ENERGY AUDIT – FINAL REPORT

BOROUGH OF OLD TAPPAN
BOROUGH HALL

227 OLD TAPPAN ROAD
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
Borough Hall
227 Old Tappan Road
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	$18,309
Natural Gas	$7,753
Total	$26,052

The potential annual energy cost savings are shown below in Table 1. Be aware that the measures are not additive because of the interrelation of several of the measures. The cost of each measure for this level of auditing is ± 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	$12,140	$1,643	7.4	238 %
2	LED Exit Signs	$780	$564	0.96	2,477 %
3	Lighting Controls	$2,035	355	5.7	162 %
4	High Efficiency Boiler Replacement	$44,100	$1,388	31.7	10.2 %
5	High Efficiency Rooftop Unit Replacement	$72,225	$2,097	34.4	-56.0 %
6	Condensing Unit Replacement	$7,225	$807	8.9	55.2 %
7	Domestic Hot Water Heater Replacement	$3,900	$262	14.9	0.763 %

Note A: 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	5.06	7591.1	-
2	LED Exit Signs	-	2848	-
3	Lighting Controls	-	1793	-
4	High Efficiency Boiler Replacement	-	-	1119.6
5	High Efficiency Rooftop Unit Replacement	-	6,833.6	601
6	Condensing Unit Replacement	-	4,079	
7	Domestic Hot Water Heater Replacement	-	-	315

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 Tappans Borough Hall:

- **ECM #1: Lighting Upgrades**
- **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 #6 with a payback of 8.9 years. Also, ECM #5 should be considered This ECM replaces the existing rooftop heating and air conditioning units that serve the east wing and court room. They are past their useful life and replacement will greatly increase occupant comfort as well as reduce repair costs. CEG recommends the owner review the implementation of this ECM and determine the overall benefit to the facility operation.

II. INTRODUCTION

This comprehensive energy audit covers the 8,400 square foot Borough Hall that includes administrative offices, municipal court, tax office, Mayor's office, municipal clerk, construction department, planning and zoning office, violations office, public restrooms, employees lounge, and mechanical room.

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 municipal 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.

Description	Average
Electricity	19.8¢ /kWh
Natural Gas	$1.24 /Therm

Table 3
Electricity Billing Data

Borough Hall	Rockland Electric	Acct. # 69098-47003	Rate: Electric Small C&I General Service Secondary
MONTH OF USE	**CONSUMPTION KWH**	**DEMAND KW**	**TOTAL BILL**
Jun-08	9,760	58.0	$2,023
Jul-08	11,760	57.6	$2,428
Aug-08	9,440	57.6	$2,190
Sep-08	9,360	52.8	$1,948
Oct-08	8,600	40.8	$1,548
Nov-08	8,520	31.2	$1,512
Dec-08	8,160	37.6	$1,467
Jan-09	6,920	22.8	$1,306
Feb-09	5,960	22.8	$991
Mar-09	4,800	32.8	$1,007
Apr-09	5,000	37.6	$973
May-09	5,440	49.6	$1,196
Totals	**93,720**	**58.0 Max**	**$18,590**
		AVERAGE DEMAND	**43.0 KW average**
		AVERAGE RATE	**$0.198 $/kWh**

Figure 1
Electricity Usage Profile

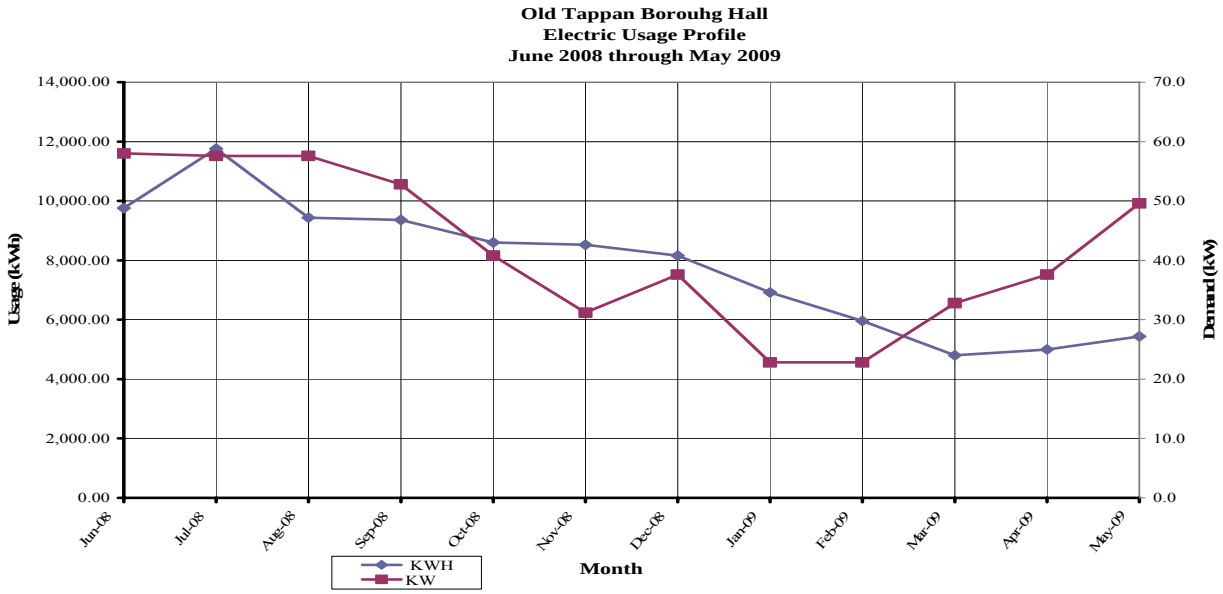
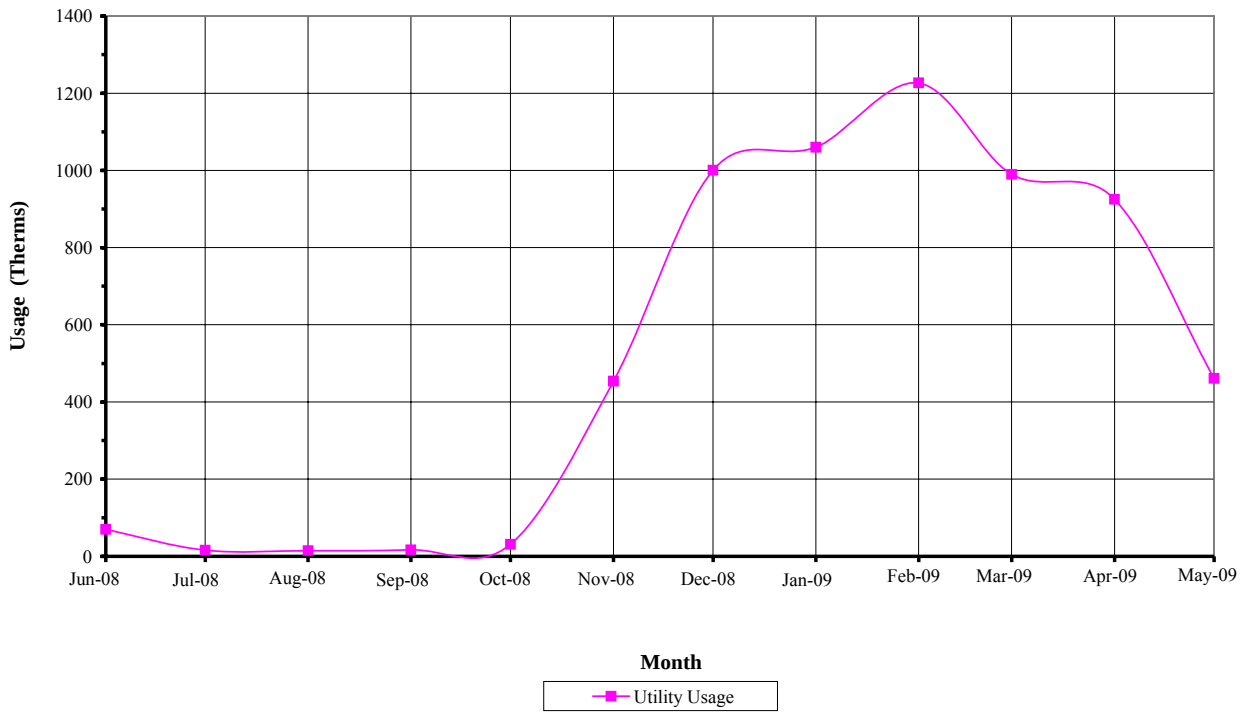


Table 4
Natural Gas Billing Data

Borough Hall	PSE&G Acct. # 41 217 452 13	Tariff Rate: GSGH Supply Chg: BGSS
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jun-08	69.84	$132.70
Jul-08	15.65	$38.88
Aug-08	14.65	$36.85
Sep-08	16.78	$34.80
Oct-08	31.39	$53.74
Nov-08	453.70	$638.78
Dec-08	1,000.37	$1,338.44
Jan-09	1,060.05	$1,448.27
Feb-09	1,227.15	$1,581.89
Mar-09	989.81	$1,114.67
Apr-09	925.18	$907.99
May-09	461.17	$425.81
TOTALS	**6265.73**	**$7,752.82**
AVERAGE RATE:	**$1.24**	**$/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):

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

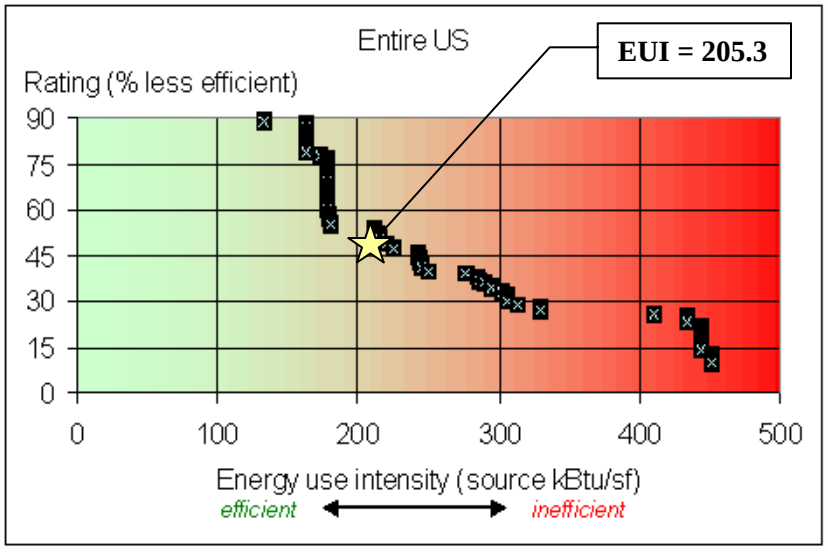
$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

Table 5
Borough Hall EUI Calculations

ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	93,720			319,960	3.340	1,068,667
NATURAL GAS		6,265.73		626,573	1.047	656,022
TOTAL				946,533		1,724,689
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		8,400		SQUARE FEET		
BUILDING SITE EUI		112.68		kBtu/SF/YR		
BUILDING SOURCE EUI		**205.32**		**kBtu/SF/YR**		

Figure 3 below depicts a national EUI grading for the source use of public order and safety buildings.

Figure 3
Source Energy Use Intensity Distributions: Public Order Buildings



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." Borough Hall would be classified as "Office" and therefore can be given an Energy Performance Rating.

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
Borough Hall	17	50

V. FACILITY DESCRIPTION

Old Tappan's Borough Hall is the town's municipal building and is located at 227 Old Tappan Road, Old Tappan, NJ. The building is of masonry construction with exterior walls having 4" face brick on concrete block. Windows are aluminum frame, double-hung, double-pane with clear glass. The floor is a 5" thick poured concrete slab on undisturbed or compacted earth. Poured concrete footings and masonry foundations support the floor and walls. The roof is of wood frame construction with 12" fiberglass batt insulation filling the ceiling joist space. Plywood sheathing and cement fiber shingles cover the wood truss roof framing

Heating System

The building is heated by a combination of forced hot air systems and hot water baseboard radiation. Two gas-fired, packaged rooftop units provide forced hot air to the east wing (AC-1) of the building and the court room (AC-2). A modular air handler located in the mechanical room has a hot water coil with 3-way automatic control valve and utilizes heating hot water to generate forced hot air. This unit (AC-3) serves the west wing of the building.

Hot water baseboard lines the perimeter walls of the entire building and uses heating hot water from the boiler to address the building "skin" heat loss during the heating season. When originally installed in 1988, there were three (3) zones of baseboard radiation, each isolated by an electronic, automatic zone valve. Zones of control were arranged for the east wing, west wing, and court room. In 1993, the zones in the east and west wings were re-piped to create "north" and "south" zones in those wings to provide better control of heat distribution.

An inline circulator pumps boiler water to the various heating elements throughout the building. The pump is activated through electronic controls and its operation is based on outdoor air temperature. Local, programmable thermostats open or close the automatic zone control valves as necessary based on space temperature.

Domestic Hot Water

Domestic hot water for the restrooms is provided by a Bradford White Residential, Direct Vent gas-fired water heater, with a 50 gallon capacity and an input of 42,000 BTUH.

Cooling System

Three (3) independently ducted air systems provide air conditioning for the entire building. Two (2) of the units (AC-1, AC-2) are packaged, rooftop heating and cooling units and the third (AC-3) is a modular air handler with direct expansion (DX) cooling coil and remote, air-cooled condensing unit. AC-1 serves the east wing, AC-2 serves the court room, and AC-3 serves the west wing.

Controls System

There are local 7-day programmable thermostats located throughout the facility that control the various heating and air conditioning systems. The heating and air conditioning set points are manually changed based upon the occupancy of the building. A local, outside air damper minimum position adjustment switch is provided for each air handler.

Boiler operation is based on outdoor air temperature and automatically fires the boilers when outdoor air temperature is below the setpoint. Space thermostats activate zone control valves as necessary when space temperature falls below the thermostat setpoint. End switches in the control valves energize the hot water pump. A boiler control panel resets boiler water temperature setting based on outdoor air temperature as well as activates second and third stage boilers when necessary.

Lighting

The office areas and corridors are lit by 2-foot by 4-foot or 2-foot by 2-foot lay-in fixtures containing T12 lamps and magnetic ballasts. Standard switching is utilized and there are no other types of lighting controls present except the main and side entry lighting is switched through a timeclock. Some incandescent downlighing exists in the Mayor's office and the courtroom.

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 188 Watts. By replacing with new lamps, reflector and electronic ballasts the total wattage would be reduced to 109 Watts per fixture and the space light levels would increase by about 15%.

This ECM investigates 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. 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.

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

$$\text{Smart Start®}\ Incentive = (92 \times\ \$\ 25) + (\ 13 \times\ \$\ 30) = \$2{,}690$$

Maintenance Savings are calculated as follows:

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

$$Savings = (10\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \$70 / yr$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$14,830*
NJ Smart Start Equipment Incentive ($):	*($2,690)*
Net Installation Cost ($):	*$12,140*
Annual Maintenance Savings ($ / yr):	*$70*
Annual Energy Savings ($ / yr):	*$1,573*
Annual Net Savings ($ / yr):	*$1,643*
Simple Payback (yrs):	*7.4*
Simple Lifetime Return On Investment:	*238 %*
Estimated ECM Return Lifetime (yr):	*25*
Simple Lifetime Energy Savings ($):	*39,325*
Simple Lifetime Maintenance Savings ($):	*1,750*

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 simple 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, thirteen (13) 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:

Existing exit sign energy costs:

13 units x 30 watts/unit ÷ 1000 watts/kW x 8,760 hrs/yr x $0.198/kWh = $676

New LED exit sign energy costs:

13 units x 5 watts/unit ÷ 1000watts/kW x 8,760 hrs x $0.198/kWh = $112

Total energy savings = $676 - $112 = $564

Installed cost of new LED exit signs = $80 x 13 = $1040

NJ Smart Start® Program Incentives are calculated as follows:

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

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ exit\ signs \times\ \$\ 20) = (13 \times \$20) = \$260$$

Maintenance Savings are calculated as follows:

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

$$Maintenance\ Savings = (13 \times \$4.50) + (13 \times \$14) = \$240/\text{yr}.$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$1,040*
NJ Smart Start Equipment Incentive ($):	*($260)*
Net Installation Cost ($):	*$780*
Annual Maintenance Savings ($ / yr.):	*$240*
Annual Energy Savings ($ / yr):	*$564*
Annual Net Savings ($ / yr):	*$804*
Simple Payback (yrs):	*.96*
Simple Lifetime Return On Investment:	*2,477%*
Estimated ECM Lifetime (yr):	*25*
Simple Lifetime Energy Savings ($):	*$14,100*
Simple Lifetime Maintenance Savings ($):	*$6,000*

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 a 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. This ECM includes the installation of dual technology occupancy sensors in all areas of the facility except the vault (8,300 SF).

Energy Savings Calculations:

From Appendix E of this report indicates the energy usage of the existing offices, toilet rooms, storage rooms, break room, etc. to be 17,933 kWh/yr. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

Energy Savings = 10% x 17,933 kWh/yr.

Energy Savings = 1,793 kWh/yr.

Cost Savings = 1,793 kWh/yr. x $0.198/kWh = $355 / 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 37. Total cost to install sensors is $55/unit x 37 units = $2,035.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,775
NJ Smart Start Equipment Incentive ($):	($740)
Net Installation Cost ($):	*$2,035*
Annual Maintenance Savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$355*
Annual Net Savings ($ / yr):	*$0*
Simple Payback (yrs):	*5.7*
Simple Return On Investment:	*162 %*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Energy Savings ($):	*$5,325*
Simple Lifetime Maintenance Savings ($):	*$0*

ECM #4: Replace Heating Hot Water Boiler

Description:

The Borough Hall is partially heated by three (3) Slant Fin model V-180-EP natural gas fired hot water boiler which presently is about 70% efficient. The boilers were installed in 1993 as replacement for the Hydrotherm boilers originally installed. The estimated service life for the boilers is 35 years as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. In this energy conservation measure we are suggesting replacing the existing boilers with three (3) new Lochinvar Knight Heating Boiler rated at 150 MBH input and 95.5% efficient (98% part load efficiency).

Existing Heating Hot Water Boiler:

Rated Capacity = 180 MBH Input (Natural Gas)
Radiation Losses = 5%
Thermal Efficiency = 70%

Replacement Boiler:

High Efficiency Lochinvar or Equal (with Sequencing Control & O/A HW Reset)
Rated Capacity = 150 MBH Input (Typical of 3)
Thermal Efficiency = 95.5%
Radiation Losses = 5%

Energy Consumption:

To estimate the amount of energy consumed by the existing gas-fired boilers throughout the heating season, the Degree Day method of energy estimating is be used where

$$EnergyUsed = \frac{H_L \times D \times 24}{\Delta t \times k \times V} \times (C_D)$$

and:

H_L = Building Heat Loss, BTU/Hr.

D = number of 65 F Heating Degree Days (5945 for Old Tappan)

Δt = Design temperature difference, deg. F (70°F)

k = a correction factor that includes the effects of rated full load efficiency, part load performance, oversizing and energy conservation devices.

V = Heating value of fuel, BTU/Therm

C_D = empirical correction factor for heating effect vs. 65 F degree days
Heat Loss = 144,000 BTU/Hr.

$$EnergyUsed = \frac{(144{,}000)\times(5945)\times 24}{70\times .6\times 100{,}000}\times(.6)$$

Energy Used = 2935.1 Therms/Year

Energy Savings Calculations:

$$AnnualEnergySavings = EnergyUsed \times \left(\frac{1}{Efficiency_{OldBoiler}} - \frac{1}{Efficiency_{NewBoiler}} \right)$$

$$AnnualEnergySavings = 2935.1 \times \left(\frac{1}{0.70} - \frac{1}{0.955} \right) = 1119.6 Therms$$

Cost Savings = Annual Energy Savings x $/Therm

Cost Savings = 1119.6 Therms x $1.24/Therm = $1388 / yr.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$45,000*
NJ Smart Start Equipment Incentive ($):	*($900)*
Net Installation Cost ($):	*$44,100*
Annual Maintenance Savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$1,388*
Annual Net Savings ($ / yr):	*$1,388*
Simple Payback (yrs):	*31.7*
Simple Lifetime Return on Investment:	*10.2 %*
Estimated ECM Lifetime (yr):	*35*
Simple Lifetime Energy Savings ($):	*$48,580*
Simple Lifetime Maintenance Savings ($):	*$0*

ECM #5: High-Efficiency Rooftop Unit Replacement

Description:

The two (2) Trane gas-fired heating, DX cooling rooftop units are excellent candidates for replacement. These units appear to be of 1988 vintage. These rooftop units have reached the end of their service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. Due to escalating owning and maintenance costs, these units should be replaced.

This measure would replace these two units with new high efficiency heating and cooling rooftop units, equivalent to Trane Voyager Series Gas/Electric units.

AC-1:

Heating Energy Savings Calculations:

The combustion efficiency of the existing units was approximately 80% when new. At this point due to the age and condition of the existing units, the combustion efficiency of these units is estimated at 70%. This is typical for both AC-1 and AC-2.

To estimate the amount of energy consumed by the existing gas-fired unit throughout the heating season, the Degree Day method of energy estimating is be used.

$$EnergyUsed = \frac{H_L \times D \times 24}{\Delta t \times k \times V} \times (C_D)$$

where:

H_L = Building Heat Loss, BTU/Hr.

D = number of 65 F Heating Degree Days

Δt = Design temperature difference, deg. F

k = a correction factor that includes the effects of rated full load efficiency, part load performance, oversizing and energy conservation devices.

V = Heating value of fuel, BTU/Therm

C_D = empirical correction factor for heating effect vs. 65 F degree days

$$EnergyUsed = \frac{(160{,}000) \times (5945) \times 24}{70 \times .6 \times 100{,}000} \times (.6)$$

Energy Used = 3261 Therms/Year

As the proposed new unit's combustion efficiency is 81%, it is estimated to be 11% more efficient than the existing unit. The proposed energy used is;

Proposed Energy Used = (1 - .11) x 3261 = 2902 Therms/Year

Energy Savings = 3261 – 2902 = 359 Therms/Year

Cost Savings = $1.24/Therm x 359 Therms = $445

Cooling Energy Savings Calculations:

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

Existing Rooftop Unit AC-1

Rated Capacity = 12 Tons per unit
Condenser Section Efficiency = 8.0 EER
Cooling Season Equivalent Full Load Hrs. of Operation = 800 hrs/yr.

Average Cost of Electricity - $0.198/kWh

Proposed High-Efficiency 12-Ton Rooftop Unit

Rated Capacity = 12 Tons per Unit
New Cooling Unit Efficiency = 11.3 SEER

$$EnergySavings = \frac{[12\ Tons \times 12{,}000\ Btu/ton-hr]}{[1000\ W/kW]} \times \left(\frac{1}{8.0} - \frac{1}{11.3} \right) \times 800 = 4205.3\,kWh$$

Energy Cost Savings = 4205.3 kWh * $0.198/kWh = $832/ Yr

Smart Start Equipment Incentive = ($75/Ton) = (12 Tons x $75) = $900.

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AC-2:

Heating Energy Savings Calculations:

As stated above, the combustion efficiency of the existing unit was approximately 80% when new. At this point due to the age and condition, the combustion efficiency of this unit is estimated at 70%.

To estimate the amount of energy consumed by the existing gas-fired unit throughout the heating season, the Degree Day method of energy estimating is be used.

$$EnergyUsed = \frac{H_L \times D \times 24}{\Delta t \times k \times V} \times (C_D)$$

$$EnergyUsed = \frac{(144{,}000) \times (5945) \times 24}{70 \times .8 \times 100{,}000} \times (.6)$$

Energy Used = 2201 Therms/Year

As the proposed new unit's combustion efficiency is 81%, it is estimated to be 11% more efficient than the existing unit. The proposed energy used is;

Proposed Energy Used = (1 - .11) x 2201 = 1959 Therms/Year

Energy Savings = 2201 – 1959 = 242 Therms/Year

Cost Savings = $1.24/Therm x 242 Therms = $300

Cooling Energy Savings Calculations:

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

Existing Rooftop Unit AC-2

Rated Capacity = 15 Tons per unit
Condenser Section Efficiency = 8.0 EER
Cooling Season Equivalent Full Load Hrs. of Operation = 400 hrs/yr.

Average Cost of Electricity - $0.198/kWh

Proposed High-Efficiency 15-Ton Rooftop Unit

Rated Capacity = 15 Tons per Unit
New Cooling Unit Efficiency = 11.5 SEER

$$EnergySavings = \frac{[15\ Tons \times 12{,}000\ Btu/ton]}{[1000\ W/kW]} \times \left(\frac{1}{8.0} - \frac{1}{11.5} \right) \times 400 = 2739.1 kWh$$

Energy Cost Savings = 2739.1 kWh * $0.198/kWh = $542 / Yr

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Installation cost for the two (2) rooftop replacements is estimated at $74,250. It is pertinent to note that this estimate includes the demolition of the existing units and curb modifications (if required).

NJ Smart Start® Program Incentives are calculated as follows:

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

$$\text{Smart Start® } Incentive\ (RTU - 12\ Tons) = (Cooling\ Tons \times\ RTU\ Incentive)$$
$$= (12\ Tons \times \$75/Ton) = \underline{\$900}$$

$$\text{Smart Start® } Incentive\ (RTU - 15\ Tons) = (Cooling\ Tons \times\ RTU\ Incentive)$$
$$= (15 Tons \times \$75/Ton) = \underline{\$1125}$$

Total Smart Start® Incentive = $900 + $1125 = $2025

Energy Savings Summary:

ECM #5 – ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$74,250*
NJ Smart Start Equipment Incentive ($):	*($2,025)*
Net Installation Cost ($):	*$72,225*
Annual Maintenance Savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$2,119*
Annual Net Savings ($ / yr):	*$2,119*
Simple Payback (yrs):	*34.4*
Simple Lifetime Return on Investment:	*-56.0 %*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Energy Savings ($):	*$31,785*
Simple Lifetime Maintenance Savings ($):	*$0*

ECM #6: Air Conditioning Upgrade – West Wing

Description:

Air-conditioning is provided within the west wing of the building by one AC-3. The indoor air handler has a hydronic heating coil which provides heating during the winter months. The heating coil is fed from the main heating boiler loop. The indoor unit's cooling coil is a refrigerant coil coupled with a 7.5 ton outdoor condensing unit which provides cooling. The estimated energy efficiency ratio (EER) of the condensing unit is about 7.0. The NJ State Energy Code (ASHRAE 90.1-2008) mandates a minimum energy efficiency of 10.1 EER for units of this type. There is no remaining service life of the condensing unit according to Chapter 36 of the 2007 ASHRAE Applications Handbook as the unit is beyond its useful life expectancy.

This energy conservation measure would replace the outdoor condensing unit. The existing unit will be replaced with an energy efficient, air-cooled condensing unit with cooling capacity equal to the existing unit. The EER of the new equipment will be 11.6 based on the performance data of a Trane model TTA090A3 condensing unit.

Energy Savings Calculations:

Existing Air Conditioning Units

Rated Capacity = 7.5 Tons
Condenser Unit Efficiency = 7.0 EER
Cooling Season Equivalent Full Load Hrs. of Operation = 800 hrs/yr. per unit
Average Cost of Electricity - $0.198/kWh

Proposed High-Efficiency Air Conditioning Unit

Rated Capacity = 7.5 Tons
New Condenser Unit Efficiency = 11.6 EER

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

$$EnergySavings = \frac{[7.5Tons \times 12{,}000\,Btu/ton-hr]}{[1000W/kW]} \times \left(\frac{1}{7.0} - \frac{1}{11.6} \right) \times 800$$

Energy Savings = 4079 kWh/ Yr.

Total Cost Savings = 4079 kWh x $0.198/kWh = $807 / Yr.

Installation cost for the 7-/12 ton condensing units is estimated at $7,600. It is pertinent to note that this estimate includes the demolition of the existing units

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix B, the condensing unit replacement falls under the category "Split Systems" and warrants an incentive based on efficiency (EER) at a certain cooling tonnage.

$$\text{Smart Start® } Incentive = (Cooling\ Tons \times \ \$/Ton\ Incentive)$$
$$= (7.5 Tons \times \$50/Ton) = \$375$$

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$7,600*
NJ Smart Start Equipment Incentive ($):	*($375)*
Net Installation Cost ($):	*$7,225*
Annual Maintenance Savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$807*
Annual Net Savings ($ / yr):	*$807*
Simple Payback (yrs):	*8.9*
Simple Lifetime Return On Investment:	*55.2 %*
Estimated ECM Lifetime (yr):	*20*
Simple Lifetime Energy Savings ($):	*$16,140*
Simple Lifetime Maintenance Savings ($):	*$0*

ECM #7: Domestic Hot Water Heater Replacement

Description:

This energy conservation measure will replace the existing gas-fired, 50-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:

Existing Gas DHW Heater
Rated Capacity = 42,000 BTU/Hr. Energy Factor (EF) = 0.58
50 gallons storage Efficiency = 80 %

Proposed High-Efficiency Gas-Fired Tankless Water Heater
Rated Capacity = 3.87 gallons per minute Natural Gas-Fired
(Two required)
Energy Factor (EF) = 0.81

Operating Data for Existing Gas DHW Heater:
Average cost of natural gas = $1.24/therm

Operating Hrs/Yr. = 824 Hrs.

Gas Consumption = (824 Hrs x 42,000) ÷ 100,000 BTU/Therm ÷ 80 % = 432 Therms

Operating Cost = $1.24/therm x 432 Therms = $535

Operating Data for new tankless gas-fired DHW heater:

Average cost of natural gas = $1.24/Therm

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

Operating Cost = 220 Therms x $ 1.24 /Therm = $273

Energy Savings = 535 – 220 = 315 Therms

Cost Savings = $535 - $273 = $262

Installed cost of tankless water heaters = $4000

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:

$$\text{Smart Start®}\ \textit{Incentive} = \left(\textit{Quantity} \times\ \$50\ \textit{per DHW Heater}\right) = \left(2 \times \$50\right) = \underline{\$100}$$

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	*$4000*
NJ Smart Start Equipment Incentive ($):	*($100)*
Net Installation Cost ($):	*$3,900*
Annual Maintenance savings ($ / yr):	*$0*
Annual Energy Savings ($ / yr):	*$262*
Annual Net Savings ($ / yr):	*$262*
Simple Payback (yrs):	*14.9*
Simple Lifetime Return On Investment:	*0.763 %*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Energy Savings ($):	*$3,930*
Simple Lifetime Maintenance Savings ($):	*$0*

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 the Borough of 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 1,428 S.F. can be utilized for a PV system on Borough Hall. A depiction of the area utilized is shown in Appendix G. Using this square footage it was determined that a system size of 22.5 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 33,175 KWh annually, reducing the overall utility bill by 35% percent. A detailed financial analysis can be found in Appendix H. 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	10.5 Years	20.9 %
Direct Purchase	105. Years	8.9 %

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 Old Tappan's Borough Hall and has determined it is not a viable option. The electrical demand of neither the building nor the available space 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.

Electricity:
The Electric Usage Profile demonstrates a fairly typical cooling load profile. The summer (July-September) demonstrates increased consumption typical to air conditioning load (as exemplified by several rooftop units for cooling and heating and an air handler). There is a fairly steady drop off in the electric load, from its peak in July, continuing through until May. A flatter load profile will allow for more competitive energy prices when shopping with alternative suppliers.

Natural Gas:
The Natural Gas Usage Profile demonstrates a typical natural gas (heat load) profile. The summer months (July – October) demonstrate very low consumption, complimenting the cooling electric load. There is an increase in winter consumption (November – March). The natural gas fired packaged rooftop units and modular air handlers add to this consumption. Hot water base-boards line the perimeter of the building and are supplied by the boiler. A base-load shaping (flat) will secure more competitive energy prices when procuring energy through an alternative energy source.

Tariff Analysis:

Electricity:
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. Chemically clean condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

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

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

E. Recalibrate existing temperature sensors within the facility.

F. Clean all light fixtures to maximize light output.

G. Confirm that outside air economizers are functioning properly to take advantage of free cooling.

DETAILED COST BREAKDOWN PER ECM

CONCORD ENGINEERING GROUP

Old Tappan Borough Hall

ECM 1 LIGHTING UPGRADE

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Retrofit	LS	$14,830	$0	$0	$14,830
Total Cost			$0	$0	$14,830
Utility Incentive - NJ Smart Start					($2,690)
Total Cost Less Incentive					$12,140

ECM 2 LED Exit Signs

	Qty	Unit Cost $	Material $	Labor $	Total $
New LED Exit Signs	13	$80	$50	$30	$1,040
Total Cost			$50	$30	$1,040
Utility Incentive - NJ Smart Start ($20 per Exit Sign)					($260)
Total Cost Less Incentive					$780

ECM 3 Lighting Controls

	Qty	Unit Cost $	Material $	Labor $	Total $
Dual - Technology Sensor	37	$75	$1,295	$1,480	$2,775
Total Cost			$1,295	$1,480	$2,775
Utility Incentive - NJ Smart Start ($20 per Sensor)					($740)
Total Cost Less Incentive					$2,035

ECM 4 Replace Heating Hot Water Boiler

	Qty	Unit Cost $	Material $	Labor $	Total $
New Boilers	LS	$45,000	$0	$0	$45,000
Total Cost			$0	$0	$45,000
Utility Incentive - NJ Smart Start					($900)
Total Cost Less Incentive					$44,100

ECM 5 High Efficiency Rooftop Unit Replacement

	Qty	Unit Cost $	Material $	Labor $	Total $
New Rooftop Units	LS	$74,250	$0	$0	$74,250
Total Cost			$0	$0	$74,250
Utility Incentive - NJ Smart Start					($2,025)
Total Cost Less Incentive					$72,225

ECM 6 Air Conditioning Upgrade- West Wing

	Qty	Unit Cost $	Material $	Labor $	Total $
New Condensing Unit	LS	$7,600	$0	$0	$7,600
Total Cost			$0	$0	$7,600
Utility Incentive - NJ Smart Start					($375)
Total Cost Less Incentive					$7,225

ECM 7 Domestic Hot Water Heater Replacement					
	Qty	Unit Cost $	Material $	Labor $	Total $
New HW Heaters	LS	$4,000	$0	$0	$4,000
Total Cost			$0	$0	$4,000
Utility Incentive - NJ Smart Start					($100)
Total Cost Less Incentive					$3,900

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
Borough Hall

Building ID: 1819320
For 12-month Period Ending: April 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: September 09, 2009

Facility	**Facility Owner**	**Primary Contact for this Facility**
Borough Hall 227 Old Tappan Road Old Tappan, NJ 07675	Borough of Old Tappan 227 Old Tappan Road Old Tappan, NJ 07675	Patrick O'Brien 227 Old Tappan Road Old Tappan, NJ 07675

Year Built: 1988
Gross Floor Area (ft²): 8,400

Energy Performance Rating[2] (1-100) 17

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	319,363
Natural Gas (kBtu)[4]	634,332
Total Energy (kBtu)	953,695

Energy Intensity[5]

Site (kBtu/ft²/yr)	114
Source (kBtu/ft²/yr)	206

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	65

Electric Distribution Utility
Rockland Electric Co

National Average Comparison

National Average Site EUI	78
National Average Source EUI	141
% Difference from National Average Source EUI	46%
Building Type	Office

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	Borough Hall	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	Is this an accurate description of the space in question?		☐
Location	227 Old Tappan Road, 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		☐
Municipal Court (Courthouse)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	1,700 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.		☐
Weekly operating hours	10 Hours	Is this the total number of hours per week that the Courthouse 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	4 (Default)	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.		☐
Number of PCs	3	Is this the number of personal computers in the Courthouse?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Municipal Offices (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑

Gross Floor Area	6,700 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.		☐
Weekly operating hours	40 Hours	Is this the total number of hours per week that the Office 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	15	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. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	15	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Rockland Electric Co

Fuel Type: Electricity		
Meter: 69098-47003 (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
04/01/2009	04/30/2009	5,000.00
03/01/2009	03/31/2009	4,800.00
02/01/2009	02/28/2009	5,960.00
01/01/2009	01/31/2009	6,920.00
12/01/2008	12/31/2008	8,160.00
11/01/2008	11/30/2008	8,520.00
10/01/2008	10/31/2008	8,600.00
09/01/2008	09/30/2008	9,360.00
08/01/2008	08/31/2008	9,440.00
07/01/2008	07/31/2008	11,760.00
06/01/2008	06/30/2008	9,760.00
05/01/2008	05/31/2008	5,320.00
69098-47003 Consumption (kWh (thousand Watt-hours))		**93,600.00**
69098-47003 Consumption (kBtu (thousand Btu))		**319,363.20**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**319,363.20**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas		
Meter: 41 217 452 13 (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
04/01/2009	04/30/2009	925.18
03/01/2009	03/31/2009	989.81
02/01/2009	02/28/2009	1,227.15
01/01/2009	01/31/2009	1,060.05
12/01/2008	12/31/2008	1,000.37
11/01/2008	11/30/2008	453.70
10/01/2008	10/31/2008	31.39
09/01/2008	09/30/2008	16.78
08/01/2008	08/31/2008	14.65
07/01/2008	07/31/2008	15.65

06/01/2008	06/30/2008	69.84
41 217 452 13 Consumption (therms)		**5,804.57**
41 217 452 13 Consumption (kBtu (thousand Btu))		**580,457.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**580,457.00**
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
Borough Hall
227 Old Tappan Road
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

Borough Hall	
Gross Floor Area Excluding Parking: (ft^2)	8,400
Year Built	1988
For 12-month Evaluation Period Ending Date:	April 30, 2009

Facility Space Use Summary

Municipal Court		Municipal Offices	
Space Type	Courthouse	Space Type	Office
Gross Floor Area(ft^2)	1,700	Gross Floor Area(ft^2)	6,700
Weekly operating hours	10	Weekly operating hours	40
Workers on Main Shift[d]	4	Workers on Main Shift	15
Number of PCs	3	Number of PCs	15
Percent Cooled	50% or more	Percent Cooled	50% or more
Percent Heated	50% or more	Percent Heated	50% or more

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 04/30/2009)	**Baseline** (Ending Date 04/30/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	17	17	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	114	114	58	N/A	78
Source (kBtu/ft^2)	206	206	105	N/A	141
Energy Cost					
$/year	$ 25,635.76	$ 25,635.76	$ 13,014.31	N/A	$ 17,595.52
$/$ft^2$/year	$ 3.05	$ 3.05	$ 1.55	N/A	$ 2.09
Greenhouse Gas Emissions					
$MtCO_2e$/year	65	65	33	N/A	45
$kgCO_2e/ft^2$/year	8	8	4	N/A	5

More than 50% of your building is defined as Office. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

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

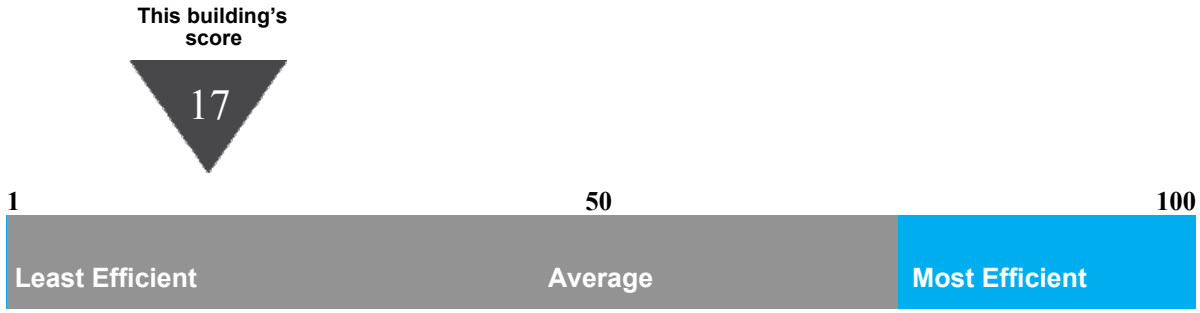
Statement of Energy Performance

2009

Borough Hall
227 Old Tappan Road
Old Tappan, NJ 07675

Portfolio Manager Building ID: 1819320

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 206 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending April 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 09/09/2009

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Borough Hall"

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mechanical Room	Entire Building	Slant Fin	3	V-180-EP	-	180	152	84	Natural Gas	17	35	18	

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	
Mechanical Room	Entire Building	Bell & Gossett	1	Series 60 1-1/2x7	-	2	1750	40	35	-	208	1	21	10	-	

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Mechanical Room	Men, Women	Bradford White	1	DS150S6BN15	-	42	45	50	75	Natural Gas	21	15	-	

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff.	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRA	Remaining
Rooftop	Clerk, Mayor	Trane	1	BYC 170G	-	DX	-	12 Tons	Gas	250	200	80%	Natural Gas	208	3	-	21	15	None
Rooftop	Court	Trane	1	BYC200G	-	DX	-	15 Tons	Gas	225	180	80%	Natural Gas	208	3	-	21	15	None
Mechanical Room	Violations Wing	Trane	1	CCDB06ANBH	-	DX	-	7-1/2 Tons	Hot Water	130	-	-	-	208	3	-	21	20	None

AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling	Eff.	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service	Remaining Life	Notes
Outdoors	Violations Wing	Trane	1	BTA 090	-	7-1/2 Tons	-	R-22	208	3	21	20	None	

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09017
Project: Old Tappan
Address: 227 Old Tappan Rd
City: Old Tappan
Building SF: 8,400

"Borough Hall"

DATE: 9/25/2009
KWH COST: **$0.198**

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		Building Office	6	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	2000	115	0.69	1380	$273.24	6	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.37	732	$144.94	$120.00	$720.00	0.32	648	$128.30	5.61
2			2	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 40W	2000	70	0.14	280	$55.44	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast METALUX 2AC-217-UNV-EB81-U	34	0.07	136	$26.93	$204.00	$408.00	0.07	144	$28.51	14.31
3		Borough Clerk	4	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	2000	115	0.46	920	$182.16	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	488	$96.62	$120.00	$480.00	0.22	432	$85.54	5.61
4		Conference Room	6	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	500	115	0.69	345	$68.31	6	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.37	183	$36.23	$120.00	$720.00	0.32	162	$32.08	22.45
5		Hallway	7	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	2000	115	0.81	1610	$318.78	7	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.43	854	$169.09	$120.00	$840.00	0.38	756	$149.69	5.61
7		Employees Break Room	1	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 40W	2000	70	0.07	140	$27.72	1	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast METALUX 2AC-217-UNV-EB81-U	34	0.03	68	$13.46	$204.00	$204.00	0.04	72	$14.26	14.31
8			2	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	2000	115	0.23	460	$91.08	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.12	244	$48.31	$120.00	$240.00	0.11	216	$42.77	5.61
9		Copy Room	2	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	2500	115	0.23	575	$113.85	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.12	305	$60.39	$120.00	$240.00	0.11	270	$53.46	4.49
10		CFO	4	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	1250	115	0.46	575	$113.85	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	305	$60.39	$120.00	$480.00	0.22	270	$53.46	8.98
11		Vestibule	1	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 40W	2000	70	0.07	140	$27.72	1	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast METALUX 2AC-217-UNV-EB81-U	34	0.03	68	$13.46	$204.00	$204.00	0.04	72	$14.26	14.31

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
12		Mens Bathroom	1	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 40W	2000	70	0.07	140	$27.72	1	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast METALUX 2AC-217-UNV-EB81-U	34	0.03	68	$13.46	$204.00	$204.00	0.04	72	$14.26	14.31
13			2	2'X4' 4-Lamp T-12 Recessed Parabolic Lens 34W	2000	146	0.29	584	$115.63	2	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	364	$72.07	$140.00	$280.00	0.11	220	$43.56	6.43
14			2	4' 1-Lamp T-12 wall Mtd. Vanity	2000	57	0.11	228	$45.14	2	4' 1-Lamp T-8 32W wall Mtd.Metalux	28	0.06	112	$22.18	$166.00	$332.00	0.06	116	$22.97	14.45
14		Womens Bathroom	1	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 40W	2000	70	0.07	140	$27.72	1	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast METALUX 2AC-217-UNV-EB81-U	34	0.03	68	$13.46	$204.00	$204.00	0.04	72	$14.26	14.31
15			2	2'X4' 4-Lamp T-12 Recessed Parabolic Lens 34W	2000	146	0.29	584	$115.63	2	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	364	$72.07	$140.00	$280.00	0.11	220	$43.56	6.43
14			2	4' 1-Lamp T-12 wall Mtd. Vanity	2000	57	0.11	228	$45.14	2	4' 1-Lamp T-8 32W wall Mtd.Metalux	28	0.06	112	$22.18	$166.00	$332.00	0.06	116	$22.97	14.45
16		Mayors Office	6	2'X4' 2-Lamp T-12 Recessed Parabolic Lens 40W	3	82	0.49	1.476	$0.29	6	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.37	1.098	$0.22	$120.00	$720.00	0.13	0.378	$0.07	9620.01
17			4	75W Incandescent	3	75	0.30	0.9	$0.18	4	18 W CFL Lamp	18	0.07	0.216	$0.04	$5.75	$23.00	0.23	0.684	$0.14	169.83
18		Public Information	2	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	2000	115	0.23	460	$91.08	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.12	244	$48.31	$120.00	$240.00	0.11	216	$42.77	5.61
19		Hallway	7	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	2000	115	0.81	1610	$318.78	7	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.64	1274	$252.25	$140.00	$980.00	0.17	336	$66.53	14.73
21		Filing	2	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	3	115	0.23	0.69	$0.14	2	2'x4' 3-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	91	0.18	0.546	$0.11	$140.00	$280.00	0.05	0.144	$0.03	9820.43
22		Storage	1	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	3	115	0.12	0.345	$0.07	1	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.06	0.183	$0.04	$120.00	$120.00	0.05	0.162	$0.03	3741.11
23		Storage	1	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	3	115	0.12	0.345	$0.07	1	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.06	0.183	$0.04	$120.00	$120.00	0.05	0.162	$0.03	3741.11
24		Judge's Chambers	4	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	48	115	0.46	22.08	$4.37	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	11.712	$2.32	$120.00	$480.00	0.22	10.368	$2.05	233.82
25		Fire Marshall	2	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 40W	1000	132	0.26	264	$52.27	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.12	122	$24.16	$120.00	$240.00	0.14	142	$28.12	8.54
26		Hallway	6	75W Incandescent	2000	75	0.45	900	$178.20	6	18 W CFL Lamp	18	0.11	216	$42.77	$5.75	$34.50	0.34	684	$135.43	0.25
28		Courtroom	5	Incandescent	500	75	0.38	187.5	$37.13	5	18 W CFL Lamp	18	0.09	45	$8.91	$5.75	$28.75	0.29	142.5	$28.22	1.02
29			24	Incandescent	500	75	1.80	900	$178.20	24	18 W CFL Lamp	18	0.43	216	$42.77	$5.75	$138.00	1.37	684	$135.43	1.02

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
30		General Office	6	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 40W	2000	132	0.79	1584	$313.63	6	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.37	732	$144.94	$120.00	$720.00	0.43	852	$168.70	4.27
31		Consruction Office	2	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 34W	1250	60	0.12	150	$29.70	2	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast METALUX 2AC-217-UNV-EB81-U	34	0.07	85	$16.83	$204.00	$408.00	0.05	65	$12.87	31.70
32			4	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 40W	1250	132	0.53	660	$130.68	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	305	$60.39	$120.00	$480.00	0.28	355	$70.29	6.83
33		Vestibule	1	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 34W	2000	60	0.06	120	$23.76	1	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast METALUX 2AC-217-UNV-EB81-U	34	0.03	68	$13.46	$204.00	$204.00	0.03	52	$10.30	19.81
34		Lobby	8	4' 1 Lamp T-12 HO, No lens, Magnetic Ballast 40W	2000	50	0.40	800	$158.40	8	4' 1-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux	22	0.18	352		$160.00	$1,280.00	0.22	448	$158.40	8.08
35		Mech Room	4	2'X4' 2-Lamp T-12 Industrial 34W	1000	73	0.29	292	$57.82	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	244	$48.31	$120.00	$480.00	0.05	48	$9.50	50.51
36		Tax Assessor	2	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	1250	115	0.23	287.5	$56.93	2	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.12	152.5	$30.20	$120.00	$240.00	0.11	135	$26.73	8.98
37		Planning & Zoning	4	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	1500	115	0.46	690	$136.62	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	366	$72.47	$120.00	$480.00	0.22	324	$64.15	7.48
38		Court Clerk	4	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	400	115	0.46	184	$36.43	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	97.6	$19.32	$120.00	$480.00	0.22	86.4	$17.11	28.06
39			1	75W Incandescent	400	75	0.08	30	$5.94	1	18 W CFL Lamp	18	0.02	7.2	$1.43	$5.75	$5.75	0.06	22.8	$4.51	1.27
40		Social Services	4	2'X4' 3-Lamp T-12 Recessed Parabolic Lens 34W	1000	115	0.46	460	$91.08	4	2'X4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N 2GC8	61	0.24	244	$48.31	$120.00	$480.00	0.22	216	$42.77	11.22
		Totals	149				14.31	17933.8	$3,550.90	149			7.07	9255.24	$1,762.84		$14,830.00	7.24	8678.6	$1,788.06	8.29

Project Name: PV Project - Old Tappan Borough Hall
Location: Old Tappan, NJ
Description: ic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$202,860
Annual kWh Production	35,175
Annual Energy Cost Reduction	$6,965
Annual SREC Revenue	$12,311
First Cost Premium	**$202,860**
Simple Payback:	**10.52** Years

Life Cycle Cost Analysis

Analysis Period (years): 25
Financing Term (mths): 240
Average Energy Cost ($/kWh) **$0.198**
Financing Rate: 7.00%
Financing %: 95%
Maintenance Escalation Rate: 3.0%
Energy Cost Escalation Rate: 3.0%
SREC Value ($/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	$10,143	0	0	0	$0	0	0	(10,143)	0
1	$0	35,175	$6,965	$0	$12,311	$13,345	$4,585	$1,346	($8,797)
2	$0	34,999	$7,174	$0	$12,250	$13,014	$4,916	$1,494	($7,303)
3	$0	34,824	$7,389	$0	$12,188	$12,658	$5,271	$1,647	($5,656)
4	$0	34,650	$7,610	$0	$12,127	$12,277	$5,653	$1,808	($3,848)
5	$0	34,476	$7,839	$355	$12,067	$11,868	$6,061	$1,621	($2,227)
6	$0	34,304	$8,074	$353	$12,006	$11,430	$6,499	$1,797	($429)
7	$0	34,133	$8,316	$352	$11,946	$10,960	$6,969	$1,981	$1,552
8	$0	33,962	$8,566	$350	$11,887	$10,457	$7,473	$2,173	$3,725
9	$0	33,792	$8,823	$348	$11,827	$9,916	$8,013	$2,372	$6,097
10	$0	33,623	$9,087	$346	$11,768	$9,337	$8,592	$2,579	$8,676
11	$0	33,455	$9,360	$345	$11,709	$8,716	$9,214	$2,795	$11,471
12	$0	33,288	$9,641	$343	$11,651	$8,050	$9,880	$3,019	$14,490
13	$0	33,121	$9,930	$341	$11,592	$7,336	$10,594	$3,252	$17,742
14	$0	32,956	$10,228	$339	$11,534	$6,570	$11,360	$3,493	$21,235
15	$0	32,791	$10,535	$338	$11,477	$5,749	$12,181	$3,744	$24,979
16	$0	32,627	$10,851	$336	$11,419	$4,868	$13,061	$4,004	$28,983
17	$0	32,464	$11,176	$334	$11,362	$3,924	$14,006	$4,274	$33,258
18	$0	32,302	$11,511	$333	$11,306	$2,912	$15,018	$4,555	$37,812
19	$0	32,140	$11,857	$331	$11,249	$1,826	$16,104	$4,845	$42,657
20	$0	31,979	$12,212	$329	$11,193	$662	$17,268	$5,146	$47,804
21	$0	31,819	$12,579	$328	$11,137	$561	$15,874	$6,952	$54,756
22	$0	31,660	$12,956	$326	$11,081	$384	$13,063	$10,264	$65,020
23	$0	31,502	$13,345	$324	$11,026	$0	$0	$24,046	$89,066
24	$0	31,344	$13,745	$323	$10,971	$0	$0	$24,393	$113,459
25	$0	31,188	$14,158	$321	$10,916	$0	$0	$24,752	$138,211
	Totals:	671,060	$187,141	$5,474	$234,871	$165,875	$192,717	$221,655	$732,732

Net Present Value (NPV)	**$30,149**
Internal Rate of Return (IRR)	**20.9%**

Project Name: LGEA Solar PV Project - Old Tappan Borough Hall
Location: Old Tappan, NJ
Description: Photovoltaic System

Simple Payback Analysis

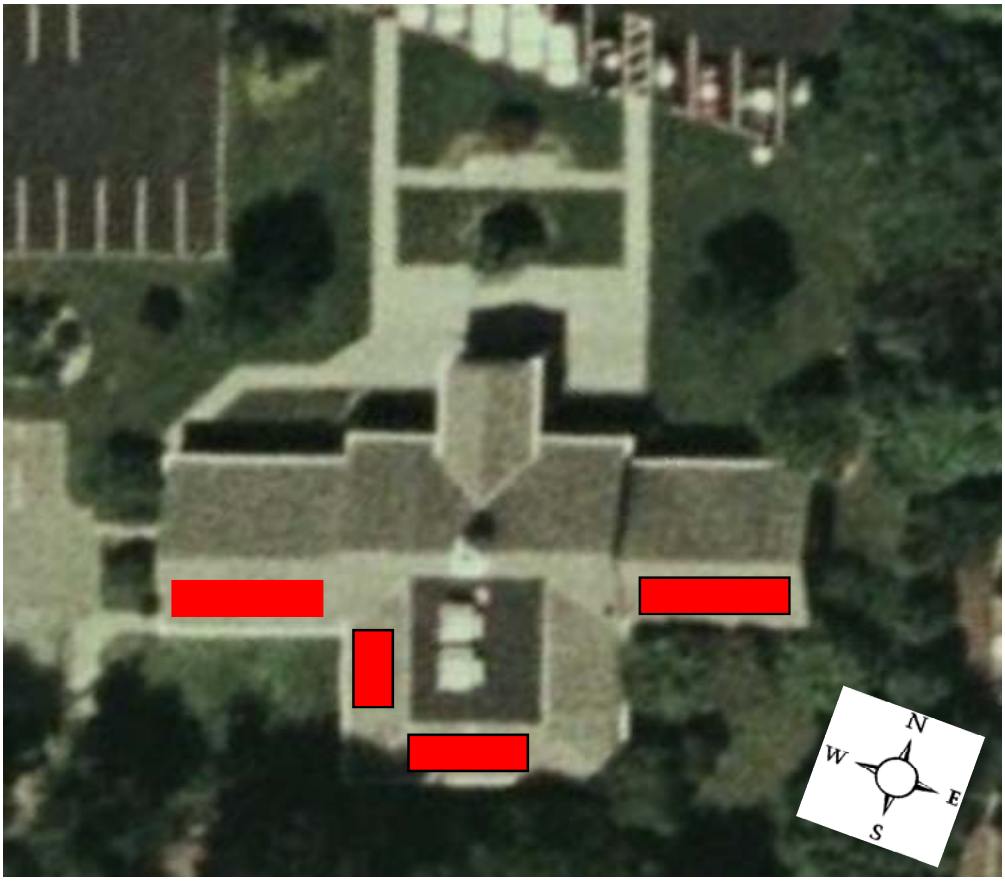
	Photovoltaic System
Total Construction Cost	$202,860
Annual kWh Production	35,175
Annual Energy Cost Reduction	$6,965
Annual SREC Revenue	$12,311
First Cost Premium	**$202,860**
Simple Payback:	**10.52** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.198**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$202,860	0	0	0	$0	(202,860)	0
1	$0	35,175	$6,965	$0	$12,311	$19,276	($183,584)
2	$0	34,999	$7,174	$0	$12,250	$19,423	($164,161)
3	$0	34,824	$7,389	$0	$12,188	$19,577	($144,584)
4	$0	34,650	$7,610	$0	$12,127	$19,738	($124,846)
5	$0	34,476	$7,839	$355	$12,067	$19,550	($105,296)
6	$0	34,304	$8,074	$353	$12,006	$19,727	($85,569)
7	$0	34,133	$8,316	$352	$11,946	$19,911	($65,658)
8	$0	33,962	$8,566	$350	$11,887	$20,102	($45,556)
9	$0	33,792	$8,823	$348	$11,827	$20,302	($25,254)
10	$0	33,623	$9,087	$346	$11,768	$20,509	($4,745)
11	$0	33,455	$9,360	$345	$11,709	$20,724	$15,980
12	$0	33,288	$9,641	$343	$11,651	$20,948	$36,928
13	$0	33,121	$9,930	$341	$11,592	$21,181	$58,109
14	$0	32,956	$10,228	$339	$11,534	$21,423	$79,532
15	$0	32,791	$10,535	$338	$11,477	$21,674	$101,206
16	$0	32,627	$10,851	$336	$11,419	$21,934	$123,140
17	$0	32,464	$11,176	$334	$11,362	$22,204	$145,344
18	$0	32,302	$11,511	$333	$11,306	$22,484	$167,828
19	$0	32,140	$11,857	$331	$11,249	$22,775	$190,603
20	$0	31,979	$12,212	$329	$11,193	$23,076	$213,679
21	$1	31,819	$12,579	$328	$11,137	$23,388	$237,066
22	$2	31,660	$12,956	$326	$11,081	$23,711	$260,778
23	$3	31,502	$13,345	$324	$11,026	$24,046	$284,824
24	$4	31,344	$13,745	$323	$10,971	$24,393	$309,217
25	$5	31,188	$14,158	$321	$10,916	$24,752	$333,969
	Totals:	671,060	$187,141	$5,474	$234,871	$536,829	$416,539
				Net Present Value (NPV)		**$333,994**	
				Internal Rate of Return (IRR)		**8.9%**	

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
Old Tappan Borrow Hall	1428	Sunpower SPR230	98	14.7	1,441	22.54	35,175	3,234	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.