TOWNSHIP OF MARLBORO

GROUNDS BUILDING

1979 TOWNSHIP DRIVE
MARLBORO, NJ 07746

FACILITY ENERGY REPORT

TABLE OF CONTENTS

I. HISTORIC ENERGY CONSUMPTION/COST

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

Electric Utility Provider:	Jersey Central Power & Light
Electric Utility Rate Structure:	General Service Secondary
Third Party Supplier:	Hudson Energy Services

Natural Gas Utility Provider:	New Jersey Natural Gas (NJNG)
Utility Rate Structure:	General Service Large (GSL)
Third Party Supplier:	Woodruff Energy

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. 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 historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Jersey Central Power & Light
Rate: General Service Secondary
Meter No: S308222474
Account No: 100 011 239 744
Third Party Utility Provider: Hudson Energy Services
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Jan-13	4,351	12.8	$573
Feb-13	2,745	12.1	$462
Mar-13	4,723	13.0	$579
Apr-13	2,576	13.0	$340
May-13	2,964	12.6	$389
Jun-13	2,127	13.0	$637
Jul-13	4,077	11.7	$507
Aug-13	3,824	13.0	$454
Sep-13	1,644	13.0	$235
Oct-13	2,296	13.0	$296
Nov-13	2,392	13.0	$306
Dec-13	3,358	13.0	$403
Totals	**37,077**	**13.0 Max**	**$5,179**

AVERAGE DEMAND **12.8 KW average**
AVERAGE RATE **$0.140** **$/kWh**

Figure 1
Electricity Usage Profile

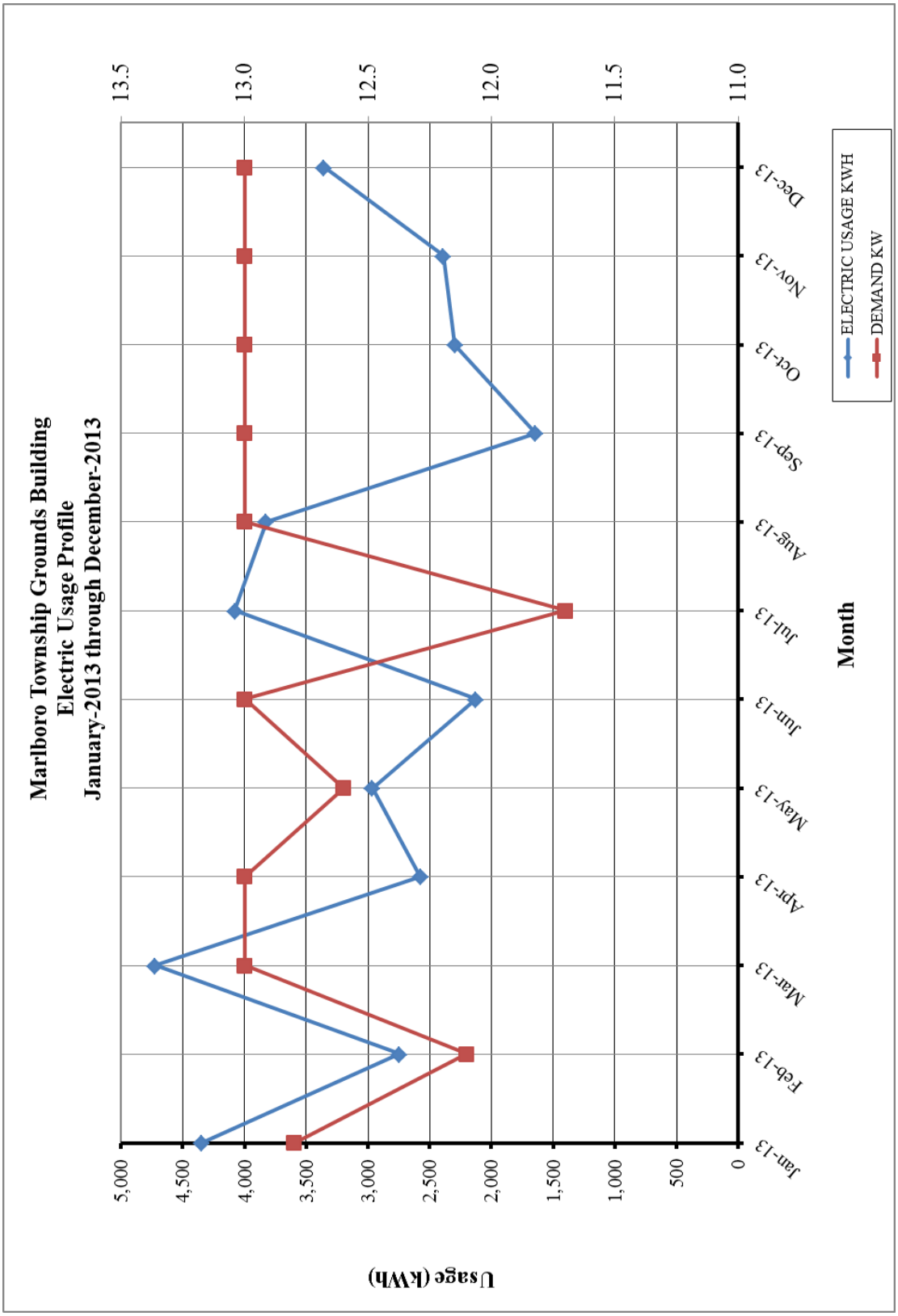
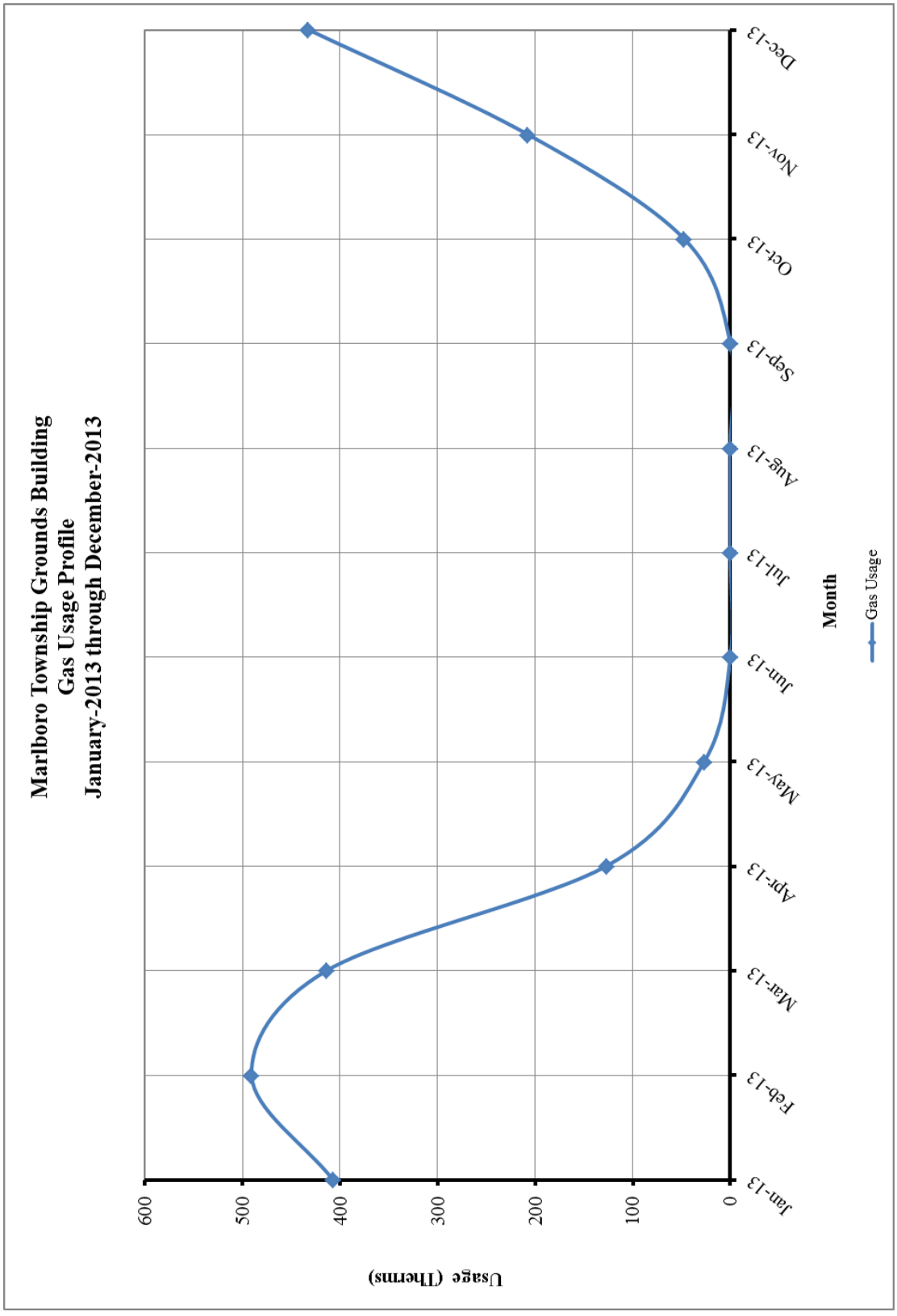


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: New Jersey Natural Gas (NJNG)		
Rate: GSL		
Meter No: 00583063		
Account No: 13-3462-0794-15		
Third Party Utility Provider: Woodruff Energy		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-13	407.44	$451.18
Feb-13	490.79	$538.37
Mar-13	413.72	$457.76
Apr-13	127.00	$157.84
May-13	26.71	$52.94
Jun-13	0.00	$25.00
Jul-13	0.00	$25.00
Aug-13	0.00	$25.00
Sep-13	0.00	$25.00
Oct-13	47.42	$73.26
Nov-13	207.94	$229.66
Dec-13	432.48	$484.25
TOTALS	**2,153.50**	**$2,545.26**
AVERAGE RATE:	**$1.18**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

The Grounds Building is located on 1979 Township Drive in Marlboro Township, New Jersey. The 11,600 SF facility was built in 1940 with no major additions. This facility is comprised mostly of a 2-story structure with office areas on the second floor and numerous bays of storage on the ground floor for lawnmowers, riding mowers, snow removal equipment, tools, supplies, repair shops, etc.

Occupancy Profile

The typical hours of operation for the Grounds Building are Monday through Friday between 7:00 am and 4:00 pm. The building is mainly occupied during the early morning and early afternoon. The building is occupied at peak times with at most 15 people while during the off-peak hours the building may have as little as 5 people.

Building Envelope

The various sections of the facility are comprised of pre-fabricated wood trusses/joists, beams, and columns with pitched roofing and 6-inches of insulation between the wood joists. The attic over the offices also has 6-inches of insulation between the wood joists. The perimeter walls are concrete block construction with insulation board, vapor barrier and aluminum siding. The windows, man doors, and overhead doors are in good condition and appear to be maintained. Typical windows throughout the facility are single pane, operable, 1/4" clear glass with aluminum frames.

HVAC Systems

The equipment storage/repair sections are heated by two (2) Payne Model PG8MAA048090A gas-fired, forced-air furnaces rated at 88 MBH input and 70 MBH output for a thermal efficiency of 80%. The offices on the second floor are heated/cooled by a Payne Model PG8MAA060155A gas-fired, forced air, split air handling system with a furnace rated at 154 MBH input and 123 MBH output for a thermal efficiency of 80%. The split air-cooled condenser is a ground pad-mount Payne Model PA14NA060 split system condensing unit rated at 5-Tons and an efficiency of 14 SEER

Exhaust System

Air is exhausted from various areas through roof exhausters or wall exhaust.

HVAC System Controls

The HVAC system within the office spaces is controlled through 7-day programmable thermostat. The gas furnace for the office area is set to 70°F while the cooling is set at 74°F. The gas-fired furnaces within the equipment storage/repair areas are controlled by thermostats that are set to maintain 65°F.

Domestic Hot Water

Domestic hot water for the restrooms/sinks is provided by a Bradford White Model M-II-30 electric, 30-gallon capacity, water heater with two (2) 2.5 kW electric elements.

Laundry Equipment

The clothes washer is a Haier Model XQB60-91 BF with a capacity of 13.2 pounds and a 0.2 HP motor. The electric clothes dryer is a Roper Model DWJR-ELE-2406026-FM54. Both are used occasionally.

Lighting

Refer to the Investment Grade lighting Audit Appendix for a detailed list of the lighting throughout the facility and estimated operating hours per space.

III. MAJOR EQUIPMENT LIST

The equipment list contains major energy consuming equipment that through implementation of energy conservation measures could yield substantial energy savings. 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 in some cases 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 the **Major Equipment List Appendix** for this facility.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 1
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$7,905	$1,417	5.6	168.8%
ECM #2	Lighting Upgrade - Exterior	$2,250	$1,234	1.8	722.5%
ECM #3	Lighting Controls Upgrade	$795	$33	23.9	-37.4%
ECM #4	Water Conservation	$60	$277	0.2	4516.7%
ECM #5	Domestic Hot Water Heater Upgrade	$7,200	$307	23.5	-57.4%
ECM #6	Energy Star Refrigerator	$610	$65	9.4	6.6%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	28.32 kW PV System	$115,832	$11,244	10.3	45.6%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

Table 2
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	WATER (GALLONS)
ECM #1	Lighting Upgrade - General	4.5	10,119	0	0
ECM #2	Lighting Upgrade - Exterior	2.2	8,812	0	0
ECM #3	Lighting Controls Upgrade	0.0	237	0	0
ECM #4	Water Conservation	0.0	889	0	10,200
ECM #5	Domestic Hot Water Heater Upgrade	0.0	3,121	-110	0
ECM #6	Energy Star Refrigerator	0.0	465	0	0
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	WATER (GALLONS)
REM #1	28.32 kW PV System	28.3	33,962	0	0

Table 3
ECM Emissions Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**GREENHOUSE GAS EMISSIONS REDUCTION**		
		CO_2 EMISSIONS (LBS)	**NO_X EMISSIONS (LBS)**	**SO_2 EMISSIONS (LBS)**
ECM #1	Lighting Upgrade - General	15,380	28	66
ECM #2	Lighting Upgrade - Exterior	13,394	25	57
ECM #3	Lighting Controls Upgrade	360	1	2
ECM #4	Water Conservation	120,691	96	6
ECM #5	Domestic Hot Water Heater Upgrade	4,744	9	20
ECM #6	Energy Star Refrigerator	707	1	3
Notes:	A. Emissions Reduction based on NJCEP published factors for electric & gas.			

Table 4
Facility Project Summary

FACILITY PROJECT SUMMARY TABLE					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Upgrade - General	$1,417	$7,945	$40	$7,905	5.6
Lighting Upgrade - Exterior	$1,234	$2,450	$200	$2,250	1.8
Lighting Controls Upgrade	$33	$850	$55	$795	23.9
Water Conservation	$277	$60	$0	$60	0.2
Domestic Hot Water Heater Upgrade	$307	$7,500	$300	$7,200	23.5
Energy Star Refrigerator	$65	$610	$0	$610	9.4
Total Project	**$3,332**	**$19,415**	**$595**	**$18,820**	**5.6**

Note the measure totals in this table do not take into account interactive effects of measures; see Method of Analysis Section III in Executive Report for further explanation.

This project does not qualify for additional incentives through the Pay for Performance Program; please see the Installation Funding Options section for additional program options.

ECM #1: Lighting Upgrade – General

Description:

The majority of the interior lighting throughout the Grounds Building is provided with fluorescent fixtures with older generation, T12 lamps and magnetic ballasts. These fixtures can be replaced and retrofit with new LED type fixtures and lamps.

This ECM includes replacing and retrofitting the interior lighting with new LED type lamps and fixtures. It is recommended the Township consult with a professional engineer prior to retrofitting or replacing fixtures to ensure code required minimum light levels will be met.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	4.5
Electric Usage Savings (kWh)	10,119
Electric Cost Savings ($)	$1,417

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,945
NJ Smart Start Equipment Incentive ($):	$40
Net Installation Cost ($):	$7,905
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,417
Total Yearly Savings ($/Yr):	$1,417
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.6
Simple Lifetime ROI	168.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$21,249
Internal Rate of Return (IRR)	16%
Net Present Value (NPV)	$9,006.19

ECM #2: Lighting Upgrade – Exterior Lighting

Description:

The exterior lighting at the Grounds Building is currently lit by metal halide fixtures. The exterior would be better served with more efficient LED lighting system. Concord Engineering recommends upgrading the lighting to an energy-efficient LED lighting system that includes LED lamps and fixtures for the existing exterior lighting.

This ECM would replace the existing exterior lamps and fixtures with equivalent LED lamps and fixtures.

Energy Savings Calculations:

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

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	2.2
Electric Usage Savings (kWh)	8,812
Electric Cost Savings ($)	$1,234

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,450
NJ Smart Start Equipment Incentive ($):	$200
Net Installation Cost ($):	$2,250
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,234
Total Yearly Savings ($/Yr):	$1,234
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.8
Simple Lifetime ROI	722.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$18,505
Internal Rate of Return (IRR)	55%
Net Present Value (NPV)	$12,477.59

ECM #3: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Grounds Building are left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

This ECM includes installation of ceiling or switch mount sensors for mostly offices. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = \left(\%\ \text{Savings} \times \text{Controlled Light Energy}\ \left(\text{kWh/Yr}\right)\right)$$

$$\text{Savings.} = \text{Energy Savings}\left(\text{kWh}\right) \times \text{Ave Elec Cost}\left(\frac{\$}{\text{kWh}}\right)$$

LIGHTING CONTROLS SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Usage Savings (kWh)	237
Electric Cost Savings ($)	$33

Rebates and Incentives:

From the **NJ Smart Start® Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Smart Start Incentive
= (# Wall mount sensors × $20 per sensor)
+ (# Ceiling mount sensors × $35 per sensor)

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$850
NJ Smart Start Equipment Incentive ($):	$55
Net Installation Cost ($):	$795
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$33
Total Yearly Savings ($/Yr):	$33
Estimated ECM Lifetime (Yr):	15
Simple Payback	23.9
Simple Lifetime ROI	-37.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$498
Internal Rate of Return (IRR)	-5%
Net Present Value (NPV)	($398.63)

ECM #4: Water Conservation

Description:

The Grounds Building utilizes standard plumbing fixtures. The typical water faucet consumption only meets the minimum federal required standard for water efficiency. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the retrofitting of the existing faucets within the facility with new low flow aerators. The estimated usage of the plumbing fixtures is based on the total population of the facility. The number of plumbing fixtures to be replaced is based on observations of the facility. (Please note that the estimate of occupants for the library is an estimate based on daily employees at the facility)

The proposed retrofit includes installation of low flow aerators. For the basis of this calculation the LEED rating system was used to estimate the occupancy usage for people in the library. When water consumption information was not available, the GPF values were estimated for the existing fixtures.

Energy Savings Calculations:

Faucets:

$$\text{Water Usage} = \text{Occupancy}\left(\frac{\text{Days}}{\text{yr}}\right) \times \frac{\text{Uses}}{\text{Day}} \times \text{Duration}\left(\frac{\text{min}}{\text{Use}}\right) \times \text{Fixture}\left(\frac{\text{Gal}}{\text{Min}}\right)$$

$$\text{Electric Cost (kWh)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.33\,\text{lbs}}{\text{Gal}} \times \Delta T(70F) \times \frac{\text{kWh}}{3{,}412\,\text{BTU}}$$

$$\text{Electric Usage } (kWh) = \text{Faucet Water Usage (Gal)} \times 8.33\frac{\text{lbs}}{\text{Gal}} \times \text{Specific Heat (1)} \times \Delta\text{T(70°F)} \times \frac{kWh}{3{,}412\ \text{Btu}} \times \frac{1}{\text{HWH Efficiency}}$$

LOW FLOW WATER SAVING DEVICES			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity of Sinks	2	2	
Flow Rate (GPM)	2.2	0.5	1.7
Device Usage (min per day)	10	10	
Facility Operation (days / year)	300	300	
Heat Content of Water (Btu/gal/°F)	8.33	8.33	
Temperature Rise (°F)	70.0	70.0	
Efficiency of Heating System (%)	98%	98%	
Electric Rate ($/kWh)	$0.140	$0.140	
Water Rate ($/1000gal)	$15.000	$15.000	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	1,151	262	889
Water Usage (gallons)	13,200	3,000	10,200
Energy Cost ($)	$359	$82	$277
COMMENTS:	Heating Savings based on 50% Hot Cold Mix		

The cost for installation and materials is based on 2 faucet aerators. There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$60
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$60
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$277
Total Yearly Savings ($/Yr):	$277
Estimated ECM Lifetime (Yr):	10
Simple Payback	0.2
Simple Lifetime ROI	4516.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,770
Internal Rate of Return (IRR)	462%
Net Present Value (NPV)	$2,302.87

ECM #5: Domestic Hot Water Heater Upgrade

Description:

The Grounds Building has a single electric hot water heater located in the garage area. The current unit is a single element with a storage capacity of 19 gallons and total electric input of 1.5 kilowatts. The unit is only 6 years old, but could be replaced with a much more efficient and cost effective natural gas fired domestic boiler.

This ECM will replace the domestic water heater with a Natural Gas fired 95% thermal efficient Bradford White Everhot HE Tankless Gas Water Heater. The natural gas line will need to be extended to the heater, and venting can be extended from the heater out the side wall. (Before proceeding with installation of aforementioned system, Concord Engineering suggests consulting an engineer to evaluate the system fully.)

Energy Savings Calculations:

Energy Density for "Service" type building = .9 kBtu / SF / year

$$\text{DHW Heat Usage (kBtu)} = \text{Energy Density} \left(\frac{\frac{\text{kBtu}}{\text{yr}}}{\text{SF}} \right) \times \text{Building Area (SF)}$$

$$\text{DHW Total Usage} = \frac{\text{DHW Heat Usage (Btu)}}{\text{Heating Eff (\%)} \times \text{Fuel Heat Value} \left(\frac{\text{Btu}}{\text{Fuel Unit}} \right)}$$

$$\text{Energy Cost} = \text{Heating Fuel Usage (Fuel Units)} \times \text{Avg. Fuel Cost} \left(\frac{\$}{\text{Fuel Unit}} \right)$$

DOM. HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Electric Water Heater	High Efficiency Heater	
Building Type	Maintenance		
Building Square-foot	11,600	11,600	
Domestic Water Usage, kBtu	10,440.00	10,440.00	
DHW Heating Fuel Type	Electric	Gas	
Heating Efficiency	98%	95%	-3%
Total Usage (kBTU)	10,653	10,989	-336
Electric Cost ($/kWh)	$ 0.140	$ -	
Nat Gas Cost ($/Therm)	$ -	$ 1.180	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Usage (kWh)	3,121	0	3,121
Natural Gas Usage (Therms)	0	110	-110
Energy Cost ($)	$437	$130	$307
COMMENTS:	Savings are based on Energy Information Administration Commercial Building Energy Consumption Survey 2003 Information		

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,500
NJ Smart Start Equipment Incentive ($):	$300
Net Installation Cost ($):	$7,200
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$307
Total Yearly Savings ($/Yr):	$307
Estimated ECM Lifetime (Yr):	10
Simple Payback	23.5
Simple Lifetime ROI	-57.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$3,070
Internal Rate of Return (IRR)	-13%
Net Present Value (NPV)	($4,581.23)

ECM #6: Refrigerator Replacement

Description:

There is a residential style refrigerator located in the Grounds Building. This unit is an older model that is not nearly as energy efficient as one manufactured today.

The proposed replacement is a one-for-one with a unit of similar size and dimensions that has the most up-to-date Energy Star Rating. The Frigidaire model FFHT1814LW or equivalent should be considered as the replacement for this measure.

Energy Savings Calculations:

ENERGY STAR REFRIGERATOR CALCULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Quantity	1	1	
Manufacturer	GE	Frigidaire	
Type	Top Freezer	Top Freezer	
Model	TBX18IAZARAA	FFHT1814LW	
Size (Cu-Ft)	18.2	18	
Per Unit Electric Usage (kWh)	850	385	465
Electric Rate ($/kWh)	$0.140	$0.140	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	850	385	465
Energy Cost ($)	$119	$54	$65
COMMENTS:	Calculations based Energy Star Website http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator		

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$610
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$610
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$65
Total Yearly Savings ($/Yr):	$65
Estimated ECM Lifetime (Yr):	10
Simple Payback	9.4
Simple Lifetime ROI	6.6%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$650
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($55.54)

REM #1: 28.32 kW Solar System

Description:

The Grounds Building has available roof space that could accommodate solar arrays. Based on the available area a 28.32 kilowatt solar array could be installed. The array will produce approximately 33,962 kilowatt-hours annually that will reduce the overall electric usage of the facility by 91.6%. The owner should consult a structural engineer prior to installing any solar array to insure the roof can accommodate the additional weight.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas. Financial results in table below are based on 100% financing of the system over a fifteen year period.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$115,832
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$115,832
Maintenance Savings ($/Yr):	$6,490
Energy Savings ($/Yr):	$4,755
Total Yearly Savings ($/Yr):	$11,244
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.3
Simple Lifetime ROI	45.6%
Simple Lifetime Maintenance Savings	$97,344
Simple Lifetime Savings	$168,664
Internal Rate of Return (IRR)	5.1%
Net Present Value (NPV)	$18,401.54

V. ADDITIONAL RECOMMENDATIONS

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

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

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

E. Turn off computers when not in use. Ensure computers are not running in screen saver mode.

F. Replace any old CRT Monitors with LED/LCD Type Monitors, which can draw as much as a quarter the power of an equivalent CRT monitor.

G. Ensure outside air dampers are functioning properly and only open during occupied mode.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Marlboro Township - Grounds Building

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY														
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade - General	$4,510	$3,435	$40	$7,905	$1,417	$0	$1,417	15	$21,249	$0	168.8%	5.6	15.98%	$9,006.19
ECM #2	Lighting Upgrade - Exterior	$1,400	$1,050	$200	$2,250	$1,234	$0	$1,234	15	$18,505	$0	722.5%	1.8	54.75%	$12,477.59
ECM #3	Lighting Controls Upgrade	$500	$350	$55	$795	$33	$0	$33	15	$498	$0	-37.4%	23.9	-5.35%	($398.63)
ECM #4	Water Conservation	$40	$20	$0	$60	$277	$0	$277	10	$2,770	$0	4516.7%	0.2	461.67%	$2,302.87
ECM #5	Domestic Hot Water Heater Upgrade	$5,000	$2,500	$300	$7,200	$307	$0	$307	10	$3,070	$0	-57.4%	23.5	-13.10%	($4,581.23)
ECM #6	Energy Star Refrigerator	$610	$0	$0	$610	$65	$0	$65	10	$650	$0	6.6%	9.4	1.17%	($55.54)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	28.32 kW PV System	$115,832	$0	$0	$115,832	$4,755	$6,490	$11,244	15	$168,664	$97,344	45.6%	10.3	5.11%	$18,401.54

Notes:

1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

APPENDIX B

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 from July 1, 2013 to June 30, 2014:

Electric Chillers

Water-Cooled Chillers	$16 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	$185 - $450 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 - $92 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
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat
A/C Economizing Controls	≤ 5 tons $85/unit; >5 tons $170/unit

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Gas Fired Boilers < 300 MBH	$2.00 per MBH, but not less than $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	$400 per unit, AFUE ≥ 95%
Boiler Economizing Controls	$1,200 - $2,700
Low Intensity Infrared Heating	$300 - $500 per unit

Ground Source Heat Pumps

Closed Loop	$450 per ton, EER ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps ≥ 20 hp	$60 per VFD rated hp
Rotary Screw Air Compressors ≥ 25 hp	$5,250 to $12,500 per drive
Cooling Towers ≥ 10 hp	$60 per VFD rated hp
Boiler Fans ≥ 5 HP	$65 to $155 per hp
Boiler Feed Water Pumps ≥ 5 HP	$60 to $155 per hp
Commercial Kitchen Hood up to 50 HP	Retrofit $55 – $300 per hp New Hood $55 - $250 per hp

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	$50 per unit
Gas-Fired Water Heaters > 50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH
Gas Fired Tankless Water Heaters	$300 per unit

Prescriptive Lighting

T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
For retrofit of T-8 fixtures by permanent de-lamping & new reflectors (Electronic ballast replacement required)	$15 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $200 per fixture
Metal Halide w/Pulse Start Including Parking Lot (For fixtures ≥ 150w)	$25 per fixture
HID ≥ 100w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	$70 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture

Prescriptive Lighting - LED

LED Display Case Lighting	$30 per display case
LED Shelf-Mtd. Display & Task Lights	$15 per linear foot
LED Portable Desk Lamp	$20 per fixture
LED Wall-wash Lights	$30 per fixture
LED Recessed Down Lights	$35 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$50 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	$150 per fixture
LED High-Bay-Aisle Lighting	$150 per fixture
LED Stairwell and Passageway Luminaires	$40 per fixture
LED Bollard Fixtures	$50 per fixture
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4)	$50 per fixture
LED Fuel Pump Canopy	$100 per fixture
LED Screw-based & Pin-based (PAR, MR, BR, R) Standards (A-Style) and Decorative Lamps	$10 per lamp for R/PAR20,MR/PAR16,Globe,Candelabra or Misc $20 per lamp for R/BR/PAR 30, R/BR/PAR 38-40, A-Lamp
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$30 per 4 foot $42 per 5 foot $65 per 6 foot
LED Retrofit Kits	To be evaluated through the customer measure path

Lighting Controls – Occupancy Sensors

Wall Mounted (Existing Facilities Only)	$20 per control
Remote Mounted (Existing Facilities Only)	$35 per control
Daylight Dimming Controls	$45 per fixture controlled
Occupancy Based hi-low Dimming Control	$35 per fixture controlled
Occupancy Sensor Remote Mounted	$35 per control

Refrigeration Doors/Covers

Energy-Efficient Doors/Covers for Installation on Open Refrigerated Cases	$100 per door
Aluminum Night Curtains for Installation on Open Refrigerated Cases	$3.50 per linear foot

Refrigeration Controls

Door Heater Controls	$50 per control
Electric Defrost Controls	$50 per control
Evaporator Fan Controls	$75 per control
Novelty Cooler Shutoff	$50 per control

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	$0.16 KWh and $1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and an IRR of at least 10%.

APPENDIX C

ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

Grounds Building

Primary Property Function: Other - Public Services
Gross Floor Area (ft²): 11,600
Built: 1940

For Year Ending: December 31, 2013
Date Generated: July 11, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Grounds Building 1979 Township Drive Marlboro, New Jersey 07746	Marlboro Township 1979 Township Drive Marlboro, NJ 07446 (____)____-_____	Jonathan Capp 1979 Township Drive Marlboro, NJ 07446 732-536-0200 jcapp@marlboro-nj.gov

Property ID: 4091349

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
29.5 kBtu/ft²

Source EUI
53.7 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	126,507 (37%)
Natural Gas (kBtu)	215,350 (63%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	67.5
National Median Source EUI (kBtu/ft²)	123.1
% Diff from National Median Source EUI	-56%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	27

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp (if applicable)

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

Grounds Building

Split System Units

Tag			
Unit Type	Split System Condensing Unit		
Qty	1		
Location	Outisde		
Area Served	Offices		
Manufacturer	Payne		
Model #	PA14NA060-A		
Serial #	2009E07674		
Cooling Type	DX, R-410A		
Cooling Capacity (Tons)	5 Tons		
Cooling Efficiency (SEER/EER)	14 SEER		
Heating Type	See Furnace		
Heating Input (MBH)	See Furnace		
Efficiency	See Furnace		
Fuel	See Furnace		
Approx Age	5		
ASHRAE Service Life	15		
Remaining Life	10		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Grounds Building

AHUs

Tag			
Unit Type	Furnaces	Split Air Handler	
Qty	2	1	
Location	Garage	Attic	
Area Served	Offices	Offices	
Manufacturer	Payne	Payne	
Model #	PG8MAA048090AEJA	PG8MAA060155ADJA	
Serial #	4813A18709	1207A19931	
Cooling Type	N/A	See outdoor Condensing Unit	
Cooling Capacity (Tons)	N/A	See outdoor Condensing Unit	
Cooling Efficiency (EER)	N/A	See outdoor Condensing Unit	
Heating Type	Natural Gas Heat	Natural Gas Heat	
Heating Input (MBH)	88	154	
Heating Efficiency (%)	80%	80%	
Supply Fan (HP)	1/2	3/4	
Approx Age	1	7	
ASHRAE Service Life	15	15	
Remaining Life	14	8	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Domestic Water Heaters

Tag			
Unit Type	Tank Water Heater		
Qty	1		
Location	Garage		
Area Served	Domestic Hot Water Loop		
Manufacturer	Bradford White		
Model #	M12QU6SS-1NAL		
Serial #	EA10024470		
Size (Gallons)	19		
Input Capacity (MBH/KW)	1.5 kW		
Recovery (Gal/Hr)	-		
Efficiency %	98%		
Fuel	Electric		
Approx Age	6		
ASHRAE Service Life	12		
Remaining Life	6		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Grounds Building

Appliances

Tag			
Unit Type	Clothes Washer	Dryer	
Qty	1	1	
Location	Garage	Garage	
Manufacturer	Haier	Roper	
Model #	XQB60-91BF	DWJR-ELE-2406026-FM54	
Serial #	-	MT4649183	
Horse Power	.2 HP	-	
Capacity	13.2 Lbs	-	
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

APPENDIX E

CEG Project #: 1C13521
Facility Name: Grounds Building
Address: 1979 Township Drive
City, State, Zip Marlboro, NJ 07746

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
501	Garage/Shed Bays	2000	(2) 90w PAR38, Flood	2	180	3	0.54	1,080	Relamp	18w LED PAR38	2	36	3	0.11	216	0.43	864	$121	0	No New Controls	0	0.0%	0	$0
121.14	Mower Bay	2000	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	2	0.16	312	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	2	0.07	144	0.08	168	$24	0	No New Controls	0	0.0%	0	$0
148.14	Mower Bay	2000	8' Channel, 4 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	4	248	1	0.25	496	Replace Fixture	1x4 3 Lamp, 54w T5HO; new fixture	3	176	1	0.18	352	0.07	144	$20	0	No New Controls	0	0.0%	0	$0
141.14	Elec. Room	2000	1x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	4	156	2	0.31	624	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	4	72	2	0.14	288	0.17	336	$47	0	No New Controls	0	0.0%	0	$0
127.11	Lockers - Flammable	2600	2x2, 2 Lamp, 34w T12 U-Tube, Mag. Ballast, Surface Mnt., Prismatic Lens	2	72	2	0.14	374	Retrofit Kit - Remove Lense Bypass Ballast	Phillips LED Evokit 2x2 P 32L 31W840 2 0-10 7 G2	1	31	2	0.06	161	0.08	213	$30	0	No New Controls	0	0.0%	0	$0
148.14	Lockers - Flammable	2600	8' Channel, 4 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	4	248	1	0.25	645	Replace Fixture	1x4 3 Lamp, 54w T5HO; new fixture	3	176	1	0.18	458	0.07	187	$26	0	No New Controls	0	0.0%	0	$0
121.14	Break Room/Garage Bay	2600	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	10	0.78	2,028	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	10	0.36	936	0.42	1,092	$153	0	No New Controls	0	0.0%	0	$0
141.14	Break Room/Garage Bay	2600	1x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	4	156	1	0.16	406	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	4	72	1	0.07	187	0.08	218	$31	0	No New Controls	0	0.0%	0	$0
148.14	Break Room/Garage Bay	2600	8' Channel, 4 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	4	248	2	0.50	1,290	Replace Fixture	1x4 3 Lamp, 54w T5HO; new fixture	3	176	2	0.35	915	0.14	374	$52	0	No New Controls	0	0.0%	0	$0
141.14	Restroom	2600	1x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	4	156	1	0.16	406	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	4	72	1	0.07	187	0.08	218	$31	0	No New Controls	0	0.0%	0	$0
121.14	Stairway	3000	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	1	0.08	234	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	1	0.04	108	0.04	126	$18	0	No New Controls	0	0.0%	0	$0
612	Women's Restroom	2600	100w A Lamp	1	100	2	0.20	520	Relamp	PHILIPS 120V EnduraLED 12.5W A19 2700K	1	12.5	2	0.03	65	0.18	455	$64	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	13	$2
121.14	Files	2600	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	1	0.08	203	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	1	0.04	94	0.04	109	$15	0	No New Controls	0	0.0%	0	$0
128.14	Office	2600	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	2	124	2	0.25	645	Replace Fixture	1x4 Surface LED 48w	1	48	2	0.10	250	0.15	395	$55	5	Dual Technology Occupancy Sensor - Remote Mnt.	0.5	20.0%	50	$7
121.14	Office	2600	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	1	0.08	203	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	1	0.04	94	0.04	109	$15	5	Dual Technology Occupancy Sensor - Remote Mnt.	0.5	20.0%	19	$3
601	Office	8760	Flour. Exit Sign	2	14	1	0.01	123	Remove Existing Fixture; Replace With New	LED Exit Sign	1	2	1	0.00	18	0.01	105	$15	0	No New Controls	0	0.0%	0	$0
121.14	Storage	2000	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	3	0.23	468	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	3	0.11	216	0.13	252	$35	0	No New Controls	0	0.0%	0	$0
128.14	Kitchenette	2600	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	2	124	1	0.12	322	Replace Fixture	1x4 Surface LED 48w	1	48	1	0.05	125	0.08	198	$28	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	$3
128.14	Office	2600	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	2	124	1	0.12	322	Replace Fixture	1x4 Surface LED 48w	1	48	1	0.05	125	0.08	198	$28	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	$3
128.14	Office	2600	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	2	124	1	0.12	322	Replace Fixture	1x4 Surface LED 48w	1	48	1	0.05	125	0.08	198	$28	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	25	$3

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
121.14	Lobby/Window	3000	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	2	0.16	468	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	2	0.07	216	0.08	252	$35	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	43	$6
121.14	Reception/Copy Area	2600	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surace Mnt., No Lens	2	78	2	0.16	406	Bypass Ballast, Relamp	4' Alledra 18w LED; LLT-X-T8-Y-SW-120-Z-S-N	2	36	2	0.07	187	0.08	218	$31	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	37	$5
500	Storage/Attic	2000	500w Quartz Flood Light	1	500	4	2.00	4,000	Replace Fixture	RAB 39w LED Flood	1	39	4	0.16	312	1.84	3,688	$516	0	No New Controls	0	0.0%	0	$0
500	Exterior	4000	500w Quartz Flood Light	1	500	4	2.00	8,000	Replace Fixture	RAB 39w LED Flood	1	39	4	0.16	624	1.84	7,376	$1,033	0	No New Controls	0	0.0%	0	$0
706	Exterior	4000	100w MH Wallpack	1	120	2	0.24	960	Replace Fixture	26w LED Wall Pack	1	26	2	0.05	208	0.19	752	$105	0	No New Controls	0	0.0%	0	$0
710	Exterior	4000	175w MH Flood Light	1	210	1	0.21	840	Replace Fixture	RAB 39w LED Flood	1	39	1	0.04	156	0.17	684	$96	0	No New Controls	0	0.0%	0	$0
	TOTAL					**54**	**9**	**25,696**					**54**	**3**	**6,765**	**7**	**18,931**	**$2,650**			**7**	**2**	**237**	**$33**

APPENDIX F

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Total KW_{AC}	Panel Weight (41.9 lbs)	W/SQFT
Grounds Building	2250	SHARP ND-240QCJ	118	17.5	2,070	28.32	33,962	22.9	4,944	13.68

= Proposed PV Roof Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

Project Name: **LGEA Solar PV Project - Grounds Building**
Location:
Description: **Photovoltaic System 100% Financing - 15 year**

Simple Payback Analysis

	Photovoltaic System 100% Financing - 15 year
Total Construction Cost	$115,832
Annual kWh Production	33,962
Annual Energy Cost Reduction	$4,755
Average Annual SREC Revenue	$6,490

Simple Payback: **10.30** Years

Life Cycle Cost Analysis

Analysis Period (years):	15	Financing %:	100%
Discount Rate:	3%	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.140**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	6.00%	Average SREC Value ($/kWh)	$0.191

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	$0	0	0	0	$0	0	0	0	0
1	$0	33,962	$4,755	$0	$8,491	$6,816	$4,913	$1,516	$1,516
2	$0	33,792	$4,897	$0	$8,448	$6,513	$5,216	$1,616	$3,132
3	$0	33,623	$5,044	$0	$8,406	$6,192	$5,538	$1,721	$4,852
4	$0	33,455	$5,196	$0	$8,364	$5,850	$5,880	$1,830	$6,682
5	$0	33,288	$5,351	$343	$8,322	$5,487	$6,242	$1,601	$8,283
6	$0	33,121	$5,512	$341	$6,624	$5,102	$6,627	$66	$8,349
7	$0	32,956	$5,677	$339	$6,591	$4,694	$7,036	$200	$8,548
8	$0	32,791	$5,848	$338	$6,558	$4,260	$7,470	$339	$8,887
9	$0	32,627	$6,023	$336	$6,525	$3,799	$7,931	$483	$9,370
10	$0	32,464	$6,204	$334	$4,870	$3,310	$8,420	($990)	$8,379
11	$0	32,302	$6,390	$333	$4,845	$2,790	$8,939	($827)	$7,552
12	$0	32,140	$6,582	$331	$4,821	$2,239	$9,490	($658)	$6,894
13	$0	31,979	$6,779	$329	$4,797	$1,654	$10,076	($483)	$6,411
14	$0	31,819	$6,982	$328	$3,182	$1,032	$10,697	($1,893)	$4,519
15	$0	31,660	$7,192	$326	$3,166	$372	$11,357	($1,698)	$2,821
Totals:		491,981	$88,432	$3,679	$94,010	$60,110	$115,832	$2,821	$96,195

Net Present Value (NPV) **$3,752**