 2,000/year, this equates to an electrical savings of:

Existing ¼ HP Motor Operating Cost =

[0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency

= [0.746 x 0.25 x 0.75 x 2,000 x 0.17] ÷ 0.80 = $59 / Year

Natural Gas Energy Savings:

20% savings x 241.5 Therms/Yr x $1.27/Therm = $61/Year

Total Energy Savings = Fan Energy Savings + Natural Gas Savings

= $59 + $61 = $120 per year

The total implementation cost including material and labor is estimated at approximately $4,500. It is pertinent to note, the labor cost includes installation of the infra-red heaters and required modifications of the existing natural gas piping.

Energy Savings Summary:

ECM #5 – ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$4,500*
NJ Smart Start Equipment Incentive ($):	*($0)* [A]
Net Installation Cost ($):	*$4,500*
Annual Maintenance Savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$120*
Annual Net Savings ($ / yr):	*$120*
Simple Payback (yrs):	*37.5*
Simple Lifetime Return on Investment:	*-65.3 %*
Estimated ECM Lifetime (yr):	*13*
Simple Lifetime Energy Savings ($):	*$1,560*
Simple Lifetime Maintenance Savings ($):	*$0*

Note: A. CEG believes that a NJ Smart Start® Custom Measure incentive could be applied for in order to offset the installation cost. However, further study is required.

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 Old Tappan, and concluded that there is potential for solar energy generation.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof is necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 309 S.F. can be utilized for a PV system on the Storage Building. A depiction of the area utilized is shown in Appendix F. Using this square footage it was determined that a system size of 4.8 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 7,537 KWh annually, reducing the overall utility bill by 87.6 % percent. A detailed financial analysis can be found in Appendix F. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The solar panel system analysis is based on Sun Power SPR-230 panels. The panel efficiency is 18% with an inverter efficiency of 95%. This region allows for a typical range of sunlight between 4.5 and 4.9 hours per day. The calculations are based on an average 4.68 hours per day. The operating hours are calculated based on 351 days per year accounting for two weeks per year of service down time. The calculations are also based on a solar PV system which utilizes the New Jersey guidelines for net metering. Net metering allows excess energy generated at production peaks to flow onto the grid. The excess energy is metered and subtracted from the facility's total energy usage on an annual basis. Due to this allowance the system design excludes the use of inefficient battery storage.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with

95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

PAYMENT TYPE	SIMPLE PAYBACK	INTERNAL RATE OF RETURN
Self-Finance	11.1 Years	14.1%
Direct Purchase	11.1 Years	8.2%

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for the Storage Building and has determined it is not a viable option. The electrical demand of the Storage Building is not large enough to satisfy the need for a wind turbine.

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 Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

<u>Electricity:</u>

The Electric Usage Profile demonstrates a typical cooling load profile. The summer (April-October) demonstrates a flat consumption profile. The typical load profile for a summer load is increased consumption due to air conditioner consumption. The opposite is true here. The winter-period (October – February) has an increased electric consumption. While the heating system is natural gas fired, the Domestic hot-water is supplied by a Bradford White electric hot-water heater. This 19 gallon, 4500 upper and 3500 lower, capacity hot water heater, is probably the reason for increased winter-time electric consumption. A flatter load profile will allow for more competitive energy prices when shopping with alternative suppliers.

<u>Natural Gas:</u>

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months (April-October) demonstrate little to no consumption (complimenting the cooling electric load). There is an increase in winter consumption (November – March). The increased winter consumption is due to the presence of natural gas fired unit heater (25,000 Btu/Hr capacity, and (3) infra-red radiant heaters. A base-load shaping (flat) will secure more competitive energy prices when procuring energy through an alternative energy source.

Tariff Analysis:

<u>Electricity:</u>
This facility receives electrical service through Orange and Rockland (O&R) on a C&I General Service Secondary (GSS) tariff rate structure, Service Classification No. 2. This service is for Sales and delivery of electric power supply, provided by the Company or delivery of electric power supply provided by an electric generation supplier (TPS) under the Company's (O&R) Retail Access Program to general secondary or primary customers. Customers under this rate schedule will use less than 1000 kW during any month or be switched to Service Classification No. 7. The character of service is for continuous electrical service is for 60 cycle A.C. single or three phase secondary voltage. The Delivery Charges are as follows: Customer Charge, Distribution Charges, Demand Charges, and Usage Charges. Supply Charges: If customer is taking Basic Generation Charges from the utility (not a Third Party Supplier), they will pay: Transmission Charges, Demand Charges, Usage Charges, and Transmission Surcharges.

Monthly Charges are as follows: Societal Benefits Charges, Regional Greenhouse Gas Initiative Surcharge, Securitization Charges, Basic Generation and Minimum Monthly Charges.

Natural Gas:

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

The service described above has a much higher priority of delivery, based on the pipeline capacity. When the pipelines capacity was unbundled (much like the telecom service), it was divided into various levels of service. The "firm" service is the highest priority, and does not get interrupted (but can be interrupted).

This rate schedule has a Delivery Charge Mechanism which includes: Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Supply Charge (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). Note: Should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service. Should the TPS under-deliver to the utility on behalf of the client, the utility will automatically supply this default service to the client.

Imbalances occur when Third Party Suppliers are used to supply natural gas, full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used. Otherwise, imbalances can occur, jeopardizing economics and scheduling.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the Township. The primary area for potential improvement is seen in the electric costs. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical average price is $.1529/kWh (this is the average "price to compare" if the client intends to shop for energy). The average price per decatherm for natural gas is $ 9.7155 / dth (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. The Township could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy increases. Based on annual historical consumption (June 2008 through May 2009) and current electric rates, the Township could see an improvement in its electric costs of up to 30% annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average 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 the natural gas costs. Based on the current market, Old Tappan could improve its natural gas costs by up to 15%. CEG recommends that Old Tappan receive further advisement on these prices through an energy advisor. The Township should also consider procuring energy (natural gas) through an alternative supply source.

CEG also recommends that the municipality schedule a meeting with the 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 municipality can learn more about the competitive supply process. The municipality can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The Township should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor".

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 par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

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

XI. ADDITIONAL RECOMMENDATIONS

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

A. Maintain all weather stripping on windows and doors.

B. Clean all light fixtures to maximize light output.

DETAILED COST BREAKDOWN PER ECM

CONCORD ENGINEERING GROUP

Old Tappan Sorage Building - DPW 25

ECM 1 LIGHTING UPGRADE					
	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Retrofit	LS	$4,352	$0	$0	$4,352
Total Cost			$0	$0	$4,352
Utility Incentive - NJ Smart Start					($525)
Total Cost Less Incentive					$3,827
ECM 2 LED Exit Signs					
	Qty	Unit Cost $	Material $	Labor $	Total $
New LED Exit Signs	3	$80	$50	$30	$240
Total Cost			$50	$30	$240
Utility Incentive - NJ Smart Start ($20 per Exit Sign)					($60)
Total Cost Less Incentive					$180
ECM 3 Lighting Controls					
	Qty	Unit Cost $	Material $	Labor $	Total $
Dual - Technology Sensor	7	$75	$0	$0	$525
Total Cost			$0	$0	$525
Utility Incentive - NJ Smart Start ($20 per Sensor)					($140)
Total Cost Less Incentive					$385
ECM 4 Domestic Hot Water Heater Repplacement					
	Qty	Unit Cost $	Material $	Labor $	Total $
New Water Heater	1	$3,000	$1,000	$2,000	$3,000
Total Cost			$1,000	$2,000	$3,000
Utility Incentive - NJ Smart Start					($50)
Total Cost Less Incentive					$2,950
ECM 5 Bus Bay Heater Replacement					
	Qty	Unit Cost $	Material $	Labor $	Total $
New Infrared Heaters	LS	$4,500	$0	$0	$4,500
Total Cost			$0	$0	$4,500
Utility Incentive - NJ Smart Start					$0
Total Cost Less Incentive					$4,500

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

Electric Unitary HVAC

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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

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

Variable Frequency Drives

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

Natural Gas Water Heating

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

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

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

Lighting Controls – Occupancy Sensors

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

Lighting Controls – HID or Fluorescent Hi-Bay Controls

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
DPW 25 Storage Building

Building ID: 1842376
For 12-month Period Ending: May 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: September 09, 2009

Facility
DPW 25 Storage Building
25 Russell Avenue
Old Tappan, NJ 07675

Facility Owner
Borough of Old Tappan
227 Old Tappan Road
Old Tappan, NJ 07675

Primary Contact for this Facility
Patrick O'Brien
227 Old Tappan Road
Old Tappan, NJ 07675

Year Built: 2001
Gross Floor Area (ft²): 6,305

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	28,187
Natural Gas (kBtu)[4]	197,315
Total Energy (kBtu)	225,502

Energy Intensity[5]

Site (kBtu/ft²/yr)	36
Source (kBtu/ft²/yr)	48

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	13

Electric Distribution Utility
Rockland Electric Co

National Average Comparison

National Average Site EUI	25
National Average Source EUI	56
% Difference from National Average Source EUI	-15%
Building Type	Storage/Shipping/Non-Refrigerated Warehouse

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 Standards[6] **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 South Burnt Mill Road
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	☑
Building Name	DPW 25 Storage Building	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Storage/Shipping/Non-Refrigerated Warehouse	Is this an accurate description of the space in question?		☐
Location	25 Russell Avenue, Old Tappan, NJ 07675	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
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		☐
StorageBuilding (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	6,305 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	N/A(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	40 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	N/A(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Rockland Electric Co

Fuel Type: Electricity		
Meter: 29310-17008 (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
05/01/2009	05/31/2009	680.00
04/01/2009	04/30/2009	616.00
03/01/2009	03/31/2009	737.00
02/01/2009	02/28/2009	597.00
01/01/2009	01/31/2009	808.00
12/01/2008	12/31/2008	994.00
11/01/2008	11/30/2008	755.00
10/01/2008	10/31/2008	639.00
09/01/2008	09/30/2008	550.00
08/01/2008	08/31/2008	476.00
07/01/2008	07/31/2008	844.00
06/01/2008	06/30/2008	565.00
29310-17008 Consumption (kWh (thousand Watt-hours))		**8,261.00**
29310-17008 Consumption (kBtu (thousand Btu))		**28,186.53**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**28,186.53**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas		
Meter: 41 214 214 18 (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
05/01/2009	05/31/2009	93.90
04/01/2009	04/30/2009	279.12
03/01/2009	03/31/2009	354.03
02/01/2009	02/28/2009	657.96
01/01/2009	01/31/2009	508.62
12/01/2008	12/31/2008	77.43
11/01/2008	11/30/2008	2.09
10/01/2008	10/31/2008	0.00
09/01/2008	09/30/2008	0.00
08/01/2008	08/31/2008	0.00

07/01/2008	07/31/2008	0.00
06/01/2008	06/30/2008	0.00
41 214 214 18 Consumption (therms)		**1,973.15**
41 214 214 18 Consumption (kBtu (thousand Btu))		**197,315.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**197,315.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the 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
DPW 25 Storage Building
25 Russell Avenue
Old Tappan, NJ 07675

Facility Owner
Borough of Old Tappan
227 Old Tappan Road
Old Tappan, NJ 07675

Primary Contact for this Facility
Patrick O'Brien
227 Old Tappan Road
Old Tappan, NJ 07675

General Information

DPW 25 Storage Building	
Gross Floor Area Excluding Parking: (ft^2)	6,305
Year Built	2001
For 12-month Evaluation Period Ending Date:	May 31, 2009

Facility Space Use Summary

StorageBuilding	
Space Type	Other - Storage/Shipping/Non-Refrigerated Warehouse
Gross Floor Area(ft^2)	6,305
Number of PCs[o]	N/A
Weekly operating hours[o]	40
Workers on Main Shift[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 05/31/2009)	**Baseline** (Ending Date 05/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft²)	36	36	0	N/A	25
Source (kBtu/ft²)	48	48	0	N/A	56
Energy Cost					
$/year	$ 3,918.10	$ 3,918.10	N/A	N/A	$ 2,738.40
$/ft²/year	$ 0.62	$ 0.62	N/A	N/A	$ 0.43
Greenhouse Gas Emissions					
$MtCO_2e$/year	13	13	0	N/A	9
$kgCO_2e/ft^2$/year	2	2	0	N/A	1

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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Department of Public Works Storage Building: DPW 25

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (Watts)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service	Remaining Life	Notes
Storage Area	Toilet Room	Bradford White	1	M120LD06S	-	4500	21	20	100	Electricity	8 yrs.	15	7	

Unit Heaters and Cabinet Unit Heaters

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Type	Heating Capacity	Heating Output	Combustion Efficiency	Approx. Age	ASHRAE Service	Remaining Life	Notes
Bus Bay Ceiling	Bus Bay	Reznor	1	Unknown	Unknown	Natural Gas	25,000 Btu/Hr.	20,000 Btu/Hr.	80%	8 yrs.	13 yrs.	5 yrs.	

Infrared Heaters

Location	Area Served	Manufacturer	Qty.	Model #	Fuel	Input	Length	Volts	Phase	Amps	Approx. Age	ASHRAE Service	Remaining Life	Notes
Storage and Maintenance Bays	Storage and Maint. Bays	Roberts-Gordon	3	GordonRay BH	Natural Gas	100,000 Btu/Hr.	Unknown	120	1	1	8	15	7	Heat Exchanger Tubing- 4" dia., 10 Ft. Sections

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09017
Project: Old Tappan
Address: 25 Russell Ave
City: Old Tappan
Building SF: 6,240

"DPW 25- Storage Building"

DATE: 9/25/2009
KWH COST: **$0.170**

EXISTING LIGHTING										**PROPOSED LIGHTING**								**SAVINGS**			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Bus Bay	2	1'X8' 2-Lamp T-12 Industrial Fixture 90W	1000	210	0.42	420	$71.40	2	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	0.24	236	$40.12	$207.00	$414.00	0.18	184	$31.28	13.24
3		Main Garage	19	1'X8' 2-Lamp T-12 Industrial Fixture 90W	1000	210	3.99	3990	$678.30	19	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDIM-232-UNV-EB81-U	118	2.24	2242	$381.14	$207.00	$3,933.00	1.75	1748	$297.16	13.24
3		Bathroom	1	65W Incandescent	200	65	0.07	13	$2.21	1	Eiko-15w mini sprial	15	0.02	3	$0.51	$4.92	$4.92	0.05	10	$1.70	2.89
		Totals	22				4.48	4423	$751.91	22			2.49	2481	$421.77		$4,351.92	1.98	1942	$330.14	13.18

Project Name: LGEA Solar PV Project - Old Tappan, NJ
Location: DPW 25 Storage Building
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$43,470
Annual kWh Production	7,537
Annual Energy Cost Reduction	$1,281
Annual SREC Revenue	$2,638
First Cost Premium	**$43,470**
Simple Payback:	**11.09** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	240	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.170**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/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	$2,174	0	0	0	$0	0	0	(2,174)	0
1	$0	7,537	$1,281	$0	$2,638	$2,860	$982	$77	($2,096)
2	$0	7,500	$1,320	$0	$2,625	$2,789	$1,053	$103	($1,993)
3	$0	7,462	$1,359	$0	$2,612	$2,712	$1,130	$129	($1,864)
4	$0	7,425	$1,400	$0	$2,599	$2,631	$1,211	$157	($1,707)
5	$0	7,388	$1,442	$76	$2,586	$2,543	$1,299	$110	($1,598)
6	$0	7,351	$1,485	$76	$2,573	$2,449	$1,393	$140	($1,457)
7	$0	7,314	$1,530	$75	$2,560	$2,349	$1,493	$173	($1,285)
8	$0	7,278	$1,576	$75	$2,547	$2,241	$1,601	$206	($1,079)
9	$0	7,241	$1,623	$75	$2,534	$2,125	$1,717	$241	($838)
10	$0	7,205	$1,672	$74	$2,522	$2,001	$1,841	$277	($560)
11	$0	7,169	$1,722	$74	$2,509	$1,868	$1,974	$315	($245)
12	$0	7,133	$1,774	$73	$2,497	$1,725	$2,117	$355	$110
13	$0	7,097	$1,827	$73	$2,484	$1,572	$2,270	$396	$506
14	$0	7,062	$1,882	$73	$2,472	$1,408	$2,434	$439	$944
15	$0	7,027	$1,938	$72	$2,459	$1,232	$2,610	$483	$1,427
16	$0	6,991	$1,996	$72	$2,447	$1,043	$2,799	$529	$1,957
17	$0	6,957	$2,056	$72	$2,435	$841	$3,001	$577	$2,534
18	$0	6,922	$2,118	$71	$2,423	$624	$3,218	$627	$3,161
19	$0	6,887	$2,181	$71	$2,411	$391	$3,451	$679	$3,840
20	$0	6,853	$2,247	$71	$2,398	$142	$3,700	$733	$4,573
21	$0	6,818	$2,314	$70	$2,386	$120	$3,402	$1,109	$5,681
22	$0	6,784	$2,384	$70	$2,375	$82	$2,799	$1,807	$7,488
23	$0	6,750	$2,455	$70	$2,363	$0	$0	$4,748	$12,236
24	$0	6,717	$2,529	$69	$2,351	$0	$0	$4,811	$17,047
25	$0	6,683	$2,605	$69	$2,339	$0	$0	$4,875	$21,922
	Totals:	143,799	$34,431	$1,173	$50,329	$35,545	$41,296	$47,497	$68,704
				Net Present Value (NPV)			**$3,648**		
				Internal Rate of Return (IRR)			**14.1%**		

Project Name: LGEA Solar PV Project - Old Tappan, NJ
Location: DPW 25 Storage Building
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

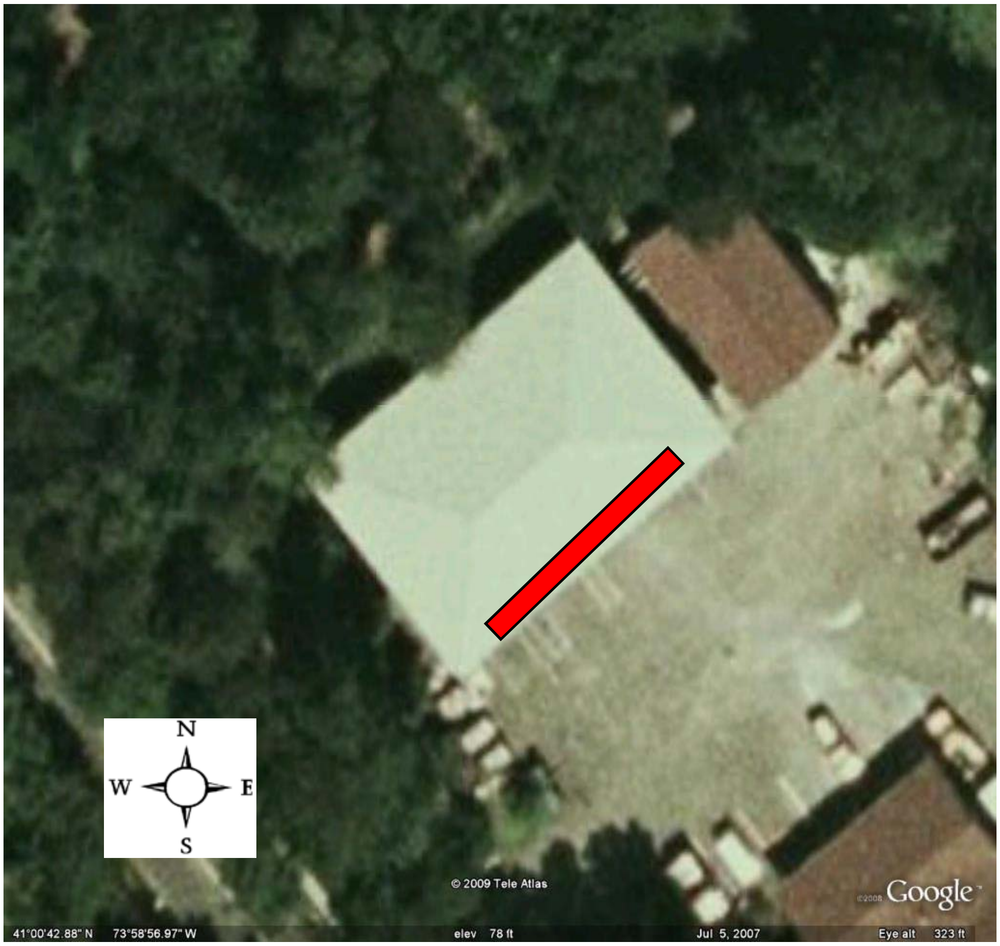
	Photovoltaic System - Direct Purchase
Total Construction Cost	$43,470
Annual kWh Production	7,537
Annual Energy Cost Reduction	$1,281
Annual SREC Revenue	$2,638
First Cost Premium	**$43,470**
Simple Payback:	**11.09** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.170**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$43,470	0	0	0	$0	(43,470)	0
1	$0	7,537	$1,281	$0	$2,638	$3,919	($39,551)
2	$0	7,500	$1,320	$0	$2,625	$3,945	($35,606)
3	$0	7,462	$1,359	$0	$2,612	$3,971	($31,635)
4	$0	7,425	$1,400	$0	$2,599	$3,999	($27,636)
5	$0	7,388	$1,442	$76	$2,586	$3,952	($23,684)
6	$0	7,351	$1,485	$76	$2,573	$3,983	($19,701)
7	$0	7,314	$1,530	$75	$2,560	$4,015	($15,687)
8	$0	7,278	$1,576	$75	$2,547	$4,048	($11,639)
9	$0	7,241	$1,623	$75	$2,534	$4,083	($7,556)
10	$0	7,205	$1,672	$74	$2,522	$4,119	($3,436)
11	$0	7,169	$1,722	$74	$2,509	$4,157	$721
12	$0	7,133	$1,774	$73	$2,497	$4,197	$4,918
13	$0	7,097	$1,827	$73	$2,484	$4,238	$9,156
14	$0	7,062	$1,882	$73	$2,472	$4,281	$13,437
15	$0	7,027	$1,938	$72	$2,459	$4,325	$17,762
16	$0	6,991	$1,996	$72	$2,447	$4,371	$22,133
17	$0	6,957	$2,056	$72	$2,435	$4,419	$26,552
18	$0	6,922	$2,118	$71	$2,423	$4,469	$31,022
19	$0	6,887	$2,181	$71	$2,411	$4,521	$35,543
20	$0	6,853	$2,247	$71	$2,398	$4,575	$40,117
21	$1	6,818	$2,314	$70	$2,386	$4,631	$44,748
22	$2	6,784	$2,384	$70	$2,375	$4,688	$49,436
23	$3	6,750	$2,455	$70	$2,363	$4,748	$54,185
24	$4	6,717	$2,529	$69	$2,351	$4,811	$58,995
25	$5	6,683	$2,605	$69	$2,339	$4,875	$63,870
	Totals:	143,799	$34,431	$1,173	$50,329	$107,340	$83,587
				Net Present Value (NPV)		**$63,895**	
				Internal Rate of Return (IRR)		**8.2%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Storage Building	300	Sunpower SPR230	21	14.7	309	4.83	7,537	693	15.64



.= Proposed PV Layout

Notes:

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