BERGEN COUNTY
VOTING MACHINE WAREHOUSE

660 GOTHAM PKWY
CARLSTADT, NJ 07072

FACILITY ENERGY REPORT

TABLE OF CONTENTS

I. HISTORIC ENERGY CONSUMPTION/COST 2

II. FACILITY DESCRIPTION 7

III. MAJOR EQUIPMENT LIST 9

IV. ENERGY CONSERVATION MEASURES 10

V. ADDITIONAL RECOMMENDATIONS 28

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start® Program Incentives

Appendix C – Portfolio Manager "Statement of Energy Performance"

Appendix D – Major Equipment List

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

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:	Public Service Electric & Gas
Electric Utility Rate Structure:	General Lighting & Power (GLP)
Third Party Supplier:	None

Natural Gas Utility Provider:	Public Service Electric & Gas
Utility Rate Structure:	Not available
Third Party Supplier:	Not available

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: PSE&G
Rate: GLP, GLP
Meter No: 728012108, 728012108
Account # 66 292 842 08, 66 327 751 01 (Two accounts on single meter)
Third Party Utility Provider: None
TPS Meter / Acct No: -

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Mar-10	32,480	208.0	$5,331
Apr-10	27,680	145.6	$4,465
May-10	57,920	230.4	$11,203
Jun-10	55,360	225.6	$11,365
Jul-10	57,280	208.0	$11,421
Aug-10	53,760	222.4	$11,286
Sep-10	45,440	185.6	$7,604
Oct-10	20,000	78.4	$3,971
Nov-10	31,360	89.6	$5,352
Dec-10	30,720	88.0	$5,311
Jan-11	33,280	88.0	$5,832
Feb-11	29,280	88.0	$5,408
Totals	**474,560**	**230.4 Max**	**$88,547**

AVERAGE DEMAND **154.8 KW average**
AVERAGE RATE **$0.187** **$/kWh**

Figure 1
Electricity Usage Profile

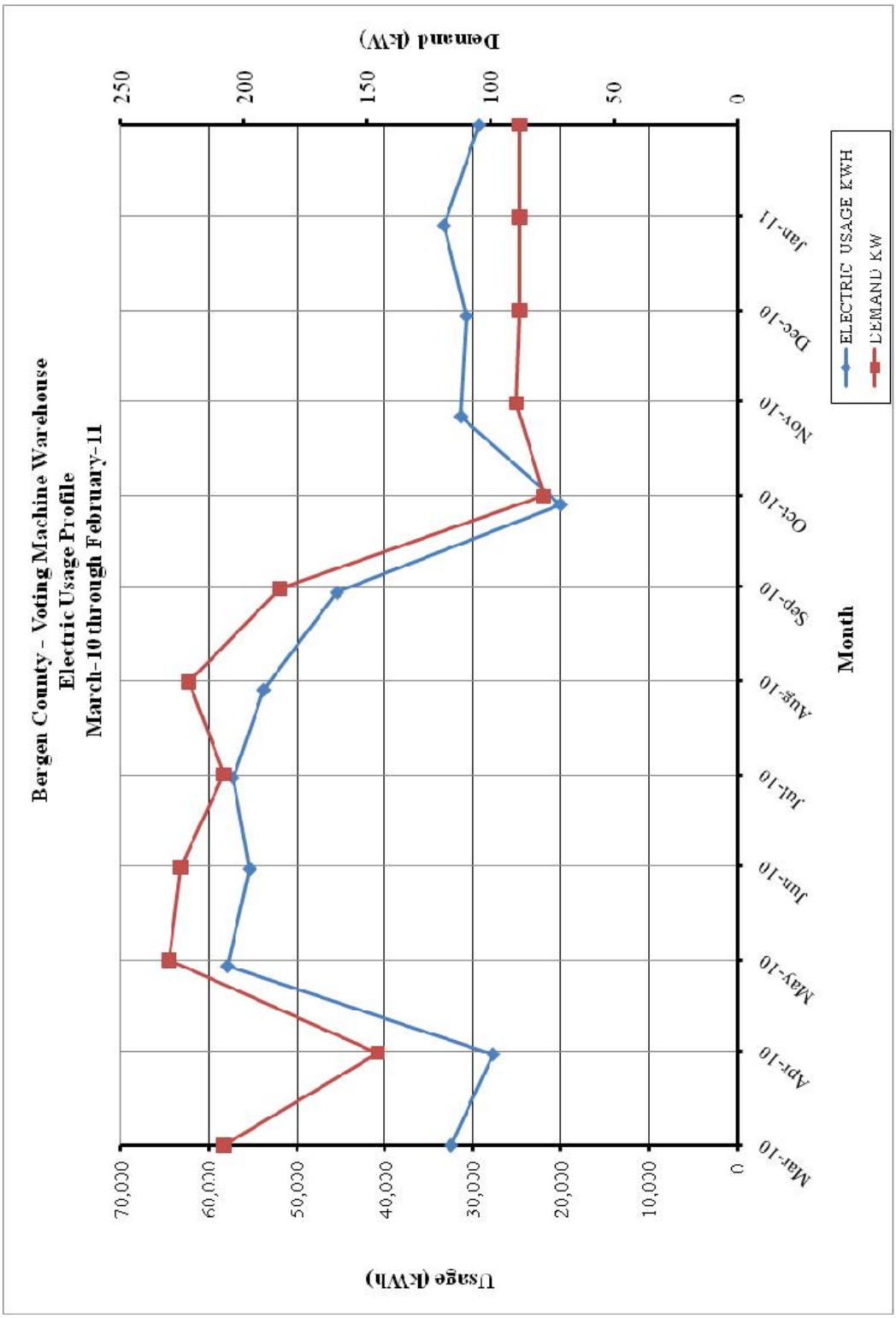

Table 2
Natural Gas Billing Data

Natural Gas Billing Data was not available for this facility.

Figure 2
Natural Gas Usage Profile

Natural Gas Usage Profile was not available for this facility.

II. FACILITY DESCRIPTION

The 38,000 SF Bergen County Voting Machine Warehouse Building is a one (1) story facility comprised of a conditioned open warehouse, office spaces, storage rooms and mechanical rooms. The building is located in Carlstadt, NJ. The typical hours of operation for this facility are between 8:00 AM and 5:00 PM during weekdays. The facility is usually closed on weekends. HVAC systems run between the hours of 7:00 am and 5:00 pm on weekdays and based on occupancy on weekends. Average number of occupancy at the Voting Machine Warehouse is 10 on a typical weekday.

Exterior of the building consists of cinder block walls with concrete façade. The facility has double pane, tinted windows in operable wood frames. The windows throughout the facility are in good condition and appear to be well maintained. Blinds are utilized throughout the offices per occupant comfort. The blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat gain in the summer. The warehouse area has four (4) old, non-insulated overhead doors in poor condition. The door seals are disintegrated on the sides and top, leaving large gaps between the doors and the frame. It is recommended to replace or restore these doors and install new weather stripping.

The building has a built-up rubber roof with tar and gravel covering. The amount of insulation below the roofing is minimal. The building was built in 1925 as a commercial warehouse facility. It was reported that there no additions since the original construction.

HVAC Systems

The warehouse area is conditioned by two (2) central packaged A/C units made by Trane. The units were installed in 2009 and appear to be in excellent condition. The packaged units include gas heat exchangers to pre-heat the primary supply air. Cooling is achieved with multiple scroll compressors for part load staging. Conditioned air is distributed throughout the warehouse via constant volume ductwork. Ceiling hung Reznor gas fired unit heaters are installed near the over head doors to assist the packaged units in the heating season. It was reported that the unit heaters are seldom needed.

Air conditioning for the offices is provided with a 7.5 Ton single zone, split air conditioning unit made by Carrier. The unit was installed in 2009 and appears to be in excellent condition. Conditioned air is distributed to the offices via a constant volume duct through ceiling diffusers.

The office area heating for the Bergen County Voting Machine Warehouse is provided by a natural gas fired, 250 MBH, Utica MGB Series hot water boiler. The boiler is a standard efficiency, non-condensing boiler installed in 2009. It is located in the boiler room of the building. A small hot water circulator delivers hot water to the baseboard heaters in the perimeter of the building.

Exhaust System

Air is exhausted from the warehouse through the roof exhausters. The exhaust fans are on manual switches. It was reported that he fans are seldom needed. Bathroom exhaust provided with a side-wall exhaust fan on manual switch.

HVAC System Controls

The HVAC systems within the facility are controlled via programmable thermostats for each of the three (3) air conditioning systems and the hydronic heating system.

The Trane units feeding the warehouse area are controlled via two (2) programmable thermostats located in the center of the warehouse. The Carrier split AC unit is controlled with a programmable thermostat located in a center office. The heating system is set up in three (3) temperature zones. Each zone temperature is controlled via mechanical zone thermostats. The overall operation is controlled via a programmable thermostat.

Domestic Hot Water

Domestic hot water for the restrooms and office lounge is provided by a 50 gallon Rheem gas fired hot water heater. The domestic hot water is directly connected to the faucets without a circulator. The domestic hot water piping insulation appeared to be in good condition.

Lighting

The lighting for the warehouse area is recently upgraded to 4 lamp T8 fixtures with high reflective backing. The offices and tool areas are lit with 8 ft T12 fixtures with electronic ballasts. Some of the mechanical areas and closets are lit with a mixture of incandescent lamps and compact fluorescent lamps. The lighting throughout the warehouse is controlled manually via switches.

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 3
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	$7,865	$1,428	5.5	172.4%
ECM #2	Lighting Controls Upgrade	$8,895	$1,992	4.5	236.0%
ECM #3	Demand Controlled Ventilation	$37,000	$2,794	13.2	13.3%
ECM #4	Premium Efficiency Motors	$4,920	$388	12.7	18.2%
ECM #5	Loading Dock Doors Weatherstripping	$500	$702	0.7	2005.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	Solar Photovoltaic System	$1,585,620	$117,078	13.5	10.8%

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

Table 4
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
ECM #1	Lighting Upgrade	3.2	7,586	0
ECM #2	Lighting Controls Upgrade	0	10,654	0
ECM #3	Demand Controlled Ventilation	0	6,063	1,509
ECM #4	Premium Efficiency Motors	0.5	2,074	0
ECM #5	Loading Dock Doors Weatherstripping	4.3	286	46,285
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
REM #1	Solar Photovoltaic System	176.2	218,023	0

Table 5
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Lighting Upgrade	$1,428	$8,105	$240	$7,865	5.5
Lighting Controls Upgrade	$1,992	$9,625	$730	$8,895	4.5
Demand Controlled Ventilation	$2,794	$37,000	$0	$37,000	13.2
Premium Efficiency Motors	$388	$5,120	$200	$4,920	12.7
Loading Dock Doors Weatherstripping	$702	$500	$0	$500	0.7
Design / Construction Extras (15%)		*$9,053*		*$9,053*	
Total Project	**$7,304**	**$69,403**	**$440**	**$68,233**	**9.3**

Design / Construction Extras is shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Lighting Upgrade – Interior Spaces

Description:

Lighting for the storage area of the Voting Machine Warehouse Facility was recently retrofitted with standard T8 fluorescent fixtures with electronic ballasts. The lamps used in these fixtures are older generation, 700 series 32W T8 lamps. Although 700 series T8 lamps are considered fairly efficient, further energy savings can be achieved by replacing the existing T8 lamps with new generation, 800 series 28W T8 lamps without compromising light output. CEG recommends, re-lamping all of the fixtures with 28W T8 lamps. In addition, some of the storage areas, locker room and gym areas, offices, auditorium, classrooms, restrooms and kitchen areas still have a variety of older fluorescent fixtures with magnetic ballasts and incandescent lamps. It is recommended to retrofit or replace all of the older fluorescent fixtures and the incandescent lights in these areas with high efficiency fluorescent T8 or T5 fixtures with electronic ballasts or compact fluorescent lamps.

This ECM includes re-lamping of the existing fluorescent fixtures with 800 series, 28W T8 lamps. The ECM also includes retrofit of all older fluorescent fixtures with T8 fluorescent fixtures with electronic ballasts in the building. The new, energy efficient T8 fixtures will provide adequate lighting and will save on electrical costs due to better performance of the lamp and ballasts. This ECM also includes maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need approximately 33% less lamps replaced per year for each one for one fixture replaced.

The ECM also includes replacement of any incandescent lamps with compact fluorescent lamps including incandescent exit signs. Compact fluorescent lamps (CFL's) were designed to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours. However, the maintenance savings due to reduced lamp replacement is offset by the higher cost of the CFL's compared to the incandescent lamps.

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.

Rebates and Incentives:

There are incentives available from NJ Smart Start® Program for the retrofits in this ECM. Incentives are calculated as follows:

From the Smart Start Incentive appendix, the retrofit of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-4 lamp) = $10 per fixture.

$$\text{SmartStart® Incentive} = (\#\text{ of } 1-4 \text{ lamp fixtures} \times \$10) = 24 \times \$10 = \$240$$

Replacement and Maintenance Savings are calculated as follows:

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

$$\text{Savings} = 1.38 \times (\$2 \text{ per lamp} + \$5 \text{ per lamp}) = \$10$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,105
NJ Smart Start Equipment Incentive ($):	$240
Net Installation Cost ($):	$7,865
Maintenance Savings ($/Yr):	$10
Energy Savings ($/Yr):	$1,419
Total Yearly Savings ($/Yr):	$1,428
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.5
Simple Lifetime ROI	172.4%
Simple Lifetime Maintenance Savings	$145
Simple Lifetime Savings	$21,424
Internal Rate of Return (IRR)	16%
Net Present Value (NPV)	$9,185.94

ECM #2: Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Voting Machine Warehouse facility 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 other instances, the lights are left on due to circuiting of the lights where it is not possible to turn off a portion of the lights when not in use because it is on a single switch. 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 and daylight sensors (The majority of the savings is expected to be after school hours when rooms are left with lights on)

This ECM includes installation of ceiling or switch mount sensors for the warehouse area, individual offices and common areas. 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:

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

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

Cost and Incentives:

Installation cost per dual-technology sensors (Basis: Sensor switch or equivalent) are as follows:

Dual Tech. Occupancy Sensor w/2 Pole Powerpack - Remote Mount	$500 per installation
Dual Technology Occupancy Sensor - Switch Mnt.	$125 per installation

Cost includes material and labor.

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

Occupancy Sensor Fixture Mounted (existing facility only) = $20 per sensor
Occupancy Sensor Remote Mounted (existing facility only) = $35 per sensor

$$\text{Smart Start® Incentive} = (\#\text{ of wall mount} \times \$\,20) + (\#\text{of ceiling mount} \times \$35)$$
$$\text{Smart Start® Incentive} = (5\text{ wall mount} \times \$\,20) + (18\text{ ceiling mount} \times \$35) = \$730$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$9,625
NJ Smart Start Equipment Incentive ($):	$730
Net Installation Cost ($):	$8,895
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,992
Total Yearly Savings ($/Yr):	$1,992
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.5
Simple Lifetime ROI	236.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$29,884
Internal Rate of Return (IRR)	21%
Net Present Value (NPV)	$14,888.25

ECM #3: Demand Controlled Ventilation

Demand Controlled Ventilation (DCV) is a means to provide active, zone level control of ventilation for spaces within a facility. The basic premise behind DCV is monitoring indoor CO2 levels versus outdoor CO2 levels in order to provide proper ventilation to the spaces within the facility as well as saving costly dollars treating unconditioned ventilation air. Carbon dioxide ventilation control or demand controlled ventilation (DCV) allows for the measurement and control of outside air ventilation levels to a target cfm/person ventilation rate in the space (i.e., 15 cfm/person) based on the number of people in the space. It is a direct measure of ventilation effectiveness and is a method whereby buildings can regain active and automatic zone level ventilation control, without having to open windows. The fixed ventilation approach depends on a set-it-and-forget-it methodology that is completely unresponsive to changes in the way spaces are utilized/occupied or how equipment is maintained. A DCV system utilizes various control algorithms to maintain a base ventilation rate. The system monitors space CO2 levels and the algorithm automatically adjusts the outdoor and return air dampers to provide the quantity of outdoor air to maintain the required CO2 level in the space. System designs are normally designed for maximum occupancy and the ventilation rates are designed for this (maximum) occupancy. In areas where occupancy swings are prevalent there is ample opportunity to reduce outdoor air quantity to satisfy the needs of the actual number of occupants present. By installing the DCV controls, energy savings are realized by the reduced quantities of outdoor air that do not require heating and cooling energy from the steam and chilled water plants.

The packaged air conditioning units serving the warehouse area are standard air conditioning systems with constant minimum outside air setup. When these units are on unoccupied mode, the outside air dampers shut. The outside air volume is typically based on the maximum occupancy of the space conditioned. When a given space is not fully occupied the outside air quantity delivered to the space is greater than the amount actually needed for adequate ventilation, which results in waste of heating or air conditioning energy.

This ECM includes the installation integrated demand control ventilation systems with CO2 sensors, for the units mentioned above. This system allows the air handling unit to respond to changes in occupancy and therefore reduce the amount of outside air that has to be conditioned. Outside air accounts for a large portion of the energy consumption in the HVAC system, especially in high occupancy spaces. 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:

- Demand Control Ventilation - 10% - 15%.

Energy savings achieved through "Demand Control Ventilation" average 10%-15%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total HVAC energy cost for this system.

The components included to install for a demand control ventilation system include damper actuators (if not exist), Variable Frequency Drives (if not exist), CO2 sensors, wiring, Energy Management System equipment expansion and programming. Each occupied zone would require minimum one CO_2 sensor installed to monitor occupancy levels.

IMPLEMENTATION SUMMARY						
INPUTS	**HVAC Unit**	**Service**	**Total Flow Capacity CFM**	**Min # of CO2 SENSORS**	**Cooling Capaity, Tons**	**Heating Capacity, MBH**
DCV-1	0	Warehouse Area	12,740	2	30	600
DCV-2	0	Warehouse Area	12,740	2	30	600
Total				**4**	**60**	**1,200**

Energy Savings Calculations:

$$\text{Cooling Energy Usage} = \frac{\text{Cooling(Tons)} \times 12{,}000 \left(\frac{\text{Btu}}{\text{Ton hr}}\right) \times \text{Annual Full Load Cooling Hrs.}}{1000 \left(\frac{\text{Wh}}{\text{kWh}}\right) \times \text{EER}\left(\frac{\text{Btu}}{\text{Wh}}\right)}$$

$$\text{Energy Savings} = \text{Cooling Energy (kwh)} \times \text{Savings\%}$$

$$\text{Cooling Cost} = \text{Energy Usage(kWh)} \times \text{Ave Electric Cost} \left(\frac{\$}{\text{kWh}}\right)$$

$$\text{Heating Energy (Therms)} = \frac{\text{Heating Capacity}\left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD(Day °F)} \times 24\left(\frac{\text{Hr.}}{\text{Day}}\right) \times (0.60)}{65(°\text{F}) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency (\%)}}$$

$$\text{Heating Cost} = \text{Heating Energy(Therms)} \times \text{Ave Fuel Cost} \left(\frac{\$}{\text{Therms}}\right)$$

$$\text{Energy Savings} = \text{Heating Energy (Therms)} \times \text{Saving \%}$$

Results of the energy savings calculations are summarized in the table below:

DEMAND CONTROLLED VENTILATION	
ECM INPUTS	**DCV-1-2**
Equipment	Packaged Units
Total Cooling Capacity, Tons	60
Efficiency (EER)	9.5
Annual Full Load Cooling Hours	800
Total Heating Capacity, MBh	1200
Heating Efficiency (Gas)	81%
Heating Degree Days (65°F)	4599
Energy Savings	10%
Elec Cost ($/kWh)	$0.187
Natural Gas Cost ($/Therm)	$1.10
ENERGY SAVINGS	
ECM RESULTS	**DCV-1-2**
Cooling Energy Cnsmption, kWh	60,632
Heating Energy (Therms)	15,094
Cooling Energy Savings kWh	6,063
Heating Energy Savings (Therms)	1,509
Electric Energy Cost Savings ($)	$1,134
Total Gas Cost Savings ($)	$1,660
Total Cost Savings ($)	$2,794
COMMENTS:	HDD estimated based on Newark,NJ.

Cost and Incentives:

Estimated installed cost for demand controlled ventilation for the air handling units serving the warehouse area is $37,000. Estimated cost includes CO2 sensors, control wiring, electrical wiring, VFDs, control system equipment expansion and programming.
There are currently no Smart Start ® incentives available for a Demand Control Ventilation System.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$37,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$37,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,794
Total Yearly Savings ($/Yr):	$2,794
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.2
Simple Lifetime ROI	13.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$41,913
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	($3,643.41)

ECM #4: Install NEMA Premium® Efficiency Motors

Description:

The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

The electric motors driving the supply fans in the main HVAC equipment are candidates for replacing with premium efficiency motors. These standard efficiency motors run considerable amount of time over a year.

This energy conservation measure replaces existing inefficient electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
HVAC-1	Packaged Heating & AC Unit	10	4,380	89.5%	92.4%
HVAC-2	Packaged Heating & AC Unit	10	4,380	89.5%	92.4%

Energy Savings Calculations:

$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric cost savings} = \text{Electric Usage Savings} \times \text{Electric Rate} \left(\frac{\$}{\text{kWh}}\right)$$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	**MOTOR HP**	**LOAD FACTOR**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**POWER SAVINGS kW**	**ENERGY SAVINGS kWH**	**COST SAVINGS**
HVAC-1	10	90%	89.5%	92.4%	0.24	1,037	$194
HVAC-2	10	90%	89.5%	92.4%	0.24	1,037	$194
TOTAL					**0.5**	**2,074**	**$388**

Equipment Cost and Incentives

Below is a summary of SmartStart Building® incentives for premium efficiency motors:

INCENTIVES	
HORSE POWER	**NJ SMART START INCENTIVE**
5	$60
7.5	$90
10	$100
15	$115
20	$125
25	$130

The following table outlines the summary of motor replacement costs and incentives:

MOTOR REPLACEMENT SUMMARY						
EQMT ID	**MOTOR POWER HP**	**INSTALLED COST**	**SMART START INCENTIVE**	**NET COST**	**TOTAL SAVINGS**	**SIMPLE PAYBACK**
HVAC-1	10	$2,560	$100	$2,460	$194	12.7
HVAC-2	10	$2,560	$100	$2,460	$194	12.7
TOTAL	**Totals:**	**$5,120**	**$200**	**$4,920**	**$388**	**12.7**

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,120
NJ Smart Start Equipment Incentive ($):	$200
Net Installation Cost ($):	$4,920
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$388
Total Yearly Savings ($/Yr):	$388
Estimated ECM Lifetime (Yr):	15
Simple Payback	12.7
Simple Lifetime ROI	18.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,816
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	($291.06)

ECM #5: Loading Dock Doors Weather-stripping

Description:

Two of the loading dock doors for the Voting Machine Warehouse Facility are in poor condition with multiple openings and cracks around the framing causing leaks and draft issues. Loading dock doors account for significant energy use through leakage heat loss in warehouse type of facilities. The age and condition of the doors contribute to the leakage rate of the building. It is recommended to recondition or replace the weather-stripping around the loading dock doors for improved energy efficiency.

This ECM includes installation of new weather-stripping around the loading dock doors where there are gaps and openings.

Energy Savings Calculations:

Calculations are based on the experimental data developed by ASHRAE, which can be found in the ASHRAE Fundamentals Handbook.

$$\text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min.}}\right) = \text{Estimated based on data in Fig.15, page.16.26}$$

$$\text{Heat Load}\left(\frac{\text{Btu}}{\text{Hr.}}\right) = 1.08 \times \text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min}}\right) \times \text{Design Temperature Difference}\left(^{\circ}\text{F}\right)$$

$$\text{Cooling Load}\left(\text{Ton}\right) = \text{Infiltration}\left(\frac{\text{Ft}^3}{\text{Min}}\right) \times 4.5 \times \text{Design Enthalpy Difference}\left(\frac{\text{BTU}}{\text{lb}}\right)$$

$$\text{Heating Leakage Energy}\left(\text{Therms}\right) = \frac{\text{Heat Load}\left(\frac{\text{Btu}}{\text{Hr.}}\right) \times \text{HDD}\left(\text{Day}\,^{\circ}\text{F}\right) \times 24\left(\frac{\text{Hr.}}{\text{Day}}\right) \times \left(0.60\right)}{65\left(^{\circ}\text{F}\right) \times \text{Fuel Heat Value}\left(\frac{\text{Btu}}{\text{Therms}}\right) \times \text{Heating Efficiency}\left(\%\right)}$$

$$\text{Cooling Leakage Energy}\left(\text{kWh}\right) = \frac{\text{Cooling Load}\left(\text{Ton}\right) \times \left(\frac{12{,}000\ \text{Btu}}{\text{Ton Hr.}}\right) \times \text{Full Load Cooling Hours}}{\frac{1000\ \text{W.h}}{\text{kWh}} \times \text{Cooling Efficiency}\left(\text{EER}\right)}$$

$$\text{Heating Energy Cost} = \text{Total Heating Energy}(\text{Therms}) \times \text{Ave Fuel Cost}\left(\frac{\$}{\text{Therms}}\right)$$

$$\text{Cooling Energy Cost} = \text{Total Cooling Energy}(\text{kWh}) \times \text{Ave Fuel Cost}\left(\frac{\$}{\text{kWh}}\right)$$

INFILTRATION CALCULATIONS			
ECM INPUTS	**VALUE**	**VALUE**	
ECM Type	Poor Weatherstripping	New Weatherstripping	
Number of Cracks	1	1	-
Crack Height, in	0.1	0.02	0.08
Est. Ave. Crack Width, in	720	720	-
Pressure Differential, in H20	0.01	0.01	-
Cooling Efficiency, EER	9.5	9.5	-
Heating Efficiency (Gas)	80%	80%	-
Full Load Cooling Hours	800	800	-
Heating Degree Days (65°F)	4599	4599	-
Elec Cost ($/kWh)	$0.187	$0.187	-
Natural Gas Cost ($/Therm)	$1.10	$1.10	-
ENERGY SAVINGS			
ECM RESULTS			
Total Infiltration, CFM	809	162	647
Cooling Load, Ton	4.2	0.8	3.4
Demand, kW	5.4	1.1	4.3
Heating Load, BTU/Hr	56,765	10,480	46,285
Cooling Energy Cnsmption, kWh	357	71	286
Heating Energy (Therms)	723	133	589
Electric Energy Cost ($)	$67	$13	$53
Natural Gas Cost ($)	$795	$147	$648
Total Energy Cost ($)	$862	$160	$702
COMMENTS:	*HDD estimated based on Newark,NJ. Calculation is based on ASHRAE Handbook, Fundamentals, Fig.15: Average Leakage Rate of Door vs Average Crack Width*		

Estimated cost for installing energy efficient weather-stripping is $500.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$702
Total Yearly Savings ($/Yr):	$702
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.7
Simple Lifetime ROI	2005.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$10,529
Internal Rate of Return (IRR)	140%
Net Present Value (NPV)	$7,879.27

REM #1: 218 kW Rooftop Solar Array

Description:

The Voting Machine Warehouse has approximately 12,500 square-foot of available roof space that can accommodate a 176 kilowatt solar array, assuming the existing roof structure is capable of supporting an array.

The array will produce approximately 218,023 kilowatt-hours annually that will reduce the overall electric usage of the facility by 46%.

Energy Savings Calculations:

See **Renewable / Distributed Energy Measures Calculations Appendix** for detailed financial summary and proposed solar layout areas.

Energy Savings Summary:

REM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,585,620
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,585,620
Maintenance Savings ($/Yr):	$76,308
Energy Savings ($/Yr):	$40,770
Total Yearly Savings ($/Yr):	$117,078
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.5
Simple Lifetime ROI	10.8%
Simple Lifetime Maintenance Savings	$1,144,621
Simple Lifetime Savings	$1,756,175
Internal Rate of Return (IRR)	1%
Net Present Value (NPV)	($187,946.25)

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 which saves the monitor screen not energy.

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

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Bergen County - Voting Machine Warehouse

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 ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	Lighting Upgrade	$3,242	$4,863	$240	$7,865	$1,419	$10	$1,428	15	$21,424	$145	172.4%	5.5	16.27%	$9,185.94
ECM #2	Lighting Controls Upgrade	$3,850	$5,775	$730	$8,895	$1,992	$0	$1,992	15	$29,884	$0	236.0%	4.5	21.14%	$14,888.25
ECM #3	Demand Controlled Ventilation	$37,000	$0	$0	$37,000	$2,794	$0	$2,794	15	$41,913	$0	13.3%	13.2	1.60%	($3,643.41)
ECM #4	Premium Efficiency Motors	$5,120	$0	$200	$4,920	$388	$0	$388	15	$5,816	$0	18.2%	12.7	2.17%	($291.06)
ECM #5	Loading Dock Doors Weatherstripping	$500	$0	$0	$500	$702	$0	$702	15	$10,529	$0	2005.7%	0.7	140.38%	$7,879.27
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Solar Photovoltaic System	$1,585,620	$0	$0	$1,585,620	$40,770	$76,308	$117,078	15	$1,756,175	$1,144,621	10.8%	13.5	1.31%	($187,946.25)

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* .

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
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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 February, 2010:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2004

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
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2004

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, AFUE ≥ 92%

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
Gas Fired Tankless Water Heaters	$300 per unit

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-2 lamps) $30 per fixture (3-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
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
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

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
Daylight Dimming - office	$50 per fixture controlled

Premium Motors

Three-Phase Motors	$45 - $700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	$40 per electronic communicated motor

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
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 a IRR of at least 10%.
Multi Measures Bonus	15%

STATEMENT OF ENERGY PERFORMANCE

Bergen County - Voting Machine Warehouse

Not able to generate report due to incomplete utility data.

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Voting Machine Warehouse

Packaged AC Units

Tag	Main AC Units #1&2	Office Area AC Unit	Window Unit
Unit Type	Packaged AC units	Packaged AC unit	Window AC Unit
Qty	2	1	1
Location	Ground mounted on frame	Ground mounted on frame	IT room
Area Served	Main warehouse area	Offices	IT room
Manufacturer	TRANE	Carrier	Fedders
Model #	YCH360AEHY2A2DE1AB0D0000000M000	38ARZ008---511--	-
Serial #	C08G07075, C08G07076	1109G50017	-
Cooling Type	Direct expansion	Direct Expansion	Direct Expansion
Cooling Capacity (Tons)	30	90 MBH	10,000 BTU/hr
Cooling Efficiency (SEER/EER)	11 SEER (est)	10.6 EER	7.4 EER
Heating Type	Natural gas	None	-
Heating Input (MBH)	600	-	-
Efficiency	81%	-	-
Fuel	Natural gas		-
Approx Age	2	2	20
ASHRAE Service Life	15	15	15
Remaining Life	13	13	-
Comments	Units are new and in excellent condition	Indoor unit: 40RM-008-B611HC, 3HP supply fan	Very old and inefficient unit

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Voting Machine Warehouse

Boilers

Tag	Boiler-1		
Unit Type	Water tube hot water boiler		
Qty	1		
Location	Boiler room		
Area Served	Perimeter baseboard heaters		
Manufacturer	Utica Boilers		
Model #	MGB250HID		
Serial #	UJE29362		
Input Capacity (MBH)	250		
Rated Output Capacity (MBH)	205		
Approx. Efficiency %	82%		
Fuel	Natural Gas		
Approx Age	2		
ASHRAE Service Life	30		
Remaining Life	28		
Comments	3 heeting zones		

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Voting Machine Warehouse

Domestic Water Heaters

Tag	HWH-1		
Unit Type	Tank		
Qty	1		
Location	Custodial room		
Area Served	Bathrooms and custodial sinks		
Manufacturer	Rheem		
Model #	22V50F1		
Serial #	RHLN0410543461		
Size (Gallons)	50		
Input Capacity (MBH/KW)	38 MBH		
Recovery (Gal/Hr)	-		
Efficiency %	80%		
Fuel	Natural Gas		
Approx Age	1		
ASHRAE Service Life	12		
Remaining Life	11		
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Voting Machine Warehouse

Pumps

Tag	HWP		
Unit Type	Hot Water Circulator		
Qty	1		
Location	Boiler room		
Area Served	Heating hot water loop		
Manufacturer	-		
Model #	-		
Serial #	-		
Horse Power	Fractional		
Flow	-		
Motor Info	-		
Electrical Power	-		
RPM	-		
Motor Efficiency %	-		
Approx Age	2		
ASHRAE Service Life	20		
Remaining Life	18		
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

Bergen County - Voting Machine Warehouse

Unit Heaters

Tag	UH		
Unit Type	Gas fired unit heaters		
Qty	4		
Location	Main warehouse		
Area Served	Main warehouse		
Manufacturer	Reznor		
Model #	F50-3		
Serial #	-		
Input Capacity (MBH)	50		
Rated Output Capacity (MBH)	41		
Approx. Efficiency %	82%		
Fuel	Natural Gas		
Approx Age	10		
ASHRAE Service Life	30		
Remaining Life	20		
Comments	Used only for emergencies		

Investment Grade Lighting Audit

CEG Job #: 9C10085

Project: Bergen County - Voting Machine Warehouse
600 Gotham Pkwy
Carlstadt, NJ, 07072

Bldg. Sq. Ft. 34,980

Bergen County - Voting Machine Warehouse

KWH COST: $0.187

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.14	Warehouse	2500	174	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., No Lens	107	18.62	46,545.0	$8,703.92	174	4	Relamp - Sylvania Lamp FO28/841/SS/ECO	98	17.05	42630	$7,971.81	$28.00	$4,872.00	1.57	3915	$732.11	6.65
221.34	Workshop Area	2500	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.12	290.0	$54.23	2	2	Relamp - Sylvania Lamp FO28/841/SS/ECO	50	0.10	250	$46.75	$14.00	$28.00	0.02	40	$7.48	3.74
612.2	Boiler Room	500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	50.0	$9.35	1	1	(1) 26w CFL Lamp	26	0.03	13	$2.43	$20.00	$20.00	0.07	37	$6.92	2.89
128.341	Workshop Area	2500	4	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Pandant Mnt., No Lens	130	0.52	1,300.0	$243.10	4	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.39	980	$183.26	$100.00	$400.00	0.13	320	$59.84	6.68
128.141	Director's Office	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650.0	$121.55	2	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.20	490	$91.63	$100.00	$200.00	0.06	160	$29.92	6.68
128.141	Office	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650.0	$121.55	2	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.20	490	$91.63	$100.00	$200.00	0.06	160	$29.92	6.68
142.21	Closet	500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	78.0	$14.59	1	3	3 Lamp , FO28, T8, Elect. Ballast, Specular Reflector; retrofit	72	0.07	36	$6.73	$100.00	$100.00	0.08	42	$7.85	12.73
142.21	Men's Room	2500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	390.0	$72.93	1	3	3 Lamp , FO28, T8, Elect. Ballast, Specular Reflector; retrofit	72	0.07	180	$33.66	$100.00	$100.00	0.08	210	$39.27	2.55
142.21	Ladies Room	2500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	390.0	$72.93	1	3	3 Lamp , FO28, T8, Elect. Ballast, Specular Reflector; retrofit	72	0.07	180	$33.66	$100.00	$100.00	0.08	210	$39.27	2.55
612.2	Corridor	2500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	250.0	$46.75	1	1	(1) 26w CFL Lamp	26	0.03	65	$12.16	$20.00	$20.00	0.07	185	$34.60	0.58
142.21	Storage	500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	78.0	$14.59	1	3	3 Lamp , FO28, T8, Elect. Ballast, Specular Reflector; retrofit	72	0.07	36	$6.73	$100.00	$100.00	0.08	42	$7.85	12.73
128.141	General Office	2500	1	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.13	325.0	$60.78	1	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.10	245	$45.82	$100.00	$100.00	0.03	80	$14.96	6.68
612.2	Vestibule	2500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	250.0	$46.75	1	1	(1) 26w CFL Lamp	26	0.03	65	$12.16	$20.00	$20.00	0.07	185	$34.60	0.58
612.2	Entry - Outside	2500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	250.0	$46.75	1	1	(1) 26w CFL Lamp	26	0.03	65	$12.16	$20.00	$20.00	0.07	185	$34.60	0.58
602	Exit Sign	8760	1	2	Incandescent Exit Sign	20	0.02	175.2	$32.76	1	1	LED Exit Sign	2	0.00	17.52	$3.28	$65.00	$65.00	0.02	157.68	$29.49	2.20
128.141	Lunch room	2500	1	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.13	325.0	$60.78	1	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.10	245	$45.82	$100.00	$100.00	0.03	80	$14.96	6.68
101	Kitchen	1000	1	2	2', 2-Lamp, 20w T12, Mag. Ballast, Surface Mount, Prismatic lens	42	0.04	42.0	$7.85	1	2	Reballast & Relamp; 17w T8 Elec. Ballast	33	0.03	33	$6.17	$60.00	$60.00	0.01	9	$1.68	35.65
128.141	Work Shop	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650.0	$121.55	2	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.20	490	$91.63	$100.00	$200.00	0.06	160	$29.92	6.68
128.141	Storage	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650.0	$121.55	2	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.20	490	$91.63	$100.00	$200.00	0.06	160	$29.92	6.68

Investment Grade Lighting Audit

ECM #1: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
128.141	Spray Area	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650.0	$121.55	2	4	(2) 8' Lamps to (4) 4' Lamps - FO28, T8, Elect Ballast; retrofit	98	0.20	490	$91.63	$100.00	$200.00	0.06	160	$29.92	6.68
142.11	Shower Area	2500	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.47	1,170.0	$218.79	3	3	3 Lamp , FO28, T8, Elect. Ballast, Specular Reflector; retrofit	72	0.22	540	$100.98	$100.00	$300.00	0.25	630	$117.81	2.55
228.34	Warehouse	2500	7	2	8' Channel, 2 Lamp 32W T8	124.2	0.87	2,173.5	$406.44	7	4	Retrofit - 4 Lamp Sylvania FO28/841/SS/ECO	98	0.69	1715	$320.71	$100.00	$700.00	0.18	458.5	$85.74	8.16
	Totals		212	52				57,332	$10,721	212	64			20.0	49,746	$9,302		$8,105	3.2	7,586	$1,419	5.71

CEG Job #:
Project: **Bergen County - Voting Machine Warehouse**
Address: **600 Gotham Pkwy**
Carlstadt, NJ, 07072
Building SF: **34,980**

Bergen County - Voting Machine Warehouse

KWH COST: **$0.187**

Remote Mnt.

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS											SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
242.14	Warehouse	2500	174	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., No Lens	107	18.62	46545	$8,703.92	174	15	Dual Tech. Occupancy Sensor w/2 Pole Powerpack Remote Mnt.	107	18.62	20%	37236	$6,963.13	$500	$7,500.00	0	9309	$1,740.78	4.31
221.34	Workshop Area	2500	2	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.12	290	$54.23	2	0	No Change	58	0.12	0%	290	$54.23	$0	$0.00	0	0	$0.00	0.00
612.2	Boiler Room	500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	50	$9.35	1	0	No Change	100	0.10	0%	50	$9.35	$0	$0.00	0	0	$0.00	0.00
128.341	Workshop Area	2500	4	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Pandant Mnt., No Lens	130	0.52	1300	$243.10	4	1	Dual Tech. Occupancy Sensor w/2 Pole Powerpack Remote Mnt.	130	0.52	20%	1040	$194.48	$500	$500.00	0	260	$48.62	10.28
128.141	Director's Office	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650	$121.55	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	130	0.26	20%	520	$97.24	$125	$125.00	0	130	$24.31	5.14
128.141	Office	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650	$121.55	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	130	0.26	20%	520	$97.24	$125	$125.00	0	130	$24.31	5.14
142.21	Closet	500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	78	$14.59	1	0	No Change	156	0.16	0%	78	$14.59	$0	$0.00	0	0	$0.00	0.00
142.21	Men's Room	2500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	390	$72.93	1	0	No Change	156	0.16	0%	390	$72.93	$0	$0.00	0	0	$0.00	0.00
142.21	Ladies Room	2500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	390	$72.93	1	0	No Change	156	0.16	0%	390	$72.93	$0	$0.00	0	0	$0.00	0.00
612.2	Corridor	2500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	250	$46.75	1	0	No Change	100	0.10	0%	250	$46.75	$0	$0.00	0	0	$0.00	0.00
142.21	Storage	500	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.16	78	$14.59	1	0	No Change	156	0.16	0%	78	$14.59	$0	$0.00	0	0	$0.00	0.00
128.141	General Office	2500	1	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.13	325	$60.78	1	0	No Change	130	0.13	0%	325	$60.78	$0	$0.00	0	0	$0.00	0.00
612.2	Vestibule	2500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	250	$46.75	1	0	No Change	100	0.10	0%	250	$46.75	$0	$0.00	0	0	$0.00	0.00
612.2	Entry - Outside	2500	1	1	Pendant Mnt., 100w A19 Lamp	100	0.10	250	$46.75	1	0	No Change	100	0.10	0%	250	$46.75	$0	$0.00	0	0	$0.00	0.00
602	Exit Sign	8760	1	2	Incandescent Exit Sign	20	0.02	175.2	$32.76	1	0	No Change	20	0.02	0%	175.2	$32.76	$0	$0.00	0	0	$0.00	0.00

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
128.141	Lunch room	2500	1	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.13	325	$60.78	1	0	No Change	130	0.13	0%	325	$60.78	$0	$0.00	0	0	$0.00	0.00
101	Kitchen	1000	1	2	2', 2-Lamp, 20w T12, Mag. Ballast, Surface Mount, Prismatic lens	42	0.04	42	$7.85	1	0	No Change	42	0.04	0%	42	$7.85	$0	$0.00	0	0	$0.00	0.00
128.141	Work Shop	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650	$121.55	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	130	0.26	20%	520	$97.24	$125	$125.00	0	130	$24.31	5.14
128.141	Storage	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650	$121.55	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	130	0.26	20%	520	$97.24	$125	$125.00	0	130	$24.31	5.14
128.141	Spray Area	2500	2	2	8' Channel, 2 Lamp, 60w T12, Mag. Ballast, Surface Mnt., No Lens	130	0.26	650	$121.55	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	130	0.26	20%	520	$97.24	$125	$125.00	0	130	$24.31	5.14
142.11	Shower Area	2500	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.47	1170	$218.79	3	0	No Change	156	0.47	0%	1170	$218.79	$0	$0.00	0	0	$0.00	0.00
228.34	Warehouse	2500	7	2	8' Channel, 2 Lamp 32W T8	124.2	0.87	2173.5	$406.44	7	2	Dual Tech. Occupancy Sensor w/2 Pole Powerpack Remote Mnt.	124.2	0.87	20%	1738.8	$325.16	$500	$1,000.00	0	434.7	$81.29	12.30
	Totals		212	52			23.2	57,331.7	$10,721	212	23			23.2		46,678.0	$8,728.79		$9,625	0	10,654	$1,992	4.83

Project Name: LGEA Solar PV Project - Voting Machine Warehouse
Location: Carlstadt, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$1,585,620
Annual kWh Production	218,023
Annual Energy Cost Reduction	$40,770
Annual SREC Revenue	$76,308
First Cost Premium	**$1,585,620**
Simple Payback:	**13.54** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.187**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$1,585,620	0	0	0	$0	(1,585,620)	0
1	$0	218,023	$40,770	$0	$76,308	$117,078	($1,468,542)
2	$0	216,933	$41,993	$0	$75,927	$117,920	($1,350,622)
3	$0	215,848	$43,253	$0	$75,547	$118,800	($1,231,822)
4	$0	214,769	$44,551	$0	$75,169	$119,720	($1,112,102)
5	$0	213,695	$45,887	$2,201	$74,793	$118,480	($993,622)
6	$0	212,627	$47,264	$2,190	$74,419	$119,493	($874,129)
7	$0	211,564	$48,682	$2,179	$74,047	$120,550	($753,579)
8	$0	210,506	$50,142	$2,168	$73,677	$121,651	($631,928)
9	$0	209,453	$51,647	$2,157	$73,309	$122,798	($509,130)
10	$0	208,406	$53,196	$2,147	$72,942	$123,991	($385,138)
11	$0	207,364	$54,792	$2,136	$72,577	$125,233	($259,905)
12	$0	206,327	$56,436	$2,125	$72,214	$126,525	($133,380)
13	$0	205,295	$58,129	$2,115	$71,853	$127,868	($5,513)
14	$0	204,269	$59,873	$2,104	$71,494	$129,263	$123,750
15	$0	203,248	$61,669	$2,093	$71,137	$130,712	$254,462
16	$0	202,231	$63,519	$2,083	$70,781	$132,217	$386,679
17	$0	201,220	$65,424	$2,073	$70,427	$133,779	$520,458
18	$0	200,214	$67,387	$2,062	$70,075	$135,400	$655,858
19	$0	199,213	$69,409	$2,052	$69,725	$137,081	$792,939
20	$0	198,217	$71,491	$2,042	$69,376	$138,825	$931,764
21	$1	197,226	$73,636	$2,031	$69,029	$140,633	$1,072,398
22	$2	196,240	$75,845	$2,021	$68,684	$142,507	$1,214,905
23	$3	195,259	$78,120	$2,011	$68,340	$144,449	$1,359,354
24	$4	194,282	$80,464	$2,001	$67,999	$146,461	$1,505,816
25	$5	193,311	$82,878	$1,991	$67,659	$148,545	$1,654,361
	Totals:	5,135,739	$1,486,455	$43,983	$1,797,509	$3,239,981	$763,333
				Net Present Value (NPV)			**$1,654,386**
				Internal Rate of Return (IRR)			**6.1%**

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Voting Machine Warehouse	12,500	Sunpower SPR230	766	14.7	11,263	176.18	218,023	25,278	15.64

.= Proposed PV Layout

Notes:

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

PVWatts

AC Energy & Cost Savings

Cautions for Interpreting the Results

(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	176.2 kW
DC to AC Derate Factor:	0.810
AC Rating:	142.7 kW
Array Type:	Fixed Tilt
Array Tilt:	12.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.67	11919	1334.93
2	3.41	13887	1555.34
3	4.37	19142	2143.90
4	5.24	21635	2423.12
5	5.86	24578	2752.74
6	6.13	23862	2672.54
7	6.06	24144	2704.13
8	5.56	22282	2495.58
9	4.91	19309	2162.61
10	3.84	15955	1786.96
11	2.74	11329	1268.85
12	2.32	9980	1117.76
Year	4.43	218023	24418.58

Output Hourly Performance Data

About the Hourly Performance Data

Output Results as Text

Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

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