Gloucester Township

Energy Master Plan

Prepared for Gloucester Township

1261 Chews Landing Road

Laurel Springs, NJ 08021

Prepared By:

BlueSkyPower

Waterfront Technology Center

200 Federal Street, Suite 435

Camden, NJ 08103

Executive Summary

Blue Sky Power serves Gloucester Township (the “Township”) as its Energy Consultant and was tasked by Mayor David R. Mayer and the Township in 2010 to develop a comprehensive energy master plan for the Township to include standard energy conservation measures and cost saving strategies, as well as innovative clean energy and energy efficiency projects and creative energy procurement strategies. This significant undertaking included in-depth regulatory research and analysis, design of institutional scale and utility scale clean energy systems and energy efficiency projects, extensive financial modeling and proposal of creative finance structures, and analysis of energy procurement strategies. The result is the Gloucester Township Energy Master Plan (“GTEMP”).

The Township has been a state-wide leader on environmental issues and is taking significant action to improve the lives of Gloucester Township residents, increase business opportunities and reduce government spending. The Township has recently adopted strategies and practices to make Gloucester Township a Sustainable Jersey certified community.

The organization of the Township’s Energy Master Plan is addressed in the following detailed sections:

- Assessment of Facilities
- Assessment of Properties
- Energy Procurement
- Clean Energy Capital Projects
- Clean Energy Production
- Capital Project Financing

The Township has been proactively managing its energy costs by taking the necessary steps to implementing energy conservation measures in many of its buildings. Earlier this year, Concord Engineering Group (“CEG”) developed an Energy Audit of Gloucester Township and Black Horse Pike Regional School District facilities, which is the first step in a long process of becoming a Sustainable Energy municipality. Certain conservation measures are identified in this plan that will assist the Township in maximizing its energy efficiency.

Most recently, the Township has taken the next step in Energy Savings Improvement Program (“ESIP”) by engaging CEG to develop an Energy Savings Plan, in which the Township will identify the Energy Conservation Measures to be implemented, the available finance structures and the plan for implementing such projects. In order to achieve greater savings through aggregation, the Township is pursuing the Energy Savings Improvement Program in conjunction with Black Horse Pike Regional School District.

As energy prices continue to rise, budgeting for energy costs is unpredictable for municipalities. The Township has taken the necessary steps to reduce energy costs and as a result will lower greenhouse gas emissions, making Gloucester Township a healthier and more productive community. The Township has upgraded some of its lighting fixtures to the highly efficient T-8 lights in the Municipal Complex. Blue Sky Power has assisted the Township in understanding its energy demands and guided the Township in the proper implementation of projects for major Township facilities, available properties and current residents. All of the projects and plans in the Gloucester Township Energy Master Plan will have a lasting effect on future generations by reducing Gloucester Township's carbon footprint while saving money.

Within Gloucester Township, there are multiple large properties that have been analyzed for solar energy generating potential. There are two sizeable landfills along with 2 N.I.K.E. missile base sites with optimal typography for a solar system installation. The landfills within the Township are Owens Corning located in Chews Landing off of Somerdale Road and GEMS landfill located in Erial, situated off of Hickstown Road. Additionally, there are two (2) former N.I.K.E Missile bases in the Township located on the eastern edge of the Township along Cross Keys Road. The solar systems proposed for each site range from 4.5 megawatts (MW) to 10 MW. These systems could potentially be connected to the "Grid" or to a suitable end user.

Gloucester Township is rapidly becoming a regional leader in clean energy and energy efficiency and is creating a model sustainable community. The Mayor's vision for Sustainable Gloucester Township is being achieved through implementation of solar projects and energy savings improvements for Township and School District facilities, as well as active community engagement, making Gloucester Township clean, sustainable and vibrant community.

1 Introduction

This Energy Master Plan serves as the benchmark for Gloucester Township's development of a brighter more sustainable future with the efficient procurement of clean energy. This Plan advances the Township's goal of becoming a Sustainable Community by implementing certain short and long-term objectives.

The Township is located in Camden County, New Jersey. Recorded by the census of 2000, the Township has 64,350 people, 23,150 households and 16,876 families residing in the township. Gloucester Township borders Winslow Township, Gloucester County, Runnemede, and Somerdale.

Gloucester Township has a total area of 23.3 square miles of which .1 square miles comprises water. Within the Township, there are two major highways that stretch throughout the township, route 42 and 168. These key sources of commuter traffic allow residents to travel to highly metropolitan areas such like; Philadelphia, about 10 miles west and Atlantic City, about 25 miles east.

This EMP coincides with the Township's sustainability program and is based on economic capability, public accountability, and environmental obligation. This plan establishes the Township's energy goals that the Mayor, Council and Township residents can work together to implement in order to save energy, save money and reduce the Township's carbon footprint.

Concurrently with the development of this Energy Master Plan, the Township conducted an Energy Audit of their current facilities with Concord Engineering Group. In the audit, Concord provides the Township with key recommendations to assist in the management and control of its energy usage by vertically integrating conservation measures for the short term and long-term. This Energy Master Plan serves as a guide for the Township in undertaking clean energy projects, so that it can reduce energy costs and help the local community prosper.

The facilities and properties listed below constitute the Township's structural and operational framework for which this EMP details clean energy production, energy consumption and greenhouse gas emissions. The EMP also identifies measures to be prioritized and implemented by the Township over a planned period of time to achieve its energy and environmental goals.

The energy consumption analysis explained in this Energy Master Plan is based on approximately one fiscal year's data.

1.1 Facilities & Properties Being Assessed in the EMP

In this plan there is a detailed analysis of the Township's facilities and properties along with, the Gloucester Township Public School system and the Black Horse Pike School District.

In this EMP, analysis will be provided on a majority of Gloucester Township's owned and operated facilities, such as:

- Library
- Recreation Center
- Senior Community Center
- Academy Hall
- Municipal Building
- Public Work Building
- Monroe Drive Swimming Facility

In January of 2010, Blue Sky Power delivered a solar feasibility report to the GTMUA on financing options in conjunction with a properly sized solar system to be installed at the MUA.

- Gloucester Township MUA

The Black Horse Pike Regional School District high schools located in Gloucester Township are listed below:

- Triton Regional High School
- Timber Creek Regional High School
- Highland Regional High School

Gloucester Township Public Schools and administrative buildings are listed below:

- Ann Mullen Middle School
- Blackwood Elementary School
- Chews Elementary School
- C.W. Lewis Middle School
- Erial Elementary School
- Glen Landing Middle School
- J.W. Lilley Elementary School
- Loring-Flemming Elementary School

Along with the Township facilities, the following Township properties are assessed herein:

- Owens Corning Landfill
- Gems Landfill Site
- Nike Air Force Base

There is greater detail within this EMP describing the benefits involved with developing and implementing sustainable measures on municipal properties. In regards to Gloucester Township Public Schools, during the EMP drafting, an energy audit was not performed detailing the buildings current structure and energy consuming appliances. Concerning the Township Schools, Blue Sky Power's feasibility study has been used to identify potential Renewable Energy Measures or Solar Generation on the Public Schools listed above.

Following each facility and property there are satellite images of the buildings and landfill properties with conceptualized solar panel installation drawings. Blue Sky Power in collaboration with its engineers and facility supervisors has drawn up potential solar array proposals on numerous sites. These concepts are still in the planning stage and could be subject to change in the future to fit the scope of the Township's solar energy projects.

1.2 New Jersey's Draft Energy Master Plan

After the early effects of an oil crisis in 1970, it became law by the State that New Jersey regulatory addresses the production, distribution, consumption and conservation of energy in New Jersey. The plan calls for long-term objectives and immediate measures to be acted upon to stay consistent with the implementation of select goals identified in the New Jersey Energy Master Plan. The goals identified in the New Jersey Energy Master Plan are as follows:

1. Maximize Energy conservation and energy efficiency;
2. Reduce peak electricity demand;
3. Strive to exceed the current RPS and meet 30% of the State's electricity needs from renewable sources by 2020.
4. Develop a 21st century energy infrastructure.
5. Invest in innovative clean energy technologies and businesses to stimulate the industry's growth in New Jersey.

In the summer of 2011, current Governor Chris Christie drafted the new Energy Master Plan with new state goals and energy standards. During the summer months, Energy Master Plan hearings were assembled where residents and business owners had the opportunity to voice their opinions to appointed officials about the Draft 2011 Energy Master Plan. Below is a list of Christie's administrations' new energy goals:

1. Drive down the cost of energy for all customers;

2. Promote a diverse portfolio of new, clean, in-State generation;\
3. Reward energy efficiency and energy conservation and reduce peak demand;
4. Capitalize on emerging technologies for transportation and power production; and
5. Maintain support for the renewable energy portfolio standard of 22.5% of energy from renewable sources by 2021.

Note that the Energy Master Plan administered by Governor Christie is still temporarily a Draft. The goals set will play a significant part on Gloucester Township's future moving forward on becoming energy independent and the promotion of clean energy production.

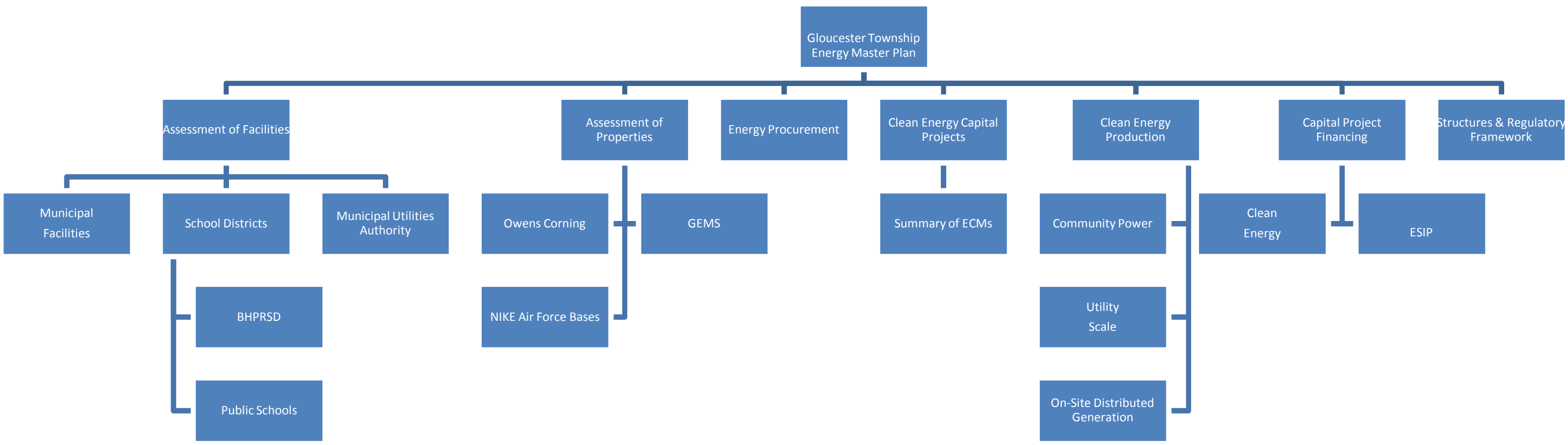
1.3 Energy Master Plan Goals

The mission of the Township is to remain proactive in concentrating its efforts to reduce energy costs and the carbon footprint of its facilities, properties and institutions. This plan explores immediate opportunities while taking into account the Township's long-term sustainability goals.

- Reduce the reliance and demand on energy costs incurred by non-renewable energy sources;
- Increase the use of clean energy sources, thus reducing energy costs and emissions;
- Apply energy conservation measures throughout numerous facilities;
- reduce greenhouse gas emissions;
- Empower the Township's Green Team to build a community that is knowledgeable about energy conservation and creating a healthier environment

The goals listed above will help guide not only the Township but also the citizens of the community toward a sustainable and eco-friendly environment.

1.4 Energy Master Plan Structure



1.5 Key Terms

<u>PPA ("Power Purchase Agreement")</u>

A Power Purchase Agreement ("PPA") is a long-term agreement to buy power from a company/developer that produces electricity. Developers pay the upfront costs of solar projects in exchange for a contract requiring the customer ("end user") to buy the resulting electricity. Majority PPA agreemnts are compromised at a fixed rate with an annual escelator. Power Purchase Agreement escalators are a lower percentage rate increase than the current trend with the current public utilities. The developer that pays for the solar panel installation also owns, operates and maintains the system. The terms of the PPA usually stipulate that the developer will retain the SRECs and benefit from federal tax credits to offset the cost of the solar panel system. With the assistance of the benefits, the developer can provide electricity to the end user at a discounted rate. The PPA is negotiated and is a stable long-term low rate that will benefit both parties. The end user benefits from a low rate of electricity that would increase slower than the historical inflation rate by a typical utility. A PPA usually ranges form 15 to 25 years and the end user would have the option of buying the solar panel system for fair market value at any time in the agreement.

Net Metering

A popular mechanisim utilized to generate cost savings from solar panel installations is Net Metering. In the case of Net Metering, the solar panel system would be fit to the facilities consumption off an annual basis. In some circumstances the system might generate more energy needed than the end user consumes, so the electric meter runs backwards. This results in energy being provided back to the grid and will result in the utility company providing the customer with credits for the extra generated supply. These credits can be used by customers as needed.

In regards to this Master Plan for Gloucester Township, many of the discussed facilities and sites will unlikely have the oppurtunity to generated electricity to offset the current consumption. Note that it is very substantial for the Township to develop these conceptual solar panel systems at their facilities so that the Township can "LOCK" in a percentage of their load for the life of the system.

Photovoltaics

Photovoltaics are a method of generating electricial power by converting solar radiation into direct current ("DC") electricity by using semiconductors prompting the photovoltaic effect. Photovoltaics ("PV") are comprised of solar panels composed of a number of cells using the PV material. The three popular PV materials used right now from most effieicnet to least effieicnt are; monocrystalline silicon, polycrystalline silicon and thin-film conductors. According to CleanEdge.com, the current market for Solar Power is $36.1 billion and is projected to soar to $116.5 billion in 2019. Photovoltaiacs are accomodating to residential and commerical consumers for economical reasons but with new technologies PV systems consistenly become more effieicent.

2.0 Assessment of Facilities

In this section, Gloucester Township's facilities will be broken down with respect to the facility condition, office hours and daily usage, and recommended Energy Conservation Measures. Earlier this year, Gloucester Township received the services from Concord Engineering Group ("CEG") to execute an Energy Audit administered through the New Jersey Department of Clean Energy. CEG referenced each facility's yearly consumption to analyze daily usage and recommend certain ECMs or each location.

Seven properties owned and operated by the Township were identified by Concord Engineering Group to be deemed optimal for being audited. Locations owned and operated by the Township that have little usage throughout the year were disregarded to the Energy Audit and were not considered further. These properties are as listed below:

- Hickstown Gun Range
- Hickstown Park Building
- Gabriel Davies' Tavern
- Old Erial School / Point Erial Park

The recommended Energy Conservation Measures contained in the Energy Audit and the Gloucester Township Energy Master Plan can serve as a basis for drafting the Energy Savings Plan for implementation. If all Energy Conservation Measures were to be executed, a total annual savings of approximately $72,610 could be realized for the Township.

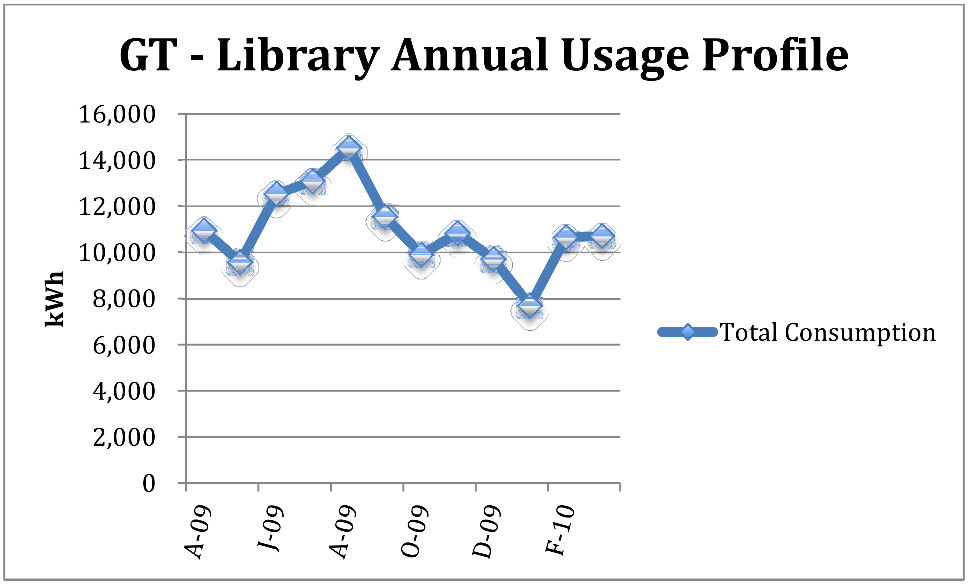
In general, Gloucester Township should take the opportunity to assemble a list of certain or all Energy Conservation Measures to implement at the facilities that the Township uses the most. The recommended ECMs may reduce annual consumption by approximately 25%; this figure being accelerated with the adoption of a Township energy management system that would be capable of automating a Township facility in real time.

2.1.1 Gloucester Township Library

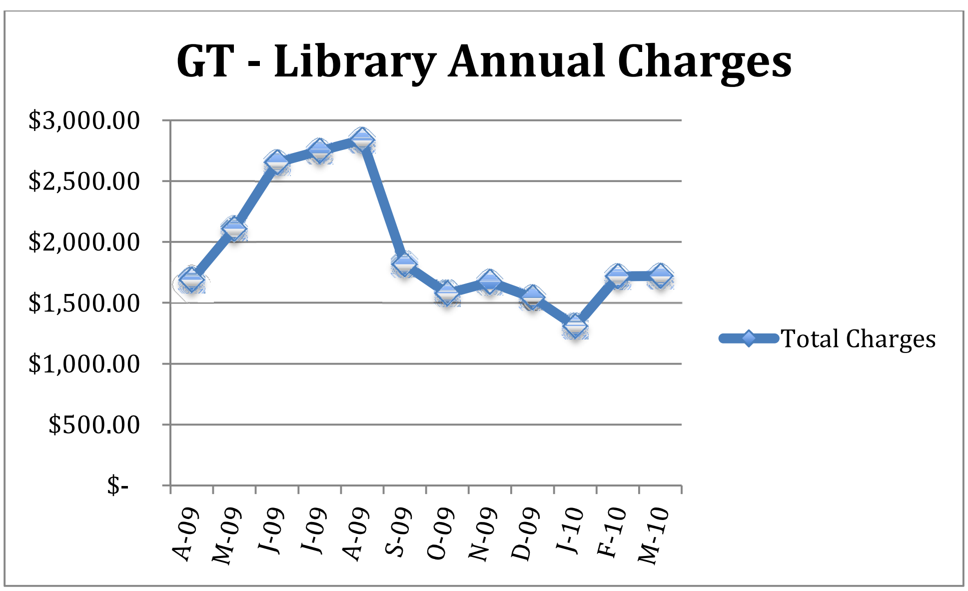
15 South Black Horse Pike

Gloucester Township, NJ 08012

Below is a line graph depicting the Gloucester Township Library's total electric consumption from April 21, 2009 to March 29, 2010.



Also relevant to the consumption is the total charges for the same months between April 21st and March 29th.



Energy Provider

Electricity – Public Service Electric & Gas

Natural Gas – South Jersey Natural Gas (GSG)

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	One story masonry facility totaling 9,868 sf. Construction in 1989, with no renovations.	Roof is flat, built up rubber roof where HVAC lays. Roof is insulated with 2"-5" of insulation.	Walls are brick faced with concrete block, with ¾" foam insulation.	Good condition and well maintained. Typical windows are double pane, ¼" clear glass with aluminum frames. Also office areas, windows are blinded.

Condition Assessment

Overall it looks to be in excellent condition.

	Description	Hours
Facility Use And Occupancy	Building serves as a public library with administrative offices.	Monday through Thursday 9:00 am and 9:00 pm. Friday and Saturday 9:00 am and 5:00 pm.

Major Energy Consuming Systems

Boiler Unit

The boiler is a gas-fired hot water boiler with an input of 325 MBH and an output of 256 MBH. This boiler has an efficiency of 80%.

Air Condition Unit

The Coleman model HHB, 20 ton split system condenser is located on the roof and serves a carrier indoor air handling unit. A non-programmable thermostat controls this 20-ton unit. A 5 ton packaged Carrier rooftop unit controls the meeting room within the library. This unit is split into two zones, with one damper in the supply ductwork and the other half for the meeting room.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters, these two bathrooms are controlled by a light switch versus the public bathroom wish is controlled by the main library relay.

HVAC System

The system is controlled by a non-programmable thermostat. These are two settings; occupied mode and unoccupied mode. Currently, the Library is not one of the buildings controlled via the building management system in the Department of Public Works. The hours set at the moment are for the hours of operation 9:00am to 9:00pm Monday through Thursday and 9:00am to 5:00pm on Fridays and Saturdays. The approx. temperature set points are 70°F for cooling and 72° for heating.

Domestic Water

The water provided to the restrooms are by (2) 12 gallon Bradford White electric hot water heaters, with a capacity of 1500 watts. The HWHs are close to the point of use.

Lighting

The majority of the lighting in the Library are 32-watt T-8 bulbs with electronic ballasts. But there are a few locations with T-12 lamps with magnetic ballasts. In certain locations throughout the Library there are incandescent lamps as well.

2.2.1a Recommended ECMs

Gloucester Township's Library was finished and operation in 1989. Instead of investing capital into renovating the building's walls and insulation, upgrades can be performed within the basic operations of the facility and savings could be realized.

Below depicts the summary of Energy Conservation Measures that were identified and the overall cost and savings could be realized with installation.

Energy Conservation Measures							
ECM #.	**Description**	**Net Installation Cost**	**Annual Savings**	**Simple Payback (yrs.)**	**Electric Demand (kW)**	**Electric Consumption (kWh)**	**Natural Gas (Therms)**
ECM #1	Lighting Upgrade	$4,273	$1,580	2.7	2.6	8,829	0
ECM #2	Lighting Controls	$260	$154	1.7	0	429	0
ECM #3	Computer Monitor Replacement	$800	$215	3.7	0.4	1,200	0
ECM #4	Condensing Boiler	$22,211	$515	43.1	0	0	305
ECM #5	AC Unit Replacements	$25,260	$1,568	16.1	7.3	8,762	0
ECM #6	Programmable Thermostats	$600	$1,605	0.4	0	0	0
Renewable Energy Measures (REM's)							
REM #1	77 kW Solar PV System	$697,590	$52,752	13.2	62.4	101,446	0

ECM #1: Lighting Upgrade

Description:

As stated before there are a few locations existing that use T-12 fixtures. The replacement of these lamps to T-8 lamps would enhance the lamp life to an approx. 30,000 burn hours from the existing 20,000 burn hours with a T-12 lamp. There are the options of rotating in the new efficient bulbs which are a 28-watt T-8 lamp, which is has the same output of light with less watt input.

NJ Smart Start Incentive – the replacement of T-12 lamps to T-8 or T-5 fixture warrants the following incentive: T-8 or T-5 (1-4 lamps) = $10/fixture.

Smart Start Incentive = (# of 1-4 lamp fixtures x $10)

= (5 fixtures x $10) = $50

ECM #2: Lighting Controls

Description:

For there to be a payback on lighting controls, rooms must be unoccupied for a span of 2 minutes or more. There are not many rooms in the library that endure this span than the meeting rooms or offices. So the implementation of lighting controls would result in an energy savings of 20%-28% annually to the Township.

NJ Smart Start Incentive – the installation of a lighting control device warrants the following incentive: Occupancy Sensor Wall Mounted (existing facility only) = $20 per sensor.

Smart Start Incentive = (# of wall mounted x $20)

= (2 x $20) = $40

ECM #3: Computer Monitor Replacement

Description:

The computers used throughout the facility are a mix between CRT computer monitors and LCD monitors. There are a lot of disadvantages to a CRT monitor, for instance increased energy consumption, uses a larger amount of desk space, poor image quality, high weight and electromagnetic emissions. According to the energy audit there are 23 LCD monitors and 8 CRT monitors. Along with the presence of CRT computers, most monitors are left on screen saver mode. This mode does not defer energy consumption only screen burn.

Energy Saving Calculations

No. of CRT Monitors : 8

Operation weeks/YR: 50

Hrs. per Week: 60(12 hours per day estimated average)

Electric Usage = # of Computers x Monitor Power (W) x Operation (Hrs.)

1000(W/KW)

Energy Cost = Electric Usage (kWh) x Ave Electric Cost ($/kWh)

Installation Costs: # Monitors X Cost per Monitor

8 Monitors X $100 per Monitor

= $800

Computer Monitor Calculations			
ECM Inputs	**Existing**	**Proposed**	**Savings**
ECM Inputs	CRT Monitors	LCD Monitor	
# of Computers	8	8	
Monitor Power Cons. (W)	75	25	
Operating Hrs./Week	60	60	
Operating Hrs./Year	50	50	

Elect Cost ($/kWh)	0.179	0.179	
Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
Electric Usage (kWh)	1,800	600	1,200
Energy Cost ($)	$322	$107	$215
COMMENTS:	CRT monitor energy consumption is based on Dell CRT Monitor M/N: CRT – E771MM.		

Concord Engineering Group, Inc. 9C10076 (Jan. 21, 2011 Draft)

ECM #4: Condensing Boiler Installation

Description:

The central heating system consists of one Weil Mclain cast iron boiler that serves the building's heating hot water loop through baseboards. The boiler is heated by natural gas. According to Concord Engineering Group, the boiler was installed in 1988 and has roughly 8 years remaining in service, which is typical for a cast iron boiler.

The new condensing boilers offered by many manufacturers improve the operating efficiency of the heating system up to 99%, depending on return water temperature. However, the operating conditions within the building are average the proposed condensing boiler would be at 88% efficient versus the current boiler which is at 78%.

The basis of this ECM is Aerco, Modulex series boiler model number MLX – 303 boiler or equal.

Installation of a new 303 MBH condensing boiler, demolition, boiler water piping modifications, gas piping modifications, electric etc. is estimated to be $22,741.

From the **NJ Smart Start Appendix**, the installation of new condensing boilers warrants the following incentive: $1.75 / MBH.

Smart Start Incentive = 1 x (boiler MBH x $1.75) = 1x(303 x $1.75)=$53

ECM #5: Air Conditioning Unit

Description:

As stated before the air-conditioned unit is a split system A/C unit and a packaged A/C unit. There is currently a 20-ton Carrier – 38AUZ system as well as a 5-ton Carrier – 48HC. This ECM only demands that the outdoor condensing units be replaced.

Energy Savings Calculations							
ECM Inputs	**Cooling Capacity, BTU/HR**	**Annual Cooling Hours**	**Existing Units EER**	**Split Units EER**	**# of Units**	**Energy Savings kWh**	**Demand Savings kW**
Coleman CU-1	240,000	1,200	8.8	11	1	6,545	5.5
Carrier RTU-1	60,000	1,200	9	12.45	1	2,217	1.8
TOTAL					**2**	**8,762**	**7.3**

Concord Engineering Group, Inc. 9C100076 (Jan. 21, 2011 Draft)

NJ Smart Start Program appendix states the replacement of split system A/C units and unitary systems with high efficiency A/C systems warrants incentives.

Summary of costs, savings and payback for this ECM is below.

Cost and Savings Summary							
ECM Inputs	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Savings**	**Pay Back Years**
Coleman CU-1	$18,200	1	$18,200	$1,580	$16,620	$1,172	14.2
Carrier RTU-1	$9,100	1	$9,100	$460	$8,640	$397	21.8
TOTAL		**2**	**$27,300**	**$2,040**	**$25,260**	**$1,568**	**16.1**

Concord Engineering Group, Inc. 9C10076 (Jan. 21, 2011 Draft)

ECM #6: Programmable Thermostats

Description:

The Library uses two thermostats, one for occupied hours and one for unoccupied hours. The meeting room utilizes a standalone non-programmable thermostat to control the heating and cooling set point these are held constant 24/7.

A programmable thermostat delivers energy savings by allowing the building to automatically adjust itself during the non-occupied and occupied times throughout the hours of operation. A great benefit with programmable thermostats is that during the summer, the thermostat will adjust itself during the non-occupied times close to the outside temperature, saving energy by reducing heat loss.

ECM #6 – Energy Savings Summary	
Installation Cost ($):	$600
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$600
Maintenance Savings ($/yr.)	$0
Energy Savings ($/yr.)	$1,605
Total Energy Savings ($/yr.)	$1,605
Estimated ECM Lifetime (YR):	15
Simple Payback	0.4
Simple Lifetime Savings	$24,075

2.2.1b Solar PV Proposal

Building	Roof Area (sf)	Panel	Qty	Panel sf	Panel Total sf	Total KWdc	Total Annual kWh	Panel Weight (33lbs)	W/sf
Gloucester Township Public Library	5500	Sunpower SPR 230	337	14.7	4,955	77.51	101,446	11,121	15.64

Total Construction Cost: $697,590

Annual kWh Production: 101,446

Annual Energy Cost Reduction: $17,246

Annual SREC Revenue: $35,506

Simple Payback 13.22 Years

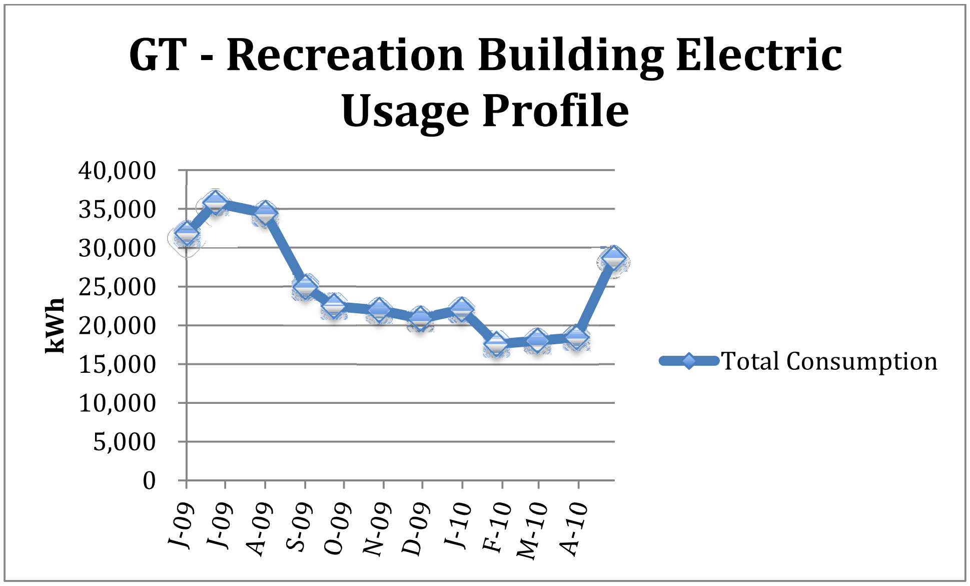
The numbers above reflect a 3% maintenance rate and a 3% energy cost escalation rate. Also the market value annual SREC revenue is factored back into the Simple Payback period as well.

2.1.2 Gloucester Township Recreation Center

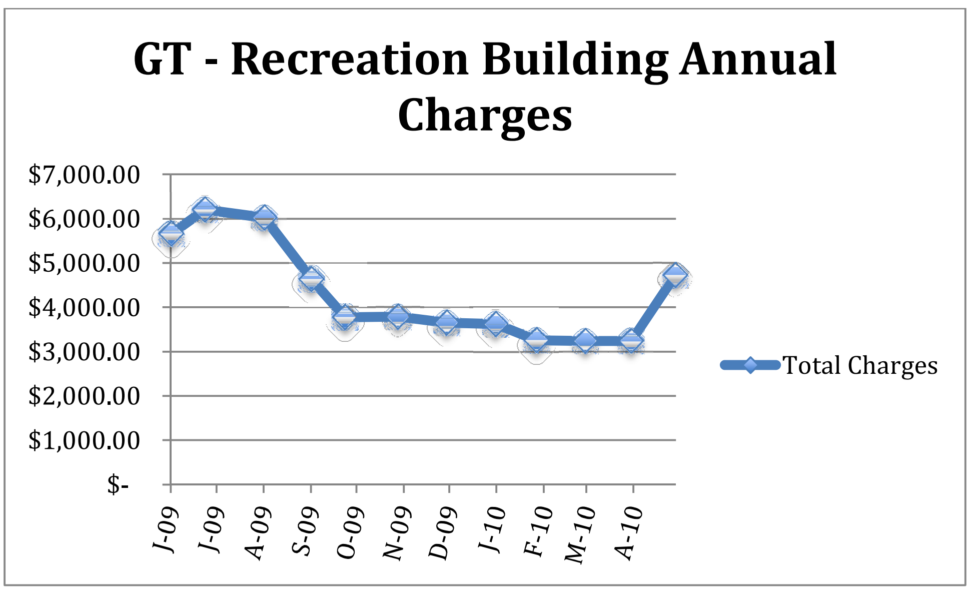
80 Broad Acre Drive

Gloucester Township, NJ 08012

Recorded by Blue Sky Power and with the help of the Township officials, the line graph bellow shows the annual consumption of electricity at the Recreation Facility, between the dates of June 8, 2009 to May 6, 2010.



Below are the annual charges for electricity at the Recreation Center.



Energy Provider

Electricity – Atlantic City Electric

Natural Gas – South Jersey Natural Gas

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	One story - 19,855 sf and was built in 1992 with no renovations.	Is a flopped A-frame style with metal seam roofing throughout.	Concrete block construction with stucco façade. Approx. insulation is 2 inches.	Good condition, well maintained. In the office, blinds are utilized.

Condition Assessment

The Recreation Center looks to be in great condition.

	Description	**Hours**
Facility Use And Occupancy	Building is used only during event, but serves as a daycare program during the week.	Monday through Thursday Daycare Average use/week 12 hrs. /day 4 days a week

Major Energy Consuming Systems

HVAC Systems

The system calls for two (2) large "King Air Systems" for the ice rink area and one (1) Lennox Pulse Air handling unit. The "King Air Systems" are paired with York condensing units outside the building for cooling. These cooling capacities hold approx. 20 tons, supplying 17,500 CFM of air to the space. These are fired by gas burners to head the location as well. The two (2) King Air Systems are in poor condition. The Lennox Pulse is located in the mechanical room and supplies the office area with 100 MBH and is paired with a condensing unit that provides 5 ½ tons of cooling. This system is in fair condition.

Exhaust System The exhaust system in the toilet rooms are controlled by the BMS within the Public Works Building, and is based off of the occupancy level.

Domestic Water The hot water for the restrooms is provided by a 40 gallon John Wood gas-fired hot water heater, with a capacity of 33,000 btu/h. The domestic hot water is not circulated throughout the building.

Lighting The recreation center is lit up by 34-watt T-12 fixtures with magnetic ballasts in the offices, lobby and mechanical rooms. The hockey rinks are lit up by a 400 watt MH lamp and the second is a 250 watt HPS lamp, lighting in the recreation center is inefficient.

2.2.2a Recommended ECMS

ECM Summary Table

Energy Conservation Measures							
ECM #.	**Description**	**Net Installation Cost**	**Annual Savings**	**Simple Payback (yrs.)**	**Electric Demand (kW)**	**Electric Consumption (kWh)**	**Natural Gas (Therms)**
ECM #1	Lighting Upgrade	$20,470	$16,108	1.3	29.4	101,461	0
ECM #2	Lighting Controls	$3,070	$1,555	2.0	28.9	97,972	0
ECM #3	Split System AC Upgrades	$42,780	$2,961	14.4	13.8	16,543	0

Concord Engineering Group, Inc. 9C10076 (Jan. 21st, 2011 Draft)

ECM #1: Lighting Upgrades

Description:

This ECM includes the replacement of all retrofit fixtures with magnetic ballasts to electric ballasts and T-8 lamps. Not only will it save on energy consumption, but the replacement of the existing T-12s to the T-8s will also save in maintenance costs.

Also this ECM requires the large indirect MH / HPS fixtures to be replaced with low bay T-8 fixtures and electronic ballasts. The exiting lighting fixtures are higher output lamps because the light is directed upward and reflected back down onto the rink. New low bay T-8 lamps will be able to provide equal light levels at a considerably less input wattage.

NJ Smart Start Incentive – the replacement of T-12 lamps to T-8 or T-5 fixture warrants the following incentive: T-8 or T-5 (1-4 lamps) = $10/fixture.

Smart Start Incentive = (# of 1-4 lamp fixtures x $10)

= (67 fixtures x $10) = $670

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on needlessly. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses.

This ECM involves the replacement of standard wall switches to sensor wall switches for the offices and break room. The savings resulting from this implementation for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

NJ Smart Start Incentive – the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Wall Mounted (existing facility only) = $20 / sensor

Occupancy Sensor Remote Mounted (existing facility only) = $35 / sensor

Smart Start Incentive = (# of wall mount x $20) + (# of ceiling mount x $35)

= (4 x $20) + (3 x $35) = $185

ECM #3: Air Conditioning Unit Upgrades

Description:

These air conditioning units are old and in need of replacement. The units that are in use are passed their ASHRAE service life and need to be replaced.

Implementation Summary					
ECM Inputs	**Service For**	**Number of Units**	**Cooling Capacity, BTU/hr.**	**Total Capacity, Tons**	**Replace Unit With**
Lennox CU-1	Lobby/office	1	60,000	5.0	5 Ton Trane – XL20i
York CU – 2,3	Ice Rink	2	240,000	40.0	20 Ton Carrier – 38AUZ
Total		**3**	**300,000**	**45**	

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2010 Draft)

Energy Savings Calculations							
ECM Inputs	**Cooling Capacity, BTU/HR**	**Annual Cooling Hours**	**Existing Units (S)EER**	**Split Unity (S)EER**	**# of Units**	**Energy Savings kWh**	**Demand Savings kW**
Lennox CU-1	60,000	1,200	10 SEER	16 SEER	1	2,700	2.3
York CU – 2,3	240,000	1,200	8.7 EER	11 EER	2	13,843	11.5
Total					**3**	**16,543**	**13.8**

Cost & Savings Summary							
ECM Inputs	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Saving**	**Pay Back Years**
Lennox CU - 1	$10,000	1	$10,000	$460	$9,540	$483	19.7
York CU – 2,3	$18,200	2	$36,400	$3,160	$33,240	$2,478	13.4
Total		**3**	**$46,000**	**$3,620**	**$42,780**	**$2,961**	**14.4**

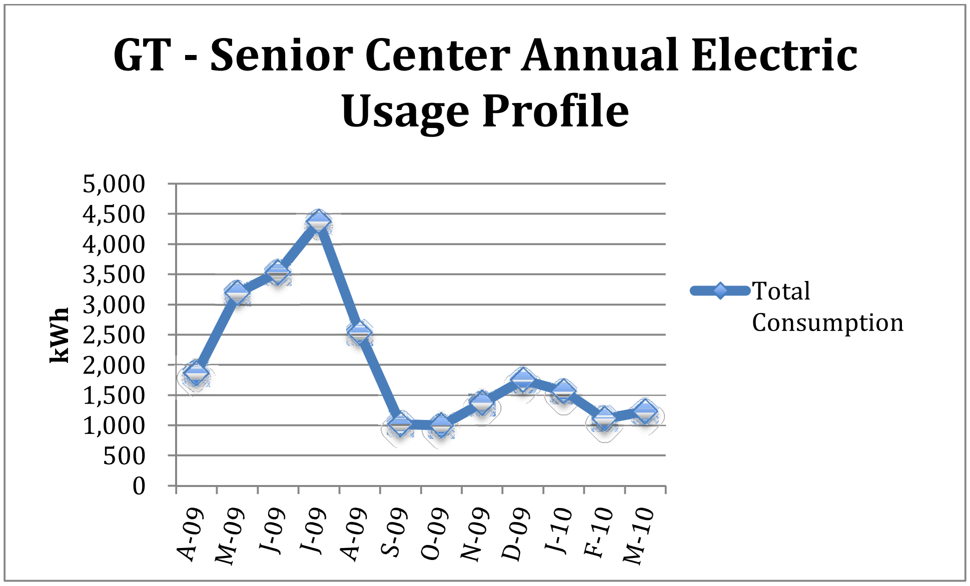
With the Pay Back period being so short on this ECM, it makes obvious sense for the party to replace both inefficient systems. Once again, the building itself is in great condition, so making adjustments to the infrastructure of the building would be highly beneficial.

2.1.3 Gloucester Township Senior Community Center

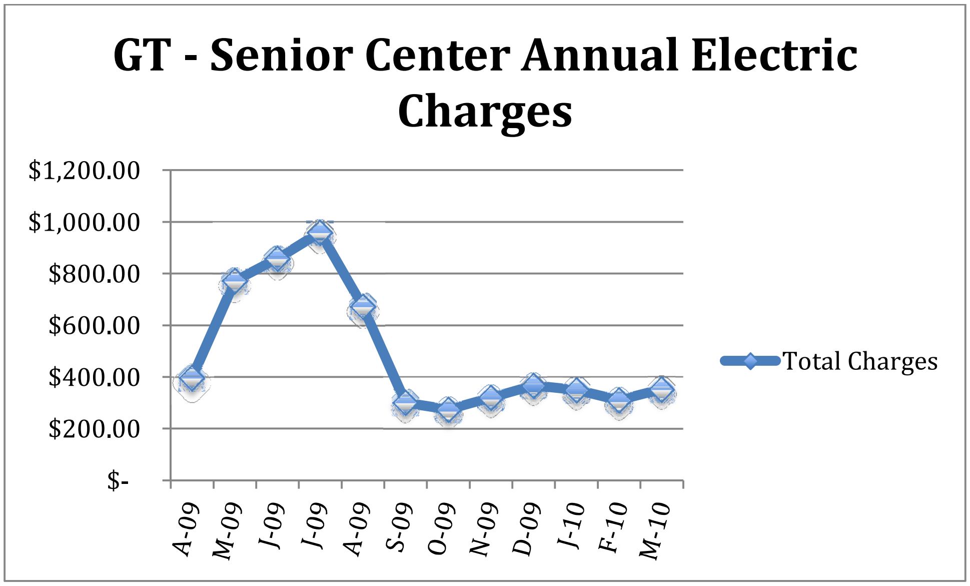
1261 Chews Landing Road

Gloucester Township, NJ 08012

The line graph preceding is a picture of the annual consumption at the Senior Center from April 18, 2009 to March 25, 2010.



Also involved in diagnosing a facility is to identify the annual charges per invoice to determine $/kWh.



Energy Provider

Electricity – Public Service Electric & Gas

Natural Gas – South Jersey Natural Gas

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	One story masonry building with 4,000 sf. Building was built in 1990, with no renovations.	Sloped shingled, shingled roof, which has bathroom and kitchen exhausters penetrating the roof.	Brick face with a concrete block construction.	Good condition, well maintained. Most windows are ¼' clear glass wood frames and single pane storm windows.

Condition Assessment

The Senior Community Center looks to be in great condition.

	Description	Hours
Facility Use And Occupancy	The building is typically used every other day for events. The building compromises of a kitchen, lobby, and a community room.	Every other day for 8 hours. Employs 2 people.

Major Energy Consuming Measures

HVAC System

The center is conditioned by two (2) Carrier gas furnaces and one (1) Carrier air conditioning only unit. The two indoor gas units have a 132 MBH input for heating and also have A-Coils installed which are connected to two (2) five ton condensing units located on the perimeter of the building. The single cooling Carrier unit is connected to a 5 ton condensing unit on the perimeter. This serves the senior center with the second stage of cooling.

Exhaust System The toilet room and kitchen is exhausted by the roof exhausters. Both rooms respectively are controlled manually.

Domestic Water The hot water for the restrooms and kitchen are provided by a 50-gallon State gas-fired hot water heater, with a capacity of 65 MBH.

Lighting The majority of the lighting in the Senior Center are 32-watt T-8 bulbs with electronic ballasts.

2.2.3a Recommended ECMS

ECM Summary Table

Energy Conservation Measures							
ECM #.	**Description**	**Net Installation Cost**	**Annual Savings**	**Simple Payback (yrs.)**	**Electric Demand (kW)**	**Electric Consumption (kWh)**	**Natural Gas (Therms)**
ECM #1	Lighting Upgrade	$860	$221	3.9	0.4	958	0
ECM #2	Lighting Controls	$245	$338	0.7	0.6	1,464	0
ECM #3	Split AC Unit Upgrades	$28,620	$1,164	24.6	14.5	5,063	0
ECM #4	Programmable Thermostats	$300	$1,579	0.2	0.0	3,400	467
ECM #5	Condensing Furnace Upgrade	$4,400	$372	11.8	0.0	0	219

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2010 Draft)

ECM #1: Lighting Upgrade

Description:

The majority of the lighting in the Senior Center is 32-watt T-8 bulbs with electronic ballasts. This ECM calls for the "SuperSaver" 28-watt T-8 lamps. The upgrade provides the same lighting but with less watt input. Also the ECM mandates that the incandescent lamps be replaced with compact florescent lamps. These compact florescent lamps burn-hours are 8 to 15 times longer than incandescent fixtures.

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on needlessly. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses.

The U.S. Department of Energy funded a study to investigate energy savings reached through various types of building system controls. The reference 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 concluded that commercial facilities have the potential to achieve significant energy savings through the use of building controls and sensors. The study reported that average savings from occupancy sensors for lighting control ranged from 20% - 28%.

This ECM involves the replacement of standard wall switches to sensor wall switches for the offices, lunchroom and bathrooms. The savings resulting from this implementation for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

NJ Smart Start Incentive – the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Wall Mounted (existing facility only) = $20 / sensor

Occupancy Sensor Remote Mounted (existing facility only) = $35 / sensor

Smart Start Incentive = (# of wall mount x $20) + (# of ceiling mount x $35)

= (1 x $20) + (1 x $35) = $55

ECM #2 – Energy Savings Summary	
Installation Cost:	$300
NJ Smart Start Equipment Incentive ($):	$55
Net Installation Cost ($):	$245
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$338
Total Yearly Savings ($/yr.)	$338
Estimated ECM Lifetime (yr.):	15
Simple Payback:	0.7

ECM #3: Air Conditioning Unit Upgrades

Description:

The Senior Center is air conditioned by two (2) split system furnace units and one (split) system AC only unit. With the current situation at the Senior Center, both systems should be replaced. With the cooling unit, the 5-ton units have a seasonal energy efficiency rating (SEER) of 7, according to Concord Engineering Group, Inc. (CEG). Another negative to the system is that it is passed its ASHRAE service life and can be replaced with a more efficient unit.

NJ Smart Start Incentive – 5.4 tons or less Unitary AC and Split System >= 14 SEER x ($92 rebate)

= 15 SEER x ($92) = $1,380

Energy Savings Calculations:

$$\text{Energy Savings, kWh} = \frac{\text{Cooling Capacity, BTU}}{\text{Hr}} \times \left(\frac{1}{SEER_{old}} - \frac{1}{SEER_{new}}\right) \times \frac{\text{Operating Hours}}{1000(\text{W/kWh})}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

Cost & Savings Summary							
ECM Units	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Savings**	**Pay Back Years**
Carrier	$10,000	3	$30,000	$1,380	$28,620	$1,164	24.6
Total		**3**	**$30,000**	**$1,380**	**$28,620**	**$1,164**	**24.6**

ECM #4: Programmable Thermostats

Description:

The Senior Community Center operates two AC split systems with gas-fired furnaces for heat. The thermostats currently controlling the systems are non-programmable. The occupancy levels in the Senior Center vary due to the current events, but mostly they are every other day and the center is closed on the weekends.

With this staggered occupancy level schedule, the new programmable thermostats have the capability to set back automatically based on pre-set schedules. Also, the new programmable thermostats have the ability to track seasons and adjust their morning warm up to ensure the space temperatures are met by the scheduled time frame.

<u>Heat Energy Savings</u>

Baseline Hot Water Gas Use: 2.5 Therms (average June through Sept)

Existing Heating Natural Gas: 2,783 Therms – (2.5 Therms x 12 Months)

=1,387 Therms

$$\text{Set Back Heating Energy} = \text{Existing Gas (Therms)} \times \frac{HDD_{55°F}}{HDD_{65°F}} \times \frac{\text{Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

$$\text{Non Set Back Heating Energy} = \text{Existing Gas (Therms)} \times \frac{\text{Non Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

Heat Cost Savings = Energy Savings (Therms) x Cost of Gas ($/Therm)

Programmable Thermostat Heating Energy Calculations			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Standard on-board thermostat controls	Programmable thermostats (10 degree set back)	
Total Heating Energy (therms)	1,387	1,387	
Heating Degree Days (65°F / 55°F)	5,154	3,072	2,082
Hours of setback per week	0	140	
Energy Savings Calculations			
Heating Energy, Therms (non setback)	1,387	920	
Heating Energy Cost	$2,358	$1,564	$794

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

$$\text{Set Back Cooling Energy} = \text{Cooling Energy (kWh)} \times \frac{\text{HDD}_{82°F}}{\text{HDD}_{72°F}} \times \frac{\text{Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

$$\text{Non Set Back Cooling Energy} = \text{Cooling Energy (kWh)} \times \frac{\text{Non Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Gas ($/kWh)

Programmable Thermostat Heating Energy Calculations			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Standard on-board thermostat controls	Programmable thermostats (10° setback)	
Cooling Capacity (Tons)	15	15	
Full Load Cooling Hrs.	350	350	
Cooling Degree Days (82°F / 72°F)	761	186	575
Hours of setback per week	0	84	
Energy Savings Calculations			
Cooling Energy, kWh	9,000	5,600	
Electric Energy Cost	$2,079	$1,294	$785

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Cost of Implementation: $300.

Acquired cost of the programmable thermostats would be $300/unit. This Energy Conservation Measure (ECM) requires that one thermostat control the current three AC systems at the senior center.

Energy Savings:

Installation Cost: $300

Energy Savings ($/yr.): $1,579

Estimated ECM Lifetime (yr.): 15

Simple Payback 0.2

Lifetime Savings: **$23,685**

ECM #5: Condensing Furnace Installation

Description:

According to the Energy Audit provided by Concord Engineering Group, Inc. (CEG), the two Carrier gas-fired furnaces that serve the entire facility are passed their ASHRAE service life of 20 years.

With a new condensing furnace, the typical efficiency output levels range around 95%, rather than the current furnace's 80% efficient level.

The proposed replacement would be two (2) 58UVB Performance 96 Series gas fired condensing furnace. This ECM is based on a one for one replacement based on capacity of the existing furnace.

Energy Savings Calculations:

Baseline HW Gas Use: 2.5 Therms (From June – Sept)

Existing Heating Natural Gas: 1,417 Therms – (2.5 Therms x 12 Months)

1,387 Therms

Building Heat Required = Existing Natural Gas (Therms) x Heating Eff. (%) x Fuel Heat Value (BTU/Therm)

$$\text{Proposed Heating Gas Usage} = \frac{\text{Building Heat Required (BTU)}}{\text{Heating Eff. (\%) x Fuel Heat Value (BTU/Therm)}}$$

Energy Cost = Heating Gas Usage (Therms) x Ave Fuel Cost ($/Therm)

Condensing Furnace Calculations			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing Gas Fired Furnace	New Condensing Furnace	
Existing Natural Gas (Therms)	1,387		
Furnace Eff. (%)	80%	95%	15%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Energy Savings Calculations			
Natural Gas Usage (Therms)	1,387	1,168	219
Energy Cost	$2,358	$1,986	$372

Installation Cost of one new Carrier 120 MBH condensing furnace, demolition, flue piping, gas piping modifications, etc. is estimated to be $2,500.

From the **NJ Smart Start Appendix**, the installation of a new furnace warrants the subsequent incentive: $300 per furnace.

Smart Start Incentive = $300 x 2 = $600

Installation Cost ($): $5,000

NJ Smart Start Incentive ($): $600

Net Installation Cost ($): $4,400

Energy Savings ($/yr.): $372

Estimated ECM Lifetime (yr.): 15

Simple Payback: 11.8

Simple Lifetime Savings: **$5,580**

2.2.3b Solar PV Proposal

Building	Roof Area (sf)	Panel	Qty	Panel sf	Panel Total sf	Total KWdc	Total Annual kWh	Panel Weight (33lbs)	W/sf
Gloucester Township Senior Community Center	1,300	Sunpower SPR 230	80	14.7	1,176	18.40	22,478	2,640	15.64

Total Construction Cost:	$165,600
Annual kWh Production:	22,478
Annual Energy Cost Reduction:	$5,192
Annual SREC Revenue:	$7,867
Simple Payback:	12.68

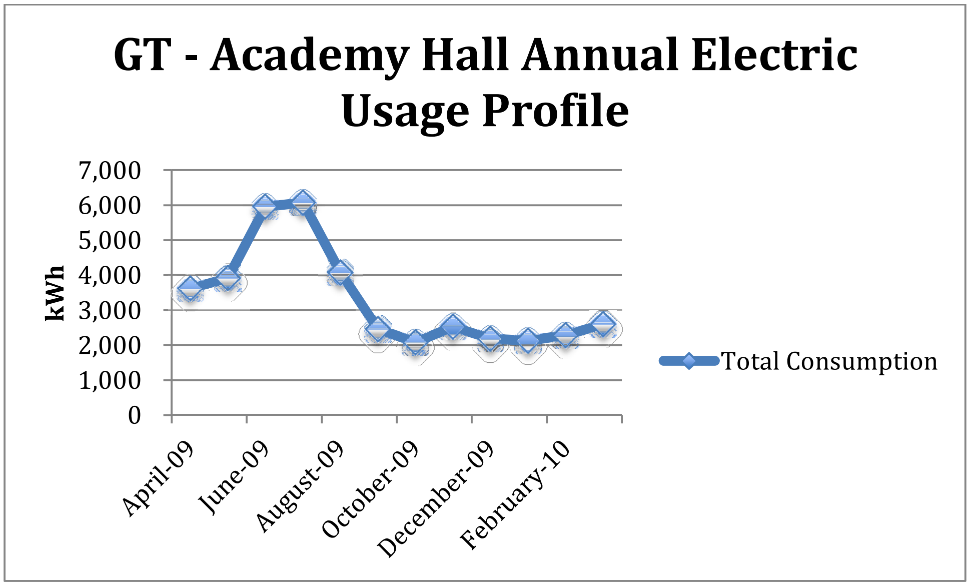
The numbers above reflect a 3% maintenance rate and a 3% energy cost escalation rate. Also the market value annual SREC revenue is factored back into the Simple Payback period as well.

2.1.4 Gloucester Township Academy Hall

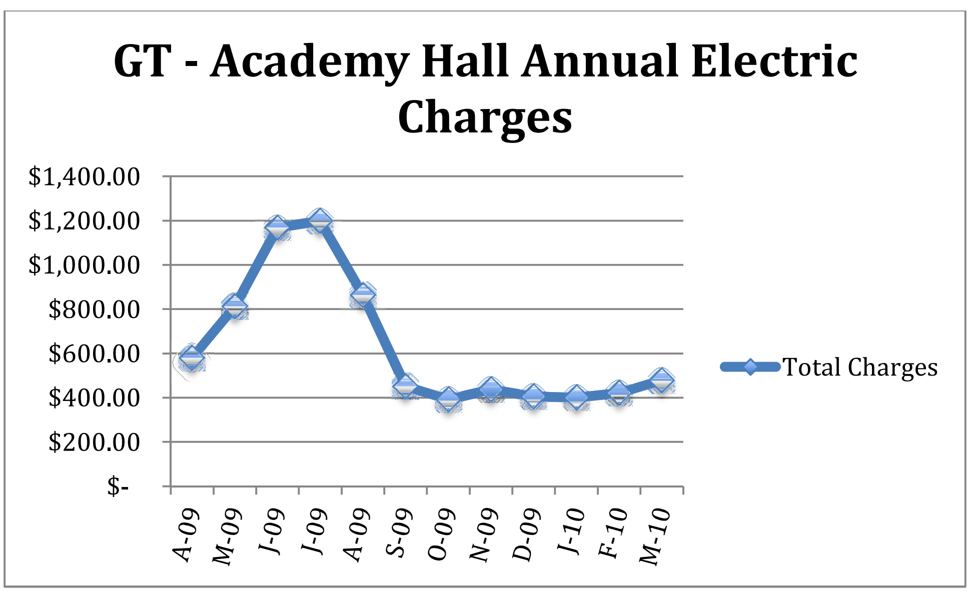
27 South Black Horse Pike

Gloucester Township, NJ 08012

Academy Hall's annual electricity consumption displayed below, from April 21, 2009 to March 29, 2010.



Accumlated monthly delivery and supply charges for Academy Hall are displayed further:



Energy Provider

Electricity – Public Service Electric & Gas

Natural Gas – South Jersey Natural Gas

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	Three-story masonry facility, built in 1930 with a renovation in 1985.	Sloped shingled, shingled roof. The amount of insulation below the roof is unknown.	Brick face with a concrete block construction and insulation is unknown.	The front door and windows in the front half of the building have gaps, the rest are well maintained.

Condition Assessment

Academy Hall of Gloucester Township looks to be in decent array.

	Description	Hours
Facility Use And Occupancy	The building is comprised of administrative offices, lounges and a basement mechanical room.	Monday – Thursday 8:00 am to 5:30 pm. The building employs 10 people and state police rent out a portion of the building, which is occupied till 8:00 pm.

Major Energy Consuming Measures

HVAC System

Academy Hall uses a gas-fired boiler with hydronic baseboard for heat. The boiler is a Weil McLain gas-fired boiler with an input efficiency of 450 MBH and an output capacity of 360 MBH. From CEG's audit, the boiler efficiency is 80%.

Exhaust System Air is exhausted from the toilet room via the roof exhausters. These exhaust systems are controlled by the toilet room light switches.

Domestic Water The hot water in the restrooms is heated by a 50 gallon Mor-Flo Industries gas-fired hot water heater, with a capacity of 50 MBH. The domestic water is distributed throughout the facility by a hot water re-circ pump controlled by an aqua stat.

Lighting Lighting is poor in Academy Hall. Most of the lights in the facility are T-12 fixtures with magnetic ballasts. Also there is the presence of incandescent lamps as well.

2.2.4a Recommended ECMs

ECM Summary Table

Energy Conservation Measures							
ECM #.	**Description**	**Net Installation Cost**	**Annual Savings**	**Simple Payback (yrs.)**	**Electric Demand (kW)**	**Electric Consumption (kWh)**	**Natural Gas (Therms)**
ECM #1	Lighting Upgrade	$8,880	$1,837	4.8	4.4	9594.0	0
ECM #2	Lighting Controls	$660	$473	1.4	0	2490.0	0
ECM #3	Computer Monitor Replacement	$200	$57	3.5	0.1	300.0	0
ECM #4	Condensing Boiler	$35,158	$450	78.1	0	0	319.0
ECM #5	AC Unit Upgrades	$32,126	$813	39.5	3.6	4278.0	0

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #1: Lighting Upgrade

Description:

The bulk of the lighting in Academy Hall is 34-watt T-12 lamps with magnetic ballasts. A quick fix would be to replace all lamps with 28-watt SuperSaver T-8 lamps with electronic ballasts. Once again, the lifespan on these T-8 lamps range from 30,000 burn hours versus the average 20,000 burn hours with the current T-12 lamp. This ECM results in 33% fewer lamps replaced per year.

In addition to having outdated T-12 lamps, there are currently incandescent lamps being used throughout Academy Hall as well. These incandescent lamps have a life span much shorter than that of compact fluorescent lamps. The introduction of compact fluorescent lamps would have an 8 to 15 times longer burn per fixture than that of an incandescent lamp, which are typically averaging 750 to 1000 burn hours.

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

Smart Start Incentive = (# of lamp fixtures x $10)

= (94 fixtures x $10) = $940

Replacement and Maintenance Savings are calculated as follows:

Savings = (reduction in lamps replaced per year) x (replacements $ per lamp + labor $ per lamp)

= (2 lamps per year) x ($2.00 + $5.00) = $14.00

ECM #1: Continued

Energy Savings Calculations

Installation Cost ($):	$9,820
NJ Smart Start Incentive ($):	$940
Net Installation ($):	$8,880
Maintenance Savings ($):	$14
Energy Savings ($):	$1,823
Total Yearly Savings ($):	$1837
Estimated ECM Lifetime (yrs.):	15
Simple Payback:	4.8

Simple Lifetime Savings: **$27,555**

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses.

The U.S. Department of Energy funded a study to investigate energy savings reached through various types of building system controls. The reference 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 concluded that commercial facilities have the potential to achieve significant energy savings through the use of building controls and sensors. The study reported that average savings from occupancy sensors for lighting control ranged from 20% - 28%.

This ECM involves the replacement of standard wall switches to sensor wall switches for the offices, lounge and bathrooms. The savings resulting from this implementation for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

Energy Savings Calculations

Energy Savings = (% Savings x Occupancy Sensored Light Energy (kWh / Yr.)

Savings = Energy Savings (kWh) x Ave Electric Cost ($/kWh)

NJ Smart Start Incentive – the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Wall Mounted (existing facility only) = $20 / sensor

Occupancy Sensor Remote Mounted (existing facility only) = $35 / sensor

Smart Start Incentive = (# of wall mount x $20) + (# of ceiling mount x $35)

= (12 x $20) + (0 x $35) = $240

Energy Savings Summary

ECM #2 Energy Savings Summary	
Installation Cost ($):	$990
NJ Smart Start Incentive ($):	$240
Net Installation Cost ($):	$660
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$473
Total Yearly Savings ($/yr.):	$473
Estimated ECM Lifetime (yr.):	15
Simple Payback	1.4
Simple Lifetime Savings	$7,095

ECM #3: Computer Monitor Replacement

Description:

Presently at Academy Hall there are mixes of CRT and LCD computer monitors. Computers today are playing a larger role in offices across the business landscape and are typically used all-day and left untouched throughout the night. With a CRT monitor the clear disadvantages are the increased energy consumption and the electromagnetic emissions. In this ECM the replacement of CRT monitors to LCD monitors saves considerable energy as well as provides other ergonomic benefits.

According to CEG's report there are 15 LCD monitors and 2 CRT monitors. Some of these monitors are left in screen saver mode, which is ironic because it only saves on monitor burn rather than energy consumption.

Energy Savings Calculations

No. of CRT Monitors: 2

Operating Weeks per yr.: 50

Hrs. per Week: 60 (12 hrs. per day estimated average

Electric Usage = <u># of Computers x Monitor Power (W) x Operating (hrs.)</u>

1000(W/kW)

Energy Cost = Electric Usage (kWh) x Ave Electric Cost ($/kWh)

Installation Cost: # Monitors x Cost per Monitor

2 Monitors x $100 per Monitor

=$200

Academy Hall ECM #3 Continued:

ECM #3 Energy Savings Summary	
Installation Cost ($):	$200
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$200
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$57
Total Yearly Savings ($/yr.):	$57
Estimated ECM Lifetime (yr.):	15
Simple Payback	3.5
Simple Lifetime Savings	$855

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

With the simple savings acquired by the replacement of two CRT monitors, the move makes clear sense to the Township where they would save $57 in the first year of their energy budget.

ECM #4: Condensing Boiler Installation

Description:

The current installed cast iron boiler is used as the primary source of heat for the building. The existing boiler is standard efficiency non-condensing boiler type made by Weil McLain. This McLain boiler is “even” for boilers that are close to their point of being inoperable. With the current updated efficiency levels of new technology to boilers, energy savings would be significant.

Continuing with high efficiency boilers, the peak performance of a new boiler is 99% depending on water temperature. With the current building operations, the annual average for a new boiler would be 88% versus the current boiler installed which is at 77%. Note, in this ECM it hinges on the idea of outdoor re-set to vary the supply water temperature based on outdoor temperature.

This ECM calls for the installation of a Aerco Modulex condensing boiler model number MLX – 454.

Energy Savings Calculations:

Baseline Hot Water Gas Use: 16.25 Therms (avg from June through Sept Gas Use)

Existing Heating Natural Gas: 2,759 Therms – (16.25 Therms x 12 Months)

= 2,554 Therms

Building Heat Required = Existing Natural Gas (Therms) x Heating Eff. (%) x Fuel Heat Value (BTU/Therm)

Proposed Heating Gas Usage = Building Heat Required (BTU) / Heating Eff. (%) x Fuel Heat Value (BTU/Therm)

$$\text{Proposed Heating Gas Usage} = \frac{\text{Building Heat Required (BTU)}}{\text{Heating Eff. (\%)} \times \text{Fuel Heat Value (BTU/Therm)}}$$

Energy Cost = Heating Gas Usage (Therms) x Ave Fuel Cost ($/Therm)

Condensing Furnace Calculations			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing cast iron boiler	New Condensing boiler	
Existing Natural Gas (Therms)	2,554	0	
Boiler Eff. (%)	77%	88%	11%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Gas Cost ($/Therm)	1.41	1.41	
Energy Savings Calculations			
Natural Gas Usage (Therms)	2,554	2,235	319
Energy Cost	$3,601	$3,151	$450

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

From the **NJ Smart Start Appendix**, the installation of new condensing boilers warrants the following incentive: $1.75 / MBH.

Smart Start Incentive = 1 x (boiler MBH x $1.75) = 1x(454 x $1.75)=$794.50

Installation Cost ($): $35,952

NJ Smart Start Incentive ($): $795

Net Installation Cost ($): $35,158

Energy Savings ($/yr.): $450

Estimated ECM Lifetime (yr.): 20

Simple Payback (yr.); 78.1

Lifetime Savings ($): **$9,000**

ECM #5: Air Conditioning Unit Upgrades

Description:

Academy Hall is air conditioned with multiple split system AC units. With new split air conditioners that provide higher full load and part load efficiencies due to the advances in inverter motor technologies it requires this ECM to do a one-to-one replacement of the current system.

Energy Savings Calculations:

$$\text{Energy Savings, kWh} = \frac{\text{Cooling Capacity, BTU}}{\text{Hr}} \times \left(\frac{1}{SEER_{old}} - \frac{1}{SEER_{new}}\right) \times \frac{\text{Operating Hours}}{1000(W/kWh)}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

Cost & Savings Summary								
ECM Units	**Rooms**	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Savings**	**Pay Back Years**
Carrier CU-1	Front Office	$6,000	1	$6,000	$138	$5,862	$137	42.9
Carrier CU-2	2nd Fl. Office	$7,000	1	$7,000	$184	$6,816	$182	37.4
Coleman CU-3	1st Floor	$6,000	1	$6,000	$138	$5,862	$137	42.9
Coleman CU-4	3rd Floor	$8,000	1	$8,000	$276	$7,724	$274	28.2
Carrier CU-6	1st Floor	$6,000	1	$6,000	$138	$5,862	$83	70.4
Total			**5**	**$33,000**	**$874**	**$32,126**	**$813**	**39.5**

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Estimated ECM Lifetime (yr.): 15

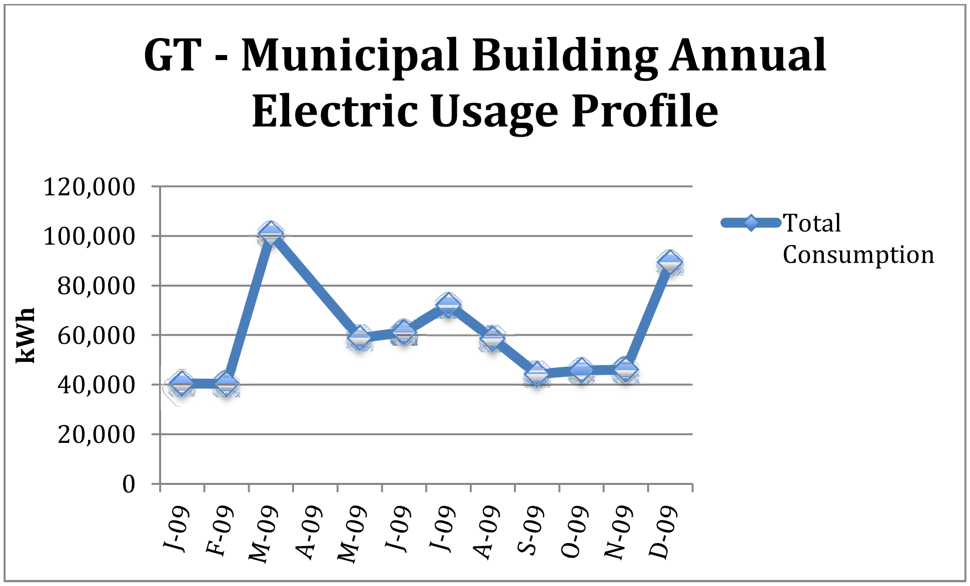
Simple Payback (yr.)	39.5
Simple Lifetime Savings ($):	**<u>12,195</u>**

2.1.5 Gloucester Township Municipal Building

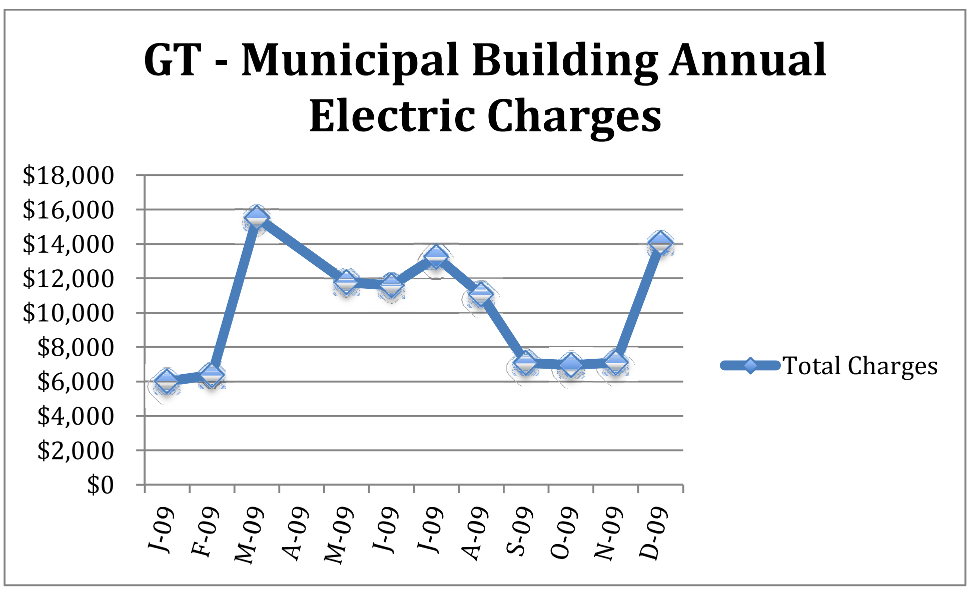
1261 Chews Landing Road

Gloucester Township, NJ 08012

The line graph below is a detailed picture of the electricity consumption between the dates of January 2009 to December 23, 2009.



Associated with the Municipal faciliity of Gloucester Township are the total charges that include delivery charges as well as supply charges, this is pictured below:



Energy Provider

Electricity – Public Service Electric & Gas

Natural Gas – South Jersey Natural Gas

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	Two-story building with 43,000 sf. There are two buildings attached; offices in 1973 and police building in 1976.	The roof is mostly flat, built up rubber roof where the majority of the HVAC exits are.	The whole building is a brick exterior with a concrete interior construction.	The windows in the facility are in average condition, most windows are ¼' single pane glass with aluminum frames.

Condition Assessment

The Municipal Building is in good condition.

	Description	Hours
Facility Use And Occupancy	The building is comprised of administrative offices, lounges, courtrooms, holding areas, and surveillance areas.	Monday – Thursday 8:00 am to 5:45 pm. The police building (1/3) are in use 24 hours a day, 7 days a week. The building is occupied with 120 employees.

Major Energy Consuming Measures

HVAC System

The building is heated mainly through a baseboard heat and hot water fan coil unit that is offered hot water by a central boiler plant located beneath the police building. The building uses one (1) Weil McLain gas-fired boiler that has an input of 2,049 MBH and an output of 1,632. The boiler efficiency is 80%.

The cooling for the police building utilizes two (2) 20-ton Drake Refrigeration Inc. Air-cooled chillers. The courtroom is cooled by one (1) 5-ton York packaged A/C unit with 125 MBH of gas heat, one (1) 20-ton packaged A/C unit with 400 MBH of gas heat and one (1) 13-ton packaged A/C unit with 250 MBH of gas heat (CEG.) Continuing on the police building, the communications building is cooled by a 3-ton York condensing unit. Lastly, one (1) 2.5-ton Fujitsu split system serves the server room.

Currently, 11 Coleman cooling units with 7 kW electric heat strips provide the municipal offices. With the heat strips they go to; one (1) 2-ton unit, eight (8) 2.5 ton units, and two (2) 3-ton units. In addition, there are two (2) Trane 15 ton split systems condensing unit, which cools the council room.

Exhaust System

Air is exhausted from the toilet room via the roof exhausters. These exhaust systems are controlled by the toilet room light switches.

Domestic Water

Domestic hot water is heated by a 30 gallon Bradford White electric hot water heater with a capacity of 4500 Watts, located in the hallway closet and a 40 gallon Bradford White electric hot water heater with a capacity of 4500 Watts located in the mayor's office

For the police sector, a 100-gallon A.O provides the hot water heater.
Smith BT100 gas fired water heater, with an input of 80 MBH.

Lighting

Lighting is good in the Municipal Building. Recently the lighting fixtures were replaced with T-8 energy efficiency fluorescent fixtures by in house employees, saving on costs of installation.

2.2.5a Recommended ECMs

ECM Summary Table

Energy Conservation Measures							
ECM #.	**Description**	**Net Installation Cost**	**Annual Savings**	**Simple Payback (yrs.)**	**Electric Demand (kW)**	**Electric Consumption (kWh)**	**Natural Gas (Therms)**
ECM #1	Lighting Upgrade	$16,546	$7,319	2.3	11.9	43,317.0	0
ECM #2	Lighting Controls	$3,535	$2,456	1.4	0	14,616.0	0
ECM #3	Computer Monitor Replacement	$500	$126	4.0	0	750.0	0
ECM #4	AC Unit Replacements	$151,851	$8,862	17.1	31.4	52,749.0	0
ECM #5	Boiler Replacement	$90,500	$3,194	28.3	0	0	1913.0

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #1: Lighting Upgrade

Description:

The majority of the lighting at the Gloucester Township Municipal building is 32-watt T-8 bulbs with electronic ballasts. This is a clear initiative that the Township has taken in the early stages of ECMs. There are once again presences of T-12 lamps with magnetic ballasts, but overall the assessment of lighting within the 43,000 sf building is prodigious.

This ECM along with many other facilities requires the Township to replace the T-12 lamps with electronic ballast, 28-watt T-8 lamps. That also goes for the current 32-watt T-8 fixtures as well.

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

Smart Start Incentive = (# of lamp fixtures x $10)

= (18 fixtures x $10) = $180

Replacement and Maintenance Savings are calculated as follows:

Savings = (reduction in lamps replaced per year) x (replacements $ per lamp + labor $ per lamp)

= (6 lamps per year) x ($2.00 + $5.00) = $42

Energy Savings Summary

ECM #1 Energy Savings Summary	
Installation Cost ($):	$16,726
NJ Smart Start Incentive ($):	$180
Net Installation Cost ($):	$16,546
Maintenance Savings ($/yr.):	$42
Energy Savings ($/yr.)	$7,277
Total Yearly Savings ($/yr.):	$7,319
Estimated ECM Lifetime (yr.):	15
Simple Payback	2.3
Simple Lifetime Savings	$109,785

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses. After noting the vast number of employees that work in the Municipal building it is still energy efficient to adapt lighting controls in many of the rooms throughout the building.

The U.S. Department of Energy funded a study to investigate energy savings reached through various types of building system controls. The reference 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 concluded that commercial facilities have the potential to achieve significant energy savings through the use of building controls and sensors. The study reported that average savings from occupancy sensors for lighting control ranged from 20% - 28%.

This ECM involves the replacement of standard wall switches to sensor wall switches for the individual offices, lounge conference rooms, storage rooms, break rooms, kitchenette and bathrooms. The savings resulting from this implementation for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

NJ Smart Start Program Incentive Appendix, indicates that the installation of lighting controls warrants the following incentive:

Occupancy Sensor Wall Mounted (existing facility only) = $20 / sensor

Occupancy Sensor Remote Mounted (existing facility only) = $35 / sensor

Smart Start Incentive = (# of wall mount x $20) + (# of ceiling mount x $35)

=(37 x $20) + (9 x $35) = $1055

Energy Savings Summary:

Installation Cost ($):	$4,590
NJ Smart Start Incentive ($):	$1,055
Net Installation ($):	$3,535
Energy Savings ($/yr.):	$2,456
Estimated ECM Lifetime (yr.):	15
Simple Payback (yr.):	1.4
Lifetime Savings ($):	**$36,840**

ECM #3: Computer Monitor Replacement

Description:

The following goes for the Township Municipal Building like others, the presence of CRT monitors are still utilized by the Township employees. Identified by CEG while during the Energy Audit of the Township facilities, CEG noticed that there are 134 LCD monitors in use and 5 CRT monitors in the Municipal building being operational.

This ECM evidently means that the remaining 5 CRT monitors be replaced.

Energy Savings Calculations:

No. of CRT Monitors: 5

Operating Weeks per yr.: 50

Hrs. per week: 60 (12 hrs. per day estimated average)

Electric Usage = $\frac{\text{\# of Computers x Monitor Power (W) x Operating (hrs.)}}{\text{1000(W/kW)}}$

Energy Cost = Electric Usage (kWh) x Ave Electric Cost ($/kWh)

Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
# of Computers	**5**	**5**	
Electric Usage (kWh)	1,125	375	750
Monitor Power Cons (W)	75	25	50
Energy Cost ($)	$189	$63	$126

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Installation Cost ($): $500

Energy Savings ($): $126

Estimated ECM Lifetime (yr.): 15

Simple Payback 4.0

Lifetime Savings: **$1,890**

ECM #4: Air Conditioning Unit Upgrades

Description:

This ECM requires the Municipal Building to be replaced on a one-to-one replacement with new higher efficiency systems.

Summaries of the current AC units are below:

Implementation Summary					
ECM Inputs	**Service For**	**# of Units**	**Cooling Capacity, BTU/hr.**	**Total Capacity, Tons**	**Replace Unit With**
York RTUs	Various Offices	2	36,000	6.0	Carrier 50XL-A
York RTUs	Various Offices	8	30,000	20.0	Carrier 50XL-A
Trane CU	GE Air Handler	2	180,000	30.0	York Series YC
GE CU	Hallway HP's	2	30,000	5.0	Trane Series 4TW
GE CU	Mayor's Office	1	60,000	5.0	Carrier 50XL-A
Packaged York	Court Room	1	60,000	5.0	Carrier 50XL-A
Packaged Snyder	Upper Corridor	1	240,000	20.0	20 Ton Carrier – 38AUZ
Packaged RTU	Lower Corridor	1	156,000	13.0	Trane Odyssey
Total		**18**	**792,000**	**104.0**	

Energy Savings Calculations:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity}, \frac{BTU}{Hr} \times \left(\frac{1}{SEER_{old}} - \frac{1}{SEER_{new}}\right) \times \frac{\text{Operating Hours}}{1000(W/kWh)}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

ECM Inputs	Cooling Capacity, BTU/hr.	Annual Cooling Hrs.	Existing Units (S)EER	Split Units (S)EER	# of Units	Energy Savings kWh	Demand Savings kW
York RTUs	36,000	1,200	10 SEER	15 SEER	2	2,880	2.4
York RTUs	30,000	1,200	10 SEER	15 SEER	8	9,600	8.0
Trane CU	180,000	1,200	9.5 SEER	11.7 SEER	2	8,551	7.1
GE CU	30,000	1,200	11 SEER	14 SEER	2	1,403	1.2
GE CU	60,000	1,200	11 SEER	14 SEER	1	1,403	1.2
Packaged York	60,000	2,500	10 SEER	15 SEER	1	5,000	2.0
Packaged Snyder	240,000	2,500	9 EER	11.5 EER	1	14,493	5.8
Packaged RTU	156,000	2,500	9 EER	11.5 EER	1	9,420	3.8
Total					**18**	**52,749**	**31.4**

Cost & Savings Summary							
ECM Units	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Savings**	**Pay Back Years**
York RTUs	$8,000	2	$16,000	$552	$15,448	$484	31.9
York RTUs	$5,340	8	$42,720	$1,840	$40,880	$1,613	25.3
Trane CU	$22,000	2	$44,000	$2,370	$41,630	$1,437	29.0
GE CU	$5,340	2	$10,680	$460	$10,220	$236	43.4
GE CU	$9,500	1	$9,500	$460	$9,040	$236	38.4
Packaged York	$6,500	1	$6,500	$460	$6,040	$840	7.2
Packaged Snyder	$18,200	1	$18,200	$1,580	$16,620	$2,435	6.8
Packaged RTU	$13,000	1	$13,000	$1,027	$11,973	$1,583	7.6
Total		**18**	**$160,600**	**$8,749**	**$151,851**	**$8,862**	**17.1**

From the information gathered above, the Lifetime Savings from replacing each unit on a one-to-one basis in the Municipal Building would be:

Lifetime Savings: **$132,930**

ECM #5: Condensing Boiler Replacement

Description:

The current installed cast iron boiler is used in conjunction with a packaged rooftop unit as the primary source of heat. The existing boiler is standard efficiency non-condensing boiler type made by Weil McLain. This boiler has passed its ASHRAE service life of 35 years. With the current updated efficiency levels of new technology to boilers, energy savings would be substantial.

Continuing with high efficiency boilers, the peak performance of a new boiler is 99% depending on water temperature. With the current building operations, the annual average for a new boiler would be 88% versus the current boiler installed which is at 75%. Note, in this ECM it hinges on the idea of outdoor re-set to vary the supply water temperature based on outdoor temperature.

This ECM calls for the Township to replace the current Weil McLain boiler with an Aerco condensing boiler model BMK-2.0.

Energy Savings Calculations:

Baseline Hot Water Gas Use: 68.75 Therms (avg from June through Sept Gas Use)

Existing Heating Natural Gas: 13,773 Therms – (68.75 Therms x 12 Months)

= 12,948 Therms

Building Heat Required = Existing Natural Gas (Therms) x Heating Eff. (%) x Fuel Heat Value (BTU/Therm)

$$\text{Proposed Heating Gas Usage} = \frac{\text{Building Heat Required (BTU)}}{\text{Heating Eff. (\%)} \times \text{Fuel Heat Value (BTU/Therm)}}$$

Energy Cost = Heating Gas Usage (Therms) x Ave Fuel Cost ($/Therm)

Condensing Furnace Calculations			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing cast iron boiler	New Condensing boiler	
Existing Natural Gas (Therms)	12,948	0	
Boiler Eff. (%)	75%	88%	13%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Gas Cost ($/Therm)	1.67	1.67	
Energy Savings Calculations			
Natural Gas Usage (Therms)	12,948	11,035	1,913
Energy Cost	$21,623	$18,429	$3,194

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

NJ Smart Start Appendix, the installation of new condensing boilers warrants the following incentive: $1.00 MBH.

Smart Start Incentive = (boiler MBH x $1.00) = (2,000 x $1.75) = $2,000

Installation Cost ($): $92,500

NJ Smart Start ($): $2,000

Net Installation ($): $90,500

Energy Savings ($/yr.): $3,194

ECM Lifetime (yr.): 20

Simple Payback 28.3

Lifetime Savings ($): **$63,880**

2.2.5b Solar PV Proposal

Renewable Energy Measures (REMs)				
REM #1	**Description**	**Annual Utility Reduction**		
		Direct Current Rating (DC)	**Electric Consumption (kWh)**	**Percentage of Current Utility**
REM #1	Blue Sky Power Solar Proposals	95.88 kW	115,056 kWh	16%

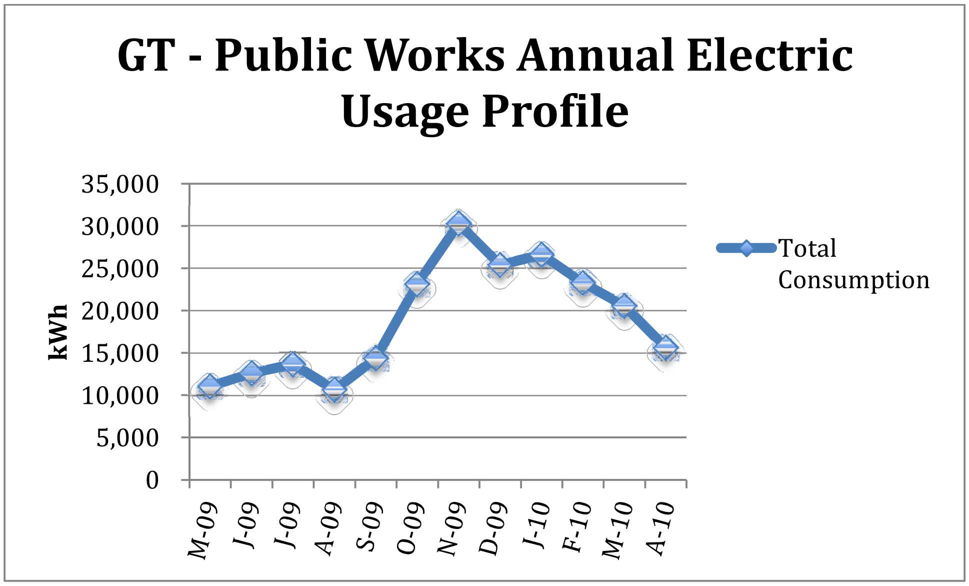
The Municipal Building is tied into an operational 33 kW DC roof-mounted system that was installed in December 2010. The Township recently went out to the public bidding process for a Solar PPA service that would allow the awarded contractor to install 96 kW DC of carports in the rear of the Municipal Complex. The Solar PV proposal for the Municipal Campus can be seen in **Appendix A.**

2.1.6 Gloucester Township Public Works Building

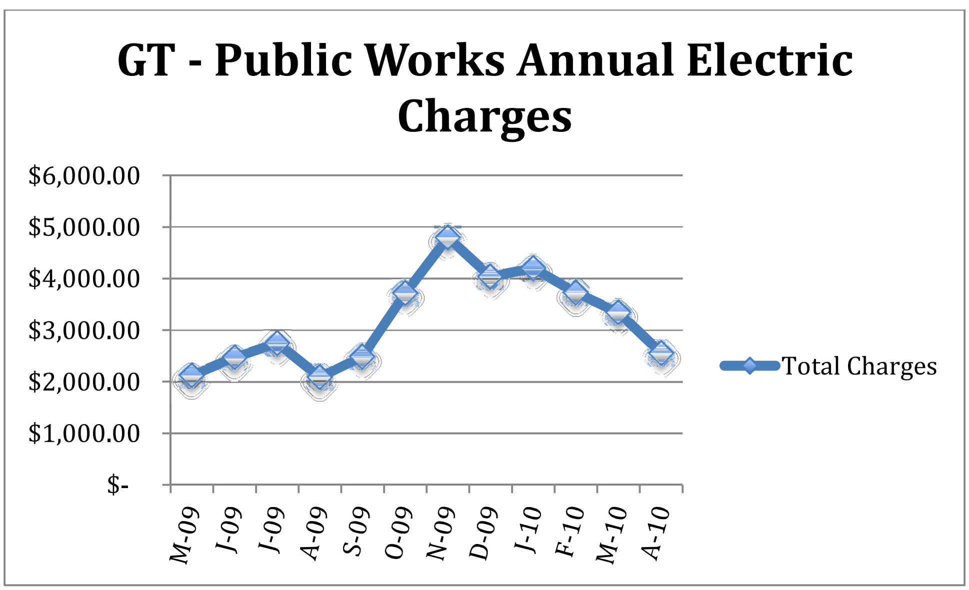
1729 Erial Road

Gloucester Township, NJ 08012

The graph below shows the annual consumption of the Public Works Building for the period of May 28, 2009 to April 27, 2010.



The displayed graph of all annual charges comprising delivery and supply charges.



Energy Provider

Electricity – Atlantic City Electric

Natural Gas – South Jersey Natural Gas

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	There are two buildings both one story. The old facility was built in 1968 and the most recent in 2004. It is 26,500 sf with both facilities.	The roof over the new building is flat with a built up rubber roof. On the old PW building, the roof is sloped with standing metal seams.	Both buildings are brick faced with concrete construction. The new PW building has R-19 insulation versus the old PW–R-13.	The windows in the facility are in average condition, most windows are ¼' single pane glass with aluminum frames.

Condition Assessment

The new Public Works building is in great condition while the old Public works building is good, but needs upgrades.

	Description	**Hours**
Facility Use And Occupancy	The building is comprised of administrative offices and multiple garages.	The typical hours of operation are Monday – Thursday between 7:00 am to 5:30 pm. The PW building employs 50 people.

Major Energy Consuming Measures

HVAC Systems The PW facility is air handled by two units with hot water and direct expansion coils. There are two (2) gas fired condensing boilers manufactured by Gas Master Industries Inc. that provide the hot water for the HVAC System. These boilers currently use has an input of 4,000 MBH and an output capacity of 3,800 MBH, with an approx. efficiency of 95%, which is great.

The owner when approached by Concord Engineering stated that the Riello RS Series Power Gas burners have not been firing properly ever since they installed them. The air-handling units have a heating set point of 70 degrees Fahrenheit during the winter months.

Exhaust System

The toilet rooms are exhausted via a fan through the roof exhausters. These are controlled by the BMS occupancy schedule.

Domestic Water

The domestic hot water for the restrooms and offices are provided by an efficient 100-gallon A.O. Smith Cyclone XHE gas-fired hot water heater, capacity 240 MBH. The hot water is recycled through a hot water pump.

Lighting

The Public Works building is currently using 32-watt T-8 lamps with electronic ballasts. These are very efficient bulbs, but there is still a presence of T-12 fixtures with magnetic ballasts.

2.2.6a Recommended ECMs

ECM Summary Table

Energy Conservation Measures							
ECM #.	**Description**	**Net Installation Cost**	**Annual Savings**	**Simple Payback (yrs.)**	**Electric Demand (kW)**	**Electric Consumption (kWh)**	**Natural Gas (Therms)**
ECM #1	Lighting Upgrade	$12,976	$4,570	2.8	8.2	28,478	0
ECM #2	Lighting Controls	$1,345	$578	2.3	1.3	3,613	0
ECM #3	Computer Monitor Replacement	$100	$24	4.2	0	150.0	0
ECM #4	AC Unit Replacements	$25,616	$1,180	21.7	6.1	7,375	0

ECM #1: Lighting Upgrade

Description:

The majority of the lighting in the Public Works building is 32-watt T-8 lamps with electronic ballasts, which is great. But there is still an existence of T-12 magnetic ballasts. This ECM recommends the replacement of the current T-12 lamps with T-8 fixtures. Also if the Township wishes to see a greater decrease in energy consumption and maintenance, the Township can go with the SuperSaver 28-watt T-8 lamps. These have a usage of up to 30,000 hours versus the current T-12 20,000 burn hours.

This ECM also recommends replacing any incandescent light fixtures with fluorescent lamps.

NJ Smart Start Incentive: the replacement of a T-12 fixture to a T-5 or T-8 warrants the following incentive: T-5 or T-8 (1-4 lamps) = $10 per fixture

Smart Start Incentive = (# of lamp fixtures x $10)

Smart Start Incentive = (36 fixtures x $10) = $360

Replacement and Maintenance Savings:

Savings = (reduction in lamps replaced per year) x (replacement $ per lamp + labor $ per lamp)

Savings = (2 lamps per year) x ($2.00 + $5.00) = $1

Energy Savings Summary

Installation Cost ($):	$13,336
NJ Smart Start ($):	$360
Net Installation ($):	$12,976
Maintenance Savings ($):	$14
Energy Savings ($):	$4,556
ECM Lifetime (yr.):	15
Simple Payback	2.8
Lifetime Savings	**$68,550**

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses. After noting the vast number of employees that work in the Public Works Building it is still energy efficient to adapt lighting controls in many of the rooms throughout the building.

The U.S. Department of Energy funded a study to investigate energy savings reached through various types of building system controls. The reference 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 concluded that commercial facilities have the potential to achieve significant energy savings through the use of building controls and sensors. The study reported that average savings from occupancy sensors for lighting control ranged from 20% - 28%.

This ECM involves the replacement of standard wall switches to sensor wall switches for the individual administrative offices, hallways, conference rooms, storage rooms, locker rooms and bathrooms. This ECM eliminates the implementation of lighting controls in the Old PW building because of the low operation levels. The savings resulting from this implementation for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

NJ Smart Start Program Incentive Appendix, indicates that the installation of lighting controls warrants the following incentive:

Occupancy Sensor Wall Mounted (existing facility only) = $20 / sensor

Occupancy Sensor Remote Mounted (existing facility only) = $35 / sensor

Smart Start Incentive = (# of wall mount x $20) + (# of ceiling mount x $35)

=(4 x $20) + (9 x $35) = $395

Energy Savings Calculations

Energy Savings = (% Savings x Occupancy Sensored Light Energy (kWh / Yr.))

Savings = Energy Savings (kWh) x Ave Electric Cost ($/kWh)

Department of Public Works ECM #2 Continued:

ECM #2 Energy Savings Summary	
Installation Cost ($):	$1,740
NJ Smart Start Incentive ($):	$395
Net Installation Cost ($):	$1,345
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$578
Total Yearly Savings ($/yr.):	$578
Estimated ECM Lifetime (yr.):	15
Simple Payback	2.3
Simple Lifetime Savings	$8,670

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #3: Computer Monitor Replacement

Description:

The current lineup of computers in the Public Works building is a mixture of CRT monitors and LCD. Based on the analysis by CEG, there are 9 LCD monitors and 1 CRT monitor. This ECM demands that the 1 CRT monitor be replaced.

Energy Savings Calculations:

# of CRT monitors: 1

Operating Weeks/yr.: 50

Hrs. per week: 60 (12 hours per day estimated avg.)

Electric Usage = <u># of Computers x Monitor Power (W) x Operating (hrs.)</u>

1000(W/kW)

Energy Cost = Electric Usage (kWh) x Ave Electric Cost ($/kWh)

Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
# Of Computers	**1**	**1**	
Electric Usage (kWh)	225	75	150
Monitor Power Cons (W)	75	25	50
Energy Cost ($)	$36	$12	$24

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Installation Cost ($): $100

ECM #3 Energy Savings Summary	
Installation Cost ($):	$100
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$100
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$24
Total Yearly Savings ($/yr.):	$24
Estimated ECM Lifetime (yr.):	15
Simple Payback	4.2
Simple Lifetime Savings	$360

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #4: Air Conditioning Unit Upgrades

Description:

The Department of public works is air conditioned by multiple split system AC units. In some areas, these units are older and are in need of replacement. With recent efficiencies in split systems this ECM would require a one-to-one replacement because of the upgrades to heat exchangers, refrigerants, and inverter technologies.

Implementation Summary					
ECM Inputs	**Service For**	**# of Units**	**Cooling Capacity, BTU/hr.**	**Total Capacity, Tons**	**Replace Unit With**
Trane CU-2	-	1	30,000	2.5	2.5 Ton Trane – XR15
Trane CU-1	-	1	42,000	3.5	3.5 Ton Trane – XR15
Trane CU-4	-	1	60,000	5.0	5.0 Ton Trane – XR15
Trane CU-5 *	-	1	72,000	6.0	5.0 Ton Trane – XR15
Total		**4**	**204,000**	**17.0**	

* CU-5 existing capacity is 6.0 tons. This ECM is based on installation of high efficiency 5.0-ton unit.

The existence of this split system air-conditioned unit is a Trane XR15 series split system with R410a refrigerant. This ECM requires the substitute of the indoor air handling unit and the outdoor condensing unit.

Energy Savings Calculations:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{SEER_{old}} - \frac{1}{SEER_{new}}\right) \times \frac{\text{Operating Hours}}{1000(\text{W/kWh})}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

ECM Inputs	Cooling Capacity, BTU/hr.	Annual Cooling Hrs.	Existing Units (S)EER	Split Units (S)EER	# of Units	Energy Savings kWh	Demand Savings kW
Trane CU-2	30,000	1,200	10 SEER	15 SEER	1	1,200	1.0
Trane CU-1	42,000	1,200	10 SEER	15 SEER	1	1,680	1.4
Trane CU-4	60,000	1,200	10 SEER	15 SEER	1	2,400	2.0
Trane CU-5 *	72,000	1,200	11 SEER	15 SEER	1	2,095	1.7
Total					**4**	**7,375**	**6.1**

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Smart Start Incentive = (coolingTons x $/Ton Incentive)

Split System AC Units Rebate Summary				
Unit Description	**Unit Efficiency**	**Rebate $/ton**	**Proposed Capacity Tons**	**Total Rebate $**
5.4 Tons or less Unitary	>= 14 SEER	$92	17.0	$1,564
Total			**17**	**$1,564**

Cost & Savings Summary							
ECM Units	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Savings**	**Pay Back Years**
Trane CU-2	$5,340	1	$5,340	$230	$5,110	$192	26.6
Trane CU-1	$6,340	1	$6,340	$332	$6,018	$269	22.4
Trane CU- 4	$7,750	1	$7,750	$460	7,290	$384	19.0
Trane CU – 5*	$7,750	1	$7,750	$1,564	$7,198	$335	21.5
Total		**18**	**$160,600**	**$8,749**	**$151,851**	**$8,862**	**17.1**

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Department of Public Works ECM #4 Continued:

There is no noteworthy maintenance savings due to implementation of this ECM.

ECM #4 Energy Savings Summary	
Installation Cost ($):	$27,180
NJ Smart Start Incentive ($):	$1,564
Net Installation Cost ($):	$25,616
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$1,180
Total Yearly Savings ($/yr.):	$1,180
Estimated ECM Lifetime (yr.):	15
Simple Payback	21.7
Simple Lifetime Savings	$17,700

Alternative Fuel Consideration: CNG Van Conversion Calculation

Description:

Gloucester Township has grown in the right direction with green advantages through the implementation of Compressed Natural Gas (CNG) vehicles. The cost of regular conventional oil is $3.10/gallon based on the U.S. Energy Information Administration (EIA.)

Identified by Concord, The current cost of natural gas used at the DPW building compared to the current cost of gasoline represents approx. 50% less cost to fuel service vehicles at Gloucester Twp.

Utility Van Fuel Economy: - 15 MPG

Annual Mileage: - 9000 Miles

Energy Savings Calculations:

Cost Savings:

$$\text{Annual Gasoline Usage (Gallons)} = \frac{\text{Annual Mileage per Service Van (Miles)}}{\text{Fuel Economy (Miles/Gallon)}}$$

$$\text{Natural Gas Usage (therms)} = \text{Annual Gasoline Usage (Gallons)} \times \frac{\text{Gasoline Heat Value (BTU/Gallon)}}{\text{Natural Gas Heat Value (BTU/Gallon)}}$$

Gasoline Fuel Cost = Fuel Usage (Gallons) x Cost of Fuel ($/gallon)

Nat Gas Fuel Cost = Fuel Usage (Therms) x Cost of Fuel ($/Therm)

Gasoline To CNG Van Conversion Calculations			
ECM Inputs	**Existing**	**Proposed**	**Savings**
Annual Service Van Mileage	Gasoline Service Van	CNG Service Van	
Service Van Fuel Economy	9,000	9,000	
Gasoline Heat Value (BTU/Gallon)	15	15	
Nat Gas Heat Value (BTU/Gallon)	100,000	100,000	
Gasoline Cost ($/gallon)	$3.05	$3.05	
Nat Gas Cost ($/Therm)	$1.06	$1.06	
Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
Annual Gasoline Usage (Gallons)	600	0	
Equivalent Nat Gas Usage (Therms)	0	684	
Energy Cost / Service Van ($)	$1,831	$1,094	$737

Blue Sky Power has worked closely with the Township of Gloucester to reduce energy consumption by becoming more efficient but also the opportunity to implement solar panel systems at optimal locations. Blue Sky Power has identified the Department of Public Works building to be an enormous consumer of electricity with the facility being used relentlessly throughout the year. The Department of Public Works overall responsibility is to be the Township's janitor. Their roles encompass filling potholes, mow township lawns, and maintain parks, etc.

In the site visit it was identified that there are only optimal locations at the southeast end of the property where a car canopy and ground mount installation would be most optimal. The proposed system installation would generate 148.6 kW DC, capable of accounting for 78% of the current Public Work's utility bill.

2.2.6b Solar PV Proposal

Renewable Energy Measures (REMs)				
REM #1	**Description**	**Annual Utility Reduction**		
		Direct Current Rating (DC)	**Electric Consumption (kWh)**	**Percentage of Current Utility**
REM #1	Blue Sky Power Solar Proposals	149 kW	178,320 kWh	78%

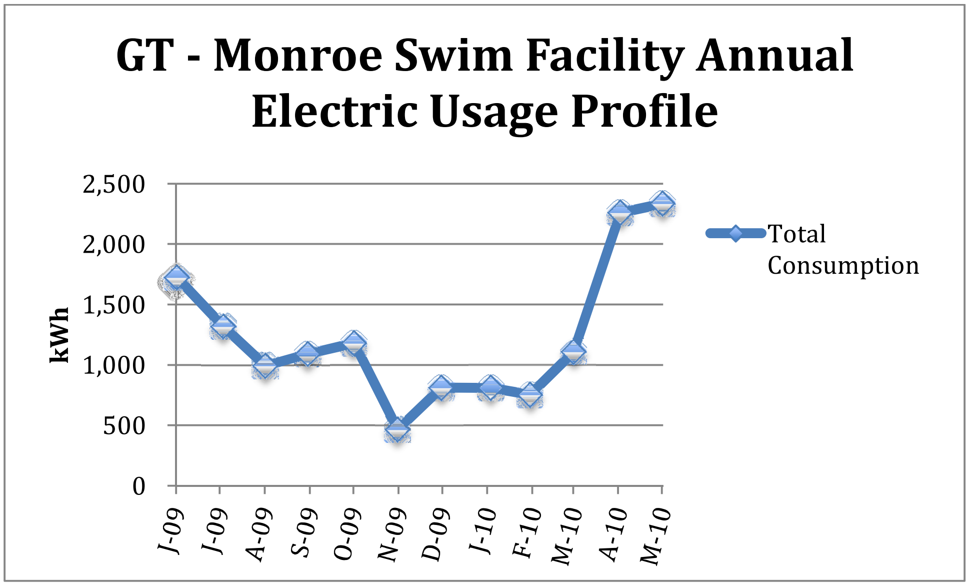
The Solar PV proposal for the Department of Public Works facility can be seen in **Appendix A.**

2.1.7 Gloucester Township Monroe Swimming Facility

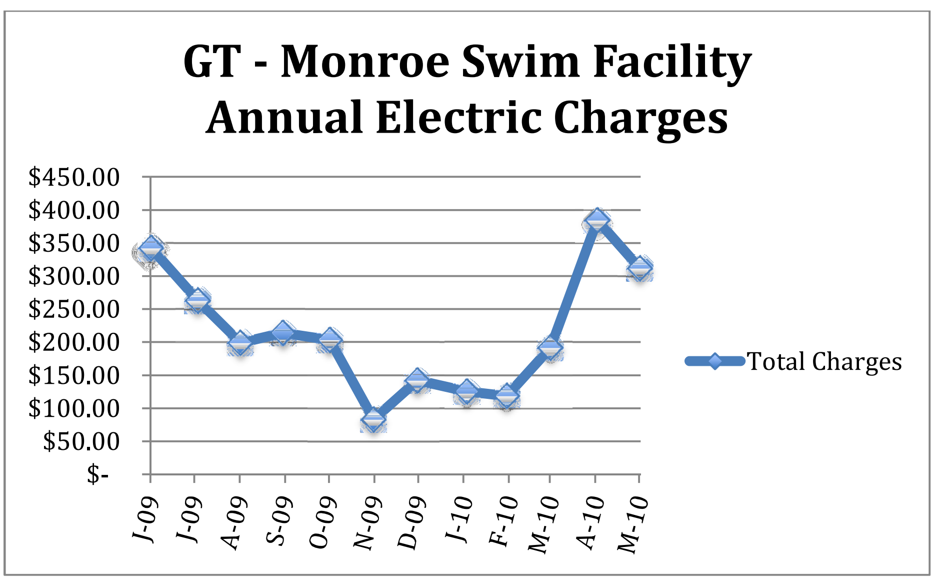
Monroe Drive

Gloucester Township, NJ 08012

Regardless of the pool being open between Memorial Day to labor day, electricity is being consumed annually. The line graph below depicts consumption between the dates of June 5, 2009 to May 5, 2010.



Associated with consumpiton are annual charges involving delivery and supply, the graph explains the monthly expense.



Energy Provider

Electricity – Public Service Electric & Gas

Natural Gas – South Jersey Natural Gas

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	The pool building is a one story, 1,460 sf public facilities. The pool building was built in 1970.	The roof is sloped roof with shingles.	Building is a brick faced, concrete construction.	There are no windows in the facility.

Condition Assessment

The pool building is in good shape.

	Description	Hours
Facility Use And Occupancy	The pool facility has a mechanical room, bathrooms and an outdoor pool area.	The pool facility is open from Memorial day – Labor day and employees 6 people.

Major Energy Consuming Measures

Pumping System There are two (2) 5 HP filter pumps that circulate water for the main swimming pools. There is two (2) 1 HP pumps are installed for the sewage ejection system. Also in the pool facility there is one (1) ½ HP filter pump that is dedicated for the baby pool.

Exhaust System The air is exhausted from the bathrooms through a wall penetration.

Domestic Water Domestic water for the restrooms is provided by a 75 gallon Bradford White gas-fired hot water heater, with a capacity of 80 MBH. A re-circ pump recirculates the domestic hot water. Lastly, the domestic hot water piping is insulated that looks to be in good condition (Concord Engineering Group, Inc.)

Lighting At the pool facility, it is a mixture of T-12 lamps as well as T-8 lamps. The latter half of this analysis will describe the implementation of replacing the existing T-12 fixtures.

2.2.7a Recommended ECMs

ECM Summary Table

Energy Conservation Measures							
ECM #.	**Description**	**Net Installation Cost**	**Annual Savings**	**Simple Payback (yrs.)**	**Electric Demand (kW)**	**Electric Consumption (kWh)**	**Natural Gas (Therms)**
ECM #1	Lighting Upgrade	$588	$406	1.4	0.6	2230.0	0
ECM #2	Lighting Controls	$220	$774	0.3	0	2230.0	0
ECM #3	Pool Pump Controls	$750	$1,783	0.4	0	8696.0	0
ECM #4	Hot Water Heater Replacement	$1,530	$105	14.6	(4.5)	(549.0)	25.0

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #1: Lighting Upgrade

Description:

The lighting fixtures at the pool building are a combination of 34-watt T-12 lamps and 32-watt T-8 lamps. A quick fix would be to replace all lamps with 28-watt SuperSaver T-8 lamps with electronic ballasts. Once again, the lifespan on these T-8 lamps range from 30,000 burn hours versus the average 20,000 burn hours with the current T-12 lamp. This ECM results in 33% fewer lamps replaced per year.

In addition to having outdated T-12 lamps, there are currently incandescent lamps being used throughout the pool facility as well. These incandescent lamps have a life span much shorter than that of compact fluorescent lamps. The introduction of compact fluorescent lamps would have an 8 to 15 times longer burn per fixture than that of an incandescent lamp, which are typically averaging 750 to 1000 burn hours.

NJ Smart Start Incentive: the replacement of a T-12 fixture to a T-5 or T-8 warrants the following incentive: T-5 or T-8 (1-4 lamps) = $10 per fixture

Smart Start Incentive = (# of lamp fixtures x $10)

Smart Start Incentive = (4 fixtures x $10) = $40

Replacement and Maintenance Savings:

Savings = (reduction in lamps replaced per year) x (replacement $ per lamp + labor $ per lamp)

Savings = (1 lamps per year) x ($2.00 + $5.00) = $7

Installation Cost ($):	$628
NJ Smart Start ($):	$40
Net Installation Cost ($):	$588

Maintenance Savings ($):	$7
Energy Savings ($/yr.):	$399
Yearly Savings ($/yr.):	$406
ECM Lifetime (yr.):	15
Payback:	1.4
Lifetime Savings	**$6,090**

ECM #2: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses. After noting the vast number of employees that work in the Monroe Pool Facility it is still energy efficient to adapt lighting controls in many of the rooms throughout the building.

The U.S. Department of Energy funded a study to investigate energy savings reached through various types of building system controls. The reference 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 concluded that commercial facilities have the potential to achieve significant energy savings through the use of building controls and sensors. The study reported that average savings from occupancy sensors for lighting control ranged from 20% - 28%.

This ECM involves the replacement of standard wall switches to sensor wall switches for the office, rest rooms, snack stand and pump room. The savings resulting from this implementation for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

NJ Smart Start Program Incentive Appendix, indicates that the installation of lighting controls warrants the following incentive:

Occupancy Sensor Wall Mounted (existing facility only) = $20 / sensor

Occupancy Sensor Remote Mounted (existing facility only) = $35 / sensor

Smart Start Incentive = (# of wall mount x $20) + (# of ceiling mount x $35)

=(4 x $20) + (0 x $35) = $80

Energy Savings = (% Savings x Occupancy Sensored Light Energy (kWh / Yr.))

Savings = Energy Savings (kWh) x Ave Electric Cost ($/kWh)

ECM #2 Energy Savings Summary	
Installation Cost ($):	$300
NJ Smart Start Incentive ($):	$80
Net Installation Cost ($):	$220
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$774
Total Yearly Savings ($/yr.):	$774
Estimated ECM Lifetime (yr.):	15
Simple Payback	0.3
Simple Lifetime Savings	$11,610

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #3: Pool Pump Controls

Description:

The Monroe Drive Swimming Facility is an outdoor pool facility open from the end of May (Memorial Day) to the beginning of September (Labor Day). When the facility is open the pool filter pumps run continuously during this time period. The facility utilizes two (2) 5 HP filter pumps for the main pools and one ½ HP filter pump for the small pool.

Pool facilities require a minimum pool water turnover rate to maintain satisfactory filtration for the pools. To define the turnover rate, it is the process it takes a filter to cycle the full volume of the pool water completely through. The turnover rate identified by Concord Engineering Group (CEG) is approximately 4-6 times per hour.

This ECM includes the installation of a time clock on both 5 HP main pool pumps. This application will reduce energy consumption when the pool is closed.

Pump Run Hours – 10:00 am to 10:00 pm (2 hours before and after pool schedule)

ECM #3: Continued

Energy Savings:

Energy Use, kWh = Pump HP x 0.746 kW/HP x Operating Hrs. x Load Factor

Motor Efficiency %

Cost Savings = Energy Savings, kWh x Cost of Efficiency, ($/kWh)

Energy Savings Calculations:

Pool Pump Control Calculations			
ECM Inputs	**Existing**	**Proposed**	**Savings**
Pump Power – HP	Continuous Operation	Pump Tire Clock Control	
Estimated Load Factor (%)	10	10	
Conversion Factor (kW/HP)	0.746	0.746	
Operation Hours	2,400	1,200	1,200
Motor Efficiency	87.5%	87.5%	
Electric Cost ($/kWh)	$0.205	$0.205	
Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
Energy use (kWh)	17392	8,696	8,696
Energy Cost ($)	$3,565	$1,783	$1,783

The installation cost of the time clock and estimated wiring would be $750 ($250 in materials).

ECM #3 Energy Savings Summary	
Installation Cost ($):	$750
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$750
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$1,783
Total Yearly Savings ($/yr.):	$1,783
Estimated ECM Lifetime (yr.):	15
Simple Payback	0.4
Simple Lifetime Savings	$26,745

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Blue Sky highly recommends implementing this ECM #3, immediately. As you can see, with a 0.4 pay back the cost benefit approach speaks volumes with this easy adaptation. The control system is very beneficial because the facility is in operation for only one third of the year. Limiting the pumps operations by half reduces the wear and tear of the system and the Township reduces the cost of maintenance.

ECM #4: Hot Water Heater Replacement

Description:

The Monroe Drive Swimming Facility utilizes a 75-gallon gas hot water heater for the facility bathrooms and showers. The hot water heater is the only burden on the natural gas service. Since the natural gas service includes a minimum charge for the service to be available typically called the “meter charge”, the effective cost of natural gas is extremely high at $8.69/therm.

This ECM requires the replacement of the existing gas hot water heater to an electric hot water heater would save the Township substantial money by avoiding relatively high chargers for a gas serviced heater.

Energy Savings

Hot water Energy (BTU) = Existing Gas (Therms) x hWh Efficiency % x Heat Value (BTU/Therm)

$$\text{Energy Use (kWh)} = \frac{\text{Hot Water Energy (BTU)}}{\text{Heat Value (BTU/kWh)} \times \text{hWh Efficiency \%}}$$

Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

ECM #4: Continued

Energy Savings Calculations:

Hot Water Heater Calculations			
ECM Inputs	**Existing**	**Proposed**	**Savings**
Existing Gas Use (Therms)	Nat Gas hWh	Electric hWh	
hWh Efficiency %	75%	100%	
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
Elect Heat Value (BTU/kWh)	3,413	3,413	
Hot Water Energy Use (BTU)	1,875,000	1,875,000	
Nat Gas Cost ($/Therm)	$8.69	$8.69	
Elec Cost ($/kWh)	$0.205	$0.205	
Energy Savings Calculations			
ECM Inputs	**Existing**	**Proposed**	**Savings**
Nat Gas Energy Use (Therms)	25	0	
Elect Energy Use (kWh)	0	549	
Energy Cost ($)	$217	$113	$105

Monroe Pool Facility ECM #4: Continued

ECM #4 Energy Savings Summary	
Installation Cost ($):	$1,530
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$1,530
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$105
Total Yearly Savings ($/yr.):	$105
Estimated ECM Lifetime (yr.):	15
Simple Payback	14.6
Simple Lifetime Savings	$1,260

2.2.1 Triton Regional High School

250 Schubert Ave

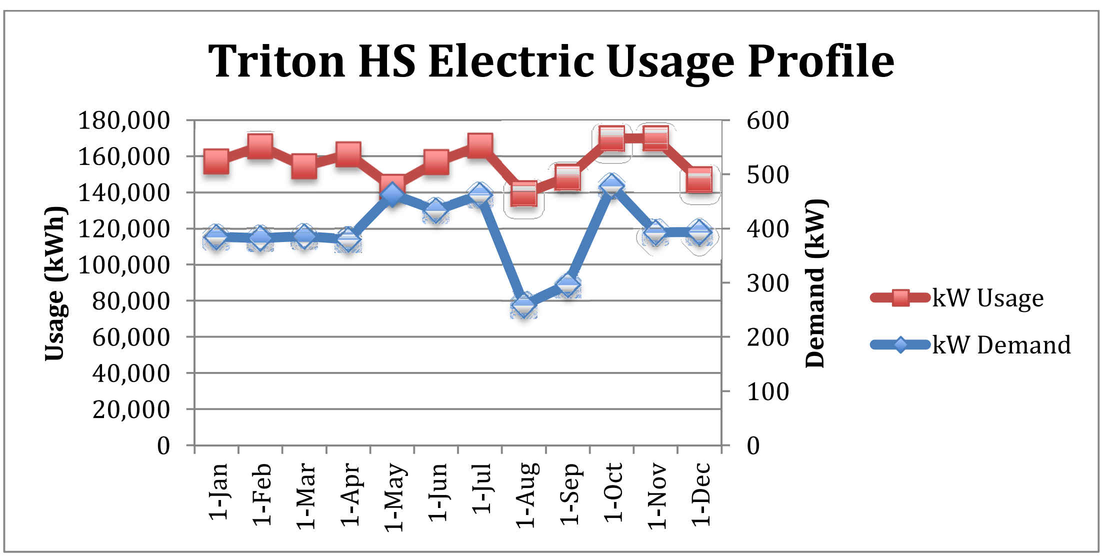
Runnemede, NJ 08078

Below is a detailed chart prepared by Concord Engineering Group of the annual electricity usage at Triton Regional High School for 2009

Triton Regional High School Annual Consumption			
Month of Use	**Consumption kWh**	**Demand**	**Total Bill**
January 09	146,960	384.5	$21,459
February 09	165,327	382.1	$22,794
March 09	154,287	385.6	$22,678
April 09	160,882	380.0	$22,718
May 09	143,082	463.1	$20,923
June 09	156,689	433.8	$22,229
July 09	165,695	461.8	$29,802
August 09	139,223	259.2	$24,246
September 09	148,271	297.0	$25,415
October 9	169,762	478.5	$30,727
November 09	169,870	393.1	$23,581
December 09	147,007	393.7	$20,804
Totals	**1,877,054**	**478.5 Max**	**$287,375**

Average Demand: 392.7 kW average
Average Rate: $0.153 $/kWh

The line chart below represents the Usage Profile for Triton High School.



Energy Provider

Electricity – Public Service Electric & Gas

Natural Gas – South Jersey Natural Gas

Third Party Gas Provider – Hess Corp.

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	Two-story 227,600 sf building, built in 1957. The H corridor added in 1963, gym in 1988.	The original roof is constructed of asphalt sheets of 3-in gypsum. Newer roofs are EPDM and Hypalon membranes.	Brick/block construction with minimum insulation.	Double pane, ¼ insulated glass with vinyl frames.

Condition Assessment

Triton Regional HS is in fair condition.

	Description	**Hours**
Facility Use And Occupancy	Triton HS has occupancy of 1,692 students, faculty and custodial staff. The building includes a gym, library, café, classrooms, offices, auditorium, choral room, band room, etc.	The High School is open between 5:30 Am and 11:30 PM for school hours and after school programs, plus custodial services.

Major Energy Consuming Measures

HVAC System The central heating system is located in the facility's boiler room and consists of three 1957 H.B. Smith Series 44 cast iron sectional hot water boilers each rated at 4,000 MBH input and 3,200 MBH output. Also Two H.B. Smith Series 28A cast iron boilers that are rated at input 1,357 MBH and output 1,084 MBH and three in-line hot water pumps heat the 1993 library/science wing.

Cooling for the 1957 building and the 1963 H Corridor is provided by an assortment of split condensing units, split heat pumps and small packaged rooftop units. Three 20-ton packaged gas/electric rooftop units cool the café and the auditorium by two 30-ton split condensing units. A 60-ton rooftop unit cools the library addition, and the library/offices by a 10-ton rooftop, the faculty dining room by a 4-ton rooftop unit.

Exhaust System

The air is exhausted from Triton through a packaged rooftop unit and centrifugal roof exhausters. There are designated exhaust systems for toilet rooms, specialty rooms (art rooms, trade shops, chemistry rooms, etc.) and large assembly areas such as the auditorium and café. The maintenance staff depending on occupancy and temperature comfort controls the exhaust systems for the specialty rooms. The commercial kitchen includes four 12 feet by 4 feet commercial exhaust hoods with make-up air and exhaust equipment on the roof. These systems work approx. 8 hours a day and are controlled by a wall mount switch.

Domestic Water

During heating seasons, hot water for the kitchen, restrooms, office lounge, etc.is provided by a 5-foot diameter by 14-foot long storage tank with an internal heat exchanger feed by the heating hot water boilers via two in-line circulation pumps. In the summer time the domestic water is heated by H.B. Smith 25 Mills cast iron sectional boiler rated at 848 MBH and output feeder that goes into the heat exchanger/tank.

Lighting

The current lighting situation at Triton HS comprises of 1x4 and 2x4 fixtures of T-8 Lamps and electronic ballasts. Some mechanical rooms, storage closets, library closets still use incandescent lamps or T-12 industrial fixtures. The main gym is lit up by a 400-watt MH fixtures and the Auxiliary Gym by a 250-watt MH lamps several of the exit signs use incandescent lamps and are a strong candidate for the LED lamp type exit sign fixtures.

2.3.1a Recommended ECMs

ECM Summary Table

Energy Conservation Measures (ECMs)				
ECM #	Description	Annual Utility Reduction		
		Electric Demand (kW)	Electric Consumption (kWh)	Natural Gas (therms)
ECM #1	Lighting Upgrade	26.1	65364.0	0.0
ECM #2	Computer Monitor Replacement	0.0	23688.0	0.0
ECM #3	Condensing Boiler Replacement	0.0	0.0	18412.0
ECM #4	AC Unit Replacement	12.7	12651.0	0.0
ECM #5	Water Conservation	0.0	0.0	0.0
ECM #6	Premium Efficiency Motors	2.8	12177.0	0.0
ECM #7	Valve Blanket Insulation	0.0	0.0	616.0
ECM #8	Kitchen Hood Controls	0.0	2008.0	811.0
ECM #9	Dishwasher Replacement	0.0	3045.0	260.0
Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)				

Renewable Energy Measures (REMs)				
REM #1	Description	Annual Utility Reduction		
		Direct Current Rating (DC)	Electric Consumption (kWh)	Natural Gas (therms)
REM #1	Blue Sky Power	347 kW	853,807.0 kWh	0.0

ECM #1: Lighting Upgrades

Description:

The standard 32-watt T-8 lamp and electronic ballasts provide the bulk of the lighting fixtures in Triton High School. There are still some spaces where 40-watt, T-12 fixtures are still in use. These areas are located in maintenance closets, library closets, and small rooms throughout the building. Also the lamps in the existing Main Gym and Auxiliary Gym compromise of twenty-five 400-watt metal-halide (MH) and 24 250-Watt MH fixtures that consume immense electricity. These lamps have poor maintenance (30% reduction in lighting output at 40% of rated lamp life). Also the lights are very noisy after they are turned off and lastly there is no color shift towards the end of the service life.

This ECM requires the replacement of all 32-watt, T-8 and 40-Watt, T-12 lamps with 25-Watt SuperSaver T-8 lamps throughout the entire facility. The expected life of the Super Saver T-8 lamp is approx. 30,000 burn-hours, in comparison to the existing T-8 lamp that has 20,000 burn-hours.

This ECM also recommends the replacement of the Gym and Auxiliary Gym lights with new T-5 high-bay light fixtures. This would include six, 4-foot T-5 High Output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus 10,000 of 400-Watt MH lamps. Once again, this savings replacement includes costs and service life.

Energy Savings Calculations:

From the NJ Smart Start Program Incentive, the following incentives are warranted:

For replacement of T-8 lamps to SuperSaver T-8 Lamps is $10 per fixture:

Smart Start incentive = (# of T-8 fixtures x $10 per fixture)

Smart Start incentive = 2,257 fixtures x $10 per fixture = $22,570

For replacement of the 400-Watt MH fixtures to T-5 HO lamps

Smart Start incentive = (# of T-5 lamps x $100 per fixture)

Smart Start incentive = 25 T-5 fixtures x $100 per fixture = $2,500

For replacement of the 250-Watt MH fixtures to T-5 HO lamps

Smart Start incentive = (# of lamps x $50 per fixture)

Smart Start incentive = 24 T-5 fixtures x $50 per fixture = $1,200

Total Smart Start Incentive Value = $26,270

Installation Cost ($):	$46,654
NJ Smart Start ($):	$26,270
Net Installation Cost ($):	$20,384
Maintenance Savings ($):	$0
Energy Savings ($/yr.):	$10,001
Yearly Savings ($/yr.):	$10,001
ECM Lifetime (yr.):	15
Payback:	2.0

Lifetime Savings **<u>$99,007.29</u>**

ECM #2: Computer Monitor Replacement

Description:

The computers throughout the facility utilize a mixture of CRT Computer Monitors and LCD computer monitors. Computers are located in the offices, computer labs, lounges, and classrooms. The CRT monitors are outdated and have several disadvantages to them, for example, larger desk space needed to use a CRT monitor, more energy consumption, poor picture, distortions, and electromagnetic emissions.

This ECM demands the replacement of all CRT monitors with LCD flat panel monitors. The different in energy consumption between CRT and LCD monitors are substantial. Another pro to this ECM the installation can be done in house, so the equated figures below do not incur installation cost.

Energy Savings Calculations:

Number of CRT monitors: 141

Weeks per Yr.: 40

Hrs. / week: 84 (12 hours per day cumulative average)

Electric Usage = # of Computers x Monitor Power (W) x Operating (hrs.) / 1000(W/kW)

Energy Cost = Electric Usage (kWh) x Ave Electric Cost ($/kWh)

Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
# Of Computers	**141**	**141**	
Electric Usage (kWh)	35,532	11,844	23,688
Monitor Power Cons (W)	75	25	50
Energy Cost ($)	$5,436	1,812	3,624

Installation Cost ($): $100

ECM #2 Energy Savings Summary	
Installation Cost ($):	$14,100
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$14,100
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$3,624
Total Yearly Savings ($/yr.):	$3,624
Estimated ECM Lifetime (yr.):	15
Simple Payback	3.9
Simple Lifetime Savings	$54,360

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #3: Condensing Boiler Installation

Description:

The central heating system for Triton Regional HS consists of three (3) 1957 H.B. Smith cast iron sectional hot water boilers each rated at 3,200 MBH output that serve the building's heating hot water circulation. These boilers are currently 23 years past their ASHRAE service life and are fired by natural gas.

Continuing along, the Library/Science wing addition constructed in 1993 is heated by two (2) H.B. Smith 28a cast iron sectional hot water boilers, that are each rated at 1,357 MBH input and 1,084 MBH output. The boiler has roughly 12 years of service life left for this particular cast iron boiler.

During the winter seasons when boilers are used the most, the domestic hot water for the kitchen, restrooms, office lounge, etc. are delivered by a 6-foot diameter by 12-foot long storage tank with an interior heat exchanger feed by the heating hot water boilers via two (2) in-line circulation pumps. On the opposite side, during the summer seasons the water is produced by one H.B. Smith cast iron sectional boiler rated at approx. 1,064 MBH output that feeds the same heat exchanger/tank. The summer boiler has roughly 4 years left on its service life.

High efficiency boilers peak performance is 99% depending on returning water temperature. With the current building operations, the annual average for a new boiler would be 88% versus the current boiler installed in the central part of the building that is at 70%. For the library/science wing, the boiler is operating at an efficiency of

80%. This is an increase of 8% to 18% efficiency for comfort heating and 25% increase in domestic hot water. Note, the new boiler sets also have the ability to be controlled by a digital boiler sequencer to optimize plant efficiency, which could yield further savings than what is calculated in this ECM.

This ECM involves the installation of two condensing boilers, gas-fired boilers to replace one of the existing 3,200 MBH boilers located in the original boiler room. The remaining two 3,200 MBH boilers at the original boiler room will remain as a backup to assist the new boilers.

The existing 1,064 MBH summer domestic hot water boiler would be replaced with two condensing gas-fired instantaneous domestic hot water boilers as a separate system.

Another replacement would involve the current library/science wing boiler be exchanged with a 1,084 MBH boiler and the one remaining of the two will remain as a back-up to the new installed boiler.

Lastly, the core of these proposed ECMs are Aerco model number BMK-1.5LN boilers or equivalent for the comfort heating and Aerco model number INN-1060 or equivalent for the domestic hot water. These replacements are accounted for only one-for-one swap that takes into consideration the current capacity of the existing boilers.

Energy Savings Calculations:

Building Heat Required = Existing Natural Gas (Therms) x Heating Eff. (%) x Fuel Heat Value (BTU/Therm)

$$\text{Proposed Heating Gas Usage} = \frac{\text{Building Heat Required (BTU)}}{\text{Heating Eff. (\%) x Fuel Heat Value (BTU/Therm)}}$$

Energy Cost = Heating Gas Usage (Therms) x Ave Fuel Cost ($/Therm)

Condensing Boiler Calculations – Central Building			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing cast iron boiler	New Condensing boiler	
Existing Natural Gas (Therms)	49,432	39,321	
Boiler Eff. (%)	70%	88%	18%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Gas Cost ($/Therm)	1.12	1.12	
Energy Savings Calculations			
Natural Gas Usage (Therms)	49,432	39,321	10,111
Energy Cost	$55,364	$44,039	$11,324

Condensing Boiler Calculations – Library/Science Wing			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing cast iron boiler	New Condensing boiler	
Existing Natural Gas (Therms)	16,770	15,245	
Boiler Eff. (%)	80%	88%	8%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Gas Cost ($/Therm)	1.12	1.12	
Energy Savings Calculations			
Natural Gas Usage (Therms)	16,770	15,245	1,525
Energy Cost	$18,782	$17,075	$1,707

Condensing Boiler Calculations – Domestic Hot Water			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing cast iron boiler	New Condensing boiler	
Existing Natural Gas (Therms)	25,751	18,975	
Boiler Eff. (%)	70%	95%	25%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Gas Cost ($/Therm)	1.12	1.12	
Energy Savings Calculations			
Natural Gas Usage (Therms)	25,751	18,975	6,777
Energy Cost	$28,842	$21,252	$7,590

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Installation Cost of the new condensing boilers, demolition, fuel piping, boiler water piping adjustments, gas piping adjustments, electric wiring, etc. is estimated to be $340,656.

From **NJ Smart Start Program Incentives Appendix,** the installation of new condensing boilers allows the following incentive: $1.00 per MBH.

Gas Fired Boilers > 300 MBH – 1500 MBH

2 boilers at 1060 MBH each

Smart Start Incentive = (Boiler MBH x $1.75) = 2,120 x $1.75 = $3,710

Gas fired boilers > 300 MBH – 1500 MBH

3 boilers at 1500 MBH each

Smart Start Incentive = (Boiler MBH x $1.75) = 4,500 x $1.75 = $7,875

Accumulated Smart Start Incentive = $11,585.

Installation Cost ($):	$340,656
NJ Smart Start ($):	$11,585
Net Installation ($):	$329,071
Energy Savings ($/yr.):	$18,412
ECM Lifetime (yr.):	30
Simple Payback	17.9

Lifetime Savings ($): **$552,360**

ECM #4: AC Unit Replacement

Description:

Different shares of Triton Regional HS are cooled by direct expansion outdoor, air-cooled condensing systems. Some of the existing AC units have passed their ASHRAE lifespan. The estimated service life for a condensing unit is twenty (20) years and fifteen (15) years for a packaged rooftop unit. Other systems operating at Triton are within the useful life but are not as efficient as the latest available technology on the market.

Proposed by Concord Engineering Group (CEG), the replacement of the packaged and split system condensing units on the roof with new equipment at equal capacities with R-410a refrigerant and replacement of the DX coil in the matching air handlers as required to accommodate higher pressure refrigerant, which is being proposed. This ECM incurs the cost of running new refrigerant lines.

In reviewing the facility, it was noticed that refrigerant gas R-22 currently in use at Triton HS. This machinery is currently being phased out gradually and can only be maintained and repaired by old R-22 supplies. So as time passes the price for R-22 parts will increase.

This ECM requires the replacement on a one-for-one basis with highly-efficient systems.

Implementation Summary					
ECM Inputs	**Service For**	**# of Units**	**Cooling Capacity, BTU/hr.**	**Total Capacity, Tons**	**Replace Unit With**
AC-1	Faculty Dining	1	48,000	4.0	Trane Equipment
Unmarked	Admin Offices	1	120,000	10.0	Trane Equipment
AC-2	Library Offices	1	120,000	10.0	Trane Equipment
Total		**3**	**188,000**	**24.0**	

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

This ECM is based on installation of high efficiency Trane equipment with R410a refrigerant.

Energy Savings Calculations:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity}, \frac{BTU}{Hr} \times \left(\frac{1}{SEER_{old}} - \frac{1}{SEER_{new}}\right) \times \frac{\text{Operating Hours}}{1000(W/kWh)}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

ECM Inputs	**Cooling Capacity, BTU/hr.**	**Annual Cooling Hrs.**	**Existing Units (S)EER**	**Split Units (S)EER**	**# of Units**	**Energy Savings kWh**	**Demand Savings kW**
AC-1	48,000	1,000	8.3 SEER	15 SEER	1	2,583	2.6
Unmarked	120,000	1,000	8.2 SEER	12.5 SEER	1	5,034	5.0
AC-2	120,000	1,000	8.2 SEER	12.5 SEER	1	5,034	5,0
Total					**3**	**12,651**	**12.7**

Smart Start Incentive = (Cooling Tons x $/Ton Incentive)

Split System AC Units Rebate Summary				
Unit Description	**Unit Efficiency**	**Rebate $/ton**	**Proposed Capacity Tons**	**Total Rebate $**
5.4 Tons or less Unitary	>= 14 SEER	$92	17.0	$1,564
5.4 tons to 11.25 tons Unitary AC and Split Systems	>=11.5	$73	20.0	$1,460
Total			**37.0**	**$3,024**

Cost & Savings Summary							
ECM Units	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Savings**	**Pay Back Years**
AC-1	$9,600	1	$9,600	$368	$9,232	$395	23.4
Unmarked	$16,125	1	$16,125	$730	$15,395	$770	20.0
AC-2	$16,125	1	$16,126	$730	$15,395	$770	20.0
Total		**3**	**$41,850**	**$1,828**	**$40,022**	**$1,936**	**20.7**

There is no noteworthy maintenance savings due to implementation of this ECM.

Triton Regional High School ECM #4 Continued:

ECM #4 Energy Savings Summary	
Installation Cost ($):	$41,850
NJ Smart Start Incentive ($):	$1,828
Net Installation Cost ($):	$40,022
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$1,936
Total Yearly Savings ($/yr.):	$1,936
Estimated ECM Lifetime (yr.):	15
Simple Payback	20.7
Simple Lifetime Savings	$29,040
Net Present Value	**($16,910.16)**

ECM #5: Water Conservation

Description:

Triton Regional HS utilizes an array of old and new plumbing fixtures. Approximately half of the total fixtures have been upgraded to the low-flow style. The faucets and pumps currently in use, the water closet and urinal water consumption only meet the minimum federally mandated standard for water efficiency. There are newer fixtures that consume less water than today's requirements by the State that can add up to substantial water reduction at Triton Regional.

This ECM recommends the replacement of all existing water closets and urinals within Triton HS. The projected retrofitting includes the installation of low flow flushometer style water closets that utilize 1.28 gallons per flush and the ultra-low flushometer style urinals that utilize 1/8 gallon per flush. For the foundation of this calculation includes LEED rating system analysis to estimate the occupancy usage for students within the school.

The water cost per gallon was estimated on other facilities served by the Municipality.

Energy Saving Calculations:

Water Cons = Occupancy (Days/yr.) x Use (Flush/Persons per Day) x Fixture (Gal/Flush)

Water Cost = Water Cons (gallons) x Avg Cost ($/1000 gallons) / 1000(gallons)

Water Conservation Calculations			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	Existing Fixtures	Low Flow Fixtures	
Total # of Students	846	846	
% Male to Female	50%	50%	
Occupied days / Yr.	180	180	
***WC uses / day / Person**	0.6	0.6	
Urinal Uses / day / Person	0.4	0.4	
Total Urinal Flushes / Day	169	169	
Total WC Flushes / Day	253.8	253.8	
Urinal Gallons / Flush (GPF)	1.0	0.125	0.875
WC Gallons / Flush (GPF)	3.5	1.28	2.22
Water Cost ($/1000)	$5.70	$5.70	
Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
Water Consumption	190,350	62,283	128,067
Water Cost ($)	$1,085	$355	$730

***WC –** Water Closet

The cost of installation of 20 water closets (WC) and 15 low flow urinals throughout the facility is estimated to be $33,408.

Triton Regional HS cannot apply for rebates, since there are no current NJ Smart Start incentives in place for low flow plumbing fixtures.

ECM #5 Energy Savings Summary	
Installation Cost ($):	$33,408
NJ Smart Start Incentive ($):	0
Net Installation Cost ($):	$44,408
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$730
Total Yearly Savings ($/yr.):	$730
Estimated ECM Lifetime (yr.):	30
Simple Payback	45.8
Simple Lifetime Savings	$21,900
Net Present Value	**($19,099.68)**

ECM #6: Install NEMA Premium Efficiency Motors

Description:

The improved productivity of the NEMA Premium efficient motors is attributed to a better design with the use of improved materials that reduce production loss. NEMA motors would replace existing electric motors that drive the hot water pumps in the old boiler room and supply fans in some of the heating and ventilating equipment. These motors being proposed (NEMA Premium) operate 24 hours a day and the electricity used to power the motors represent 95% of its total lifetime operating cost. So this ECM will reflect significant energy and dollar savings.

This ECM projected would replace all motors over 5 HP or more with NEMA Premium efficiency motors.

Implementation Summary								
Equipment Identification	**Function**	**Motor HP**	**Pole**	**RPM**	**Frame Type**	**Hours of Operation**	**Existing Efficiency**	**NEMA Premium Efficiency**
Classroom	Hot Water Pump	5	4	1,725	TEFC	4,320	82.0%	90.2%
Auxiliary	Hot Water Pump	5	4	1,750	TEFC	4,320	82.0%	90.2%
H-Corridor	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%
P-1	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%
P-2	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%
P-3	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%
Locker Room	Supply Fan	5	4	1,740	TEFC	4,320	82.0%	90.2%
HV-1	Supply Fan	5	4	1,740	TEFC	4,320	82.0%	90.2%

Energy Savings Calculations

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

Where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor *Motor Efficiency = Motor Nameplate Efficiency*

Electric Usage Savings, kWh = Electric Usage $_{Existing}$ – Electric Usage $_{Proposed}$

Electric Cost Savings = Electric Usage Savings x Electric Rate ($/kWh)

Implementation Summary							
Equipment Identification	**Motor HP**	**Load Factor**	**Existing Efficiency**	**NEMA Premium Efficiency**	**Power Savings kW**	**Energy Savings kWh**	**Cost Savings**
Classroom	5	90%	82.0%	90.2%	0.37	1,616	$247
Auxiliary	5	90%	82.0%	90.2%	0.37	1,616	$247
H-Corridor	5	90%	82.0%	90.2%	0.37	1,616	$247
P-1	5	90%	82.0%	90.2%	0.37	1,616	$247
P-2	5	90%	82.0%	90.2%	0.37	1,616	$247
P-3	5	90%	82.0%	90.2%	0.37	1,616	$247
Locker Room	5	90%	82.0%	90.2%	0.37	1,616	$247
HV-1	5	90%	82.0%	90.2%	0.20	862	$132
TOTAL					**2.8**	**12,177**	**$1,863**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Project Cost, Incentives and Maintenance Savings:

The Smart Start incentive are calculated and presented on the next page:

Motor Replacement Summary						
Equipment Identification	**Motor Power HP**	**Installed Cost**	**Smart Start Incentive**	**Net Cost**	**Total Savings**	**Simple Payback**
Classroom	5	$1,519	$60	$1,459	$247	5.9
Auxiliary	5	$1,519	$60	$1,459	$247	5.9
H-Corridor	5	$1,519	$60	$1,459	$247	5.9
P-1	5	$1,519	$60	$1,459	$247	5.9
P-2	5	$1,519	$60	$1,459	$247	5.9
P-3	5	$1,519	$60	$1,459	$247	5.9
Locker room	5	$1,519	$60	$1,459	$247	5.9
HV-1	7.5	$1,971	$90	$1,881	$132	14.3
Totals:		**$12,604**	**$510**	**$12,094**	**$1,863**	**6.5**

ECM #6 Energy Savings Summary	
Installation Cost ($):	$12,604
NJ Smart Start Incentive ($):	$510
Net Installation Cost ($):	$12,094
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$1,863
Total Yearly Savings ($/yr.):	$1,863
Estimated ECM Lifetime (yr.):	18
Simple Payback	6.5
Simple Lifetime Savings	$33,534
Net Present Value	**$13,528.79**

ECM #7: Valve Blanket Insulation Installation

Description:

The main purpose of a boiler is to provide hot water throughout the facility during heating season. This season is approx. 6 months and the valves are heated up to 180^{o}F continuously. Insulated piping, which is being recommended, has a heat loss that is a fraction of the heat loss on un-insulated valves.

Based on Triton's survey, approx. 30 pipe valves are un-insulated. This ECM requires that all exposed, un-insulated valves be blanketed.

Energy Savings Calculations:

The following calculations are based on ASHRAE 2009 Fundamentals – "Insulation for Mechanical Systems"

Bare Steel Piping Heat Loss 6" Pipe: 373 BTU/HR per Linear FT

$$\text{Heat Loss } \textit{BTU/HR per linear FT} = \frac{1}{\textit{R-value}} \times \textit{Pipe Dia (FT)} \times 3.14 \times (\textit{Pipe Temp}(^{o}F) - \text{Ambient Temp } (^{o}F))$$

Heat Loss BTU/HR = Heat Loss BTU/HR per linear FT x Length of Un - Insulated Pipe

Energy Use, Therms = $\dfrac{\text{Heat Loss BTU/HR x Operating Hours}}{\text{Heating System Eff. (\%) x Fuel Heat Value BTU/Therm}}$

Heating Energy Cost Savings = Energy Use, Therms x Cost of Natural Gas ($/Therm)

Valve Blanket Insulation Calculations			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	Bare Pipe	Insulated Blanket	
Length of Un-Insulated Pipe Valves	30	30	
Pipe Diameter (in)	6	6	
Blanket Insulation R-Value	0	6	6
Temperature Diff. Pipe to Ambient (^{o}F)	100	100	
Pipe Heat Loss – 6" Pipe (BTU/Hr/FT)	373	26	347
Heat Loss (BTU/hr.)	11,190	785	10,405
Heating System Operating Hrs.	4,380	4,380	
Energy Loss (kBtus)	49,012	3,438	45,574
Fuel Heat Value (BTU/Therm)	100,000	100,000	
Nat Gas Cost ($/Therm)	1.12	1.12	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Natural Gas Usage (Therms)	662	46	616
Energy Cost ($)	$742	$52	$690

Triton Regional High School ECM #7 Continued:

ECM #7 Energy Savings Summary	
Installation Cost ($):	$12,000
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$12,000
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$690
Total Yearly Savings ($/yr.):	$690
Estimated ECM Lifetime (yr.):	24
Simple Payback	17.4
Simple Lifetime Savings	$16,460
Net Present Value	**($313.48)**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #8: Kitchen Hood Controls

Description:

The facility being assessed is currently equipped with two-exhaust hood system for the cooking ranges in the kitchen. The range hoods in the kitchen are 4'x20'. A switch, located on the kitchen hoods, controls the kitchen exhaust fan manually.

It was identified that the kitchen hood exhaust systems run for approx. 4 hours each day.

ECM #8 requires installing a Melink Kitchen Hood Variable Air Volume Controller; variable frequency drive on the hood exhaust fan, and turn off all the kitchen hood exhaust systems when the kitchen is un-operational. When the kitchen is in optimal use, the hood exhaust fan will speed up based on the exhaust temperature. During the end of the kitchen's optimal use, the fan speed decreases, only removing the remaining amount of air, saving the exhaust fan energy and make up air conditioning energy.

Energy Calculations Summary:

It is appropriate to note that the calculation simulates the exhaust fans and make-up air fixtures are manually turned off for approx. 8 hours per day.

Energy Calculations – Natural Gas			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Make up air unit Total Heating Energy	3,121	2,309	
Boiler Efficiency (%)	70%	70%	
Heating Fuel Value	100,000	100,000	
Gas Cost ($/Therms)	$1.12	$1.12	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Fan Energy Annual kWh	3,121	2,309	811
Electric Energy Cost ($)	$3,495	$2,581	$909

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Energy Calculations – Electric			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Supply Fan HP	3	3	
Fan Energy, Annual	3,979	1,971	
Electric Cost ($/kWh)	$0.153	$0.153	
Energy Savings Calculations			
ECM Results	Existing	Proposed	Savings
Fan Energy Annual kWh	3,979	1,971	2,008
Electric Energy Cost ($)	$609	$302	$307

Energy Savings Summary:

ECM #8 Energy Savings Summary	
Installation Cost ($):	$16,381
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$16,381
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$1,216
Total Yearly Savings ($/yr.):	$1,216
Estimated ECM Lifetime (yr.):	15
Simple Payback	13.5
Simple Lifetime Savings	$18,240
Net Present Value	**($1,864.47)**

ECM #9: Dishwasher Replacement

Description:

The current dishwasher in use at Triton Regional HS is an Insinger SP 86-3. An out-of date dishwasher can be defective later on in life, with poor nozzles and can consume more water over time. Newer and more efficient models are able to reduce the consumption of water by recycling it in different parts in the washing cycle.

This ECM will involve replacing the old dishwasher Insinger SP 86-3 with a newer, more energy efficient water saving dishwasher. This ECM will include a one-to-one replacement involving the Insinger Speeder or equivalent.

Energy Savings Calculations:

<u>Algorithms:</u>

Gallons/Yr. = Operating Hours Per Week x Operating Weeks Per Year x Final Rinse Time % x Gallons / Hour

Primary Water Heat = *GPY x (*140-40) ^{o}F x 8.337 BTU/gal

Booster Water Heat = *GPY x* (180-140) ^{o}F x 8.337 BTU/gal

Water Conservation Calculations			
ECM Inputs	**Existing**	**Proposed**	**Savings**
ECM Inputs			
Water Consumption (GPH)	144	70	74
Booster Heater (kW)	23	18	5
Finale Rinse % Time On	70%	70%	
Operating Hours per Week	15	15	
Operating weeks per Year	40	40	
Water Cost ($/1000)	$5,70	$5.70	
Electric Cost, $/kWh	$0.153	$0.153	
Natural Gas Cost, $/Therm	$112	$1.12	
Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
Water Consumption (Gal)	60,480	29,316	31,164
Water Cost ($)	$345	$167	$178
Electric Consumption (kWh)	5909	2864	3,045
Electric Cost ($)	$904	$438	$466
Nat Gas Consumption (Therms)	504	244	260
Natural Gas Cost ($)	$565	$274	$291

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Installation for the new Insinger Speeder, demolition, piping, electric, etc. would estimate out to $41,790.

2.3.1b Solar PV Proposal

The access to renewable energy generation is not restricted for municipalities and business; schools have been going green as well. Many districts have been reaching out to experts on the processes of lowering their energy bill by not reducing consumption. The Black Horse Pike Regional School District reached out to the Township of Gloucester for the opportunity to enter into a shared services agreement. The district and the Township are in the process of awarding a professional solar contractor who will own and operate the solar systems and sell the generated power to the District for a discounted price, than what they are paying now to the utility.

Blue Sky Power has evaluated potential solar PV systems for all BHPRSD High Schools as well as Gloucester Township Public Schools to be accompanied into the Gloucester Township Solar PPA. During Blue Sky Power's evaluation of Triton, it was identified that there would not be a roof mount system for Triton since the current roof conditions are very poor and the uncertainty over the timing of the roof replacement. As a result, Triton is restricted to ground-mounted systems with an alternate bid for carport systems located in the front parking lot.

During the feasibility study conducted by Blue Sky Power on the potential PV systems it was identified that there are two potential systems that can be implemented. The first being a 7,138 kW PV system and the second system with all alternates proposed would have an output of 8,710 kW.

Given the large amount of capital required by the school to invest in a solar PV system it is not recommended that BHPRSD go a Direct Purchase route. It is more advantageous for the school to enter into a Power Purchase Agreement (PPA), where the end user (Triton) would enter into a contract to purchase power at a reduced price and the Owner/Generator would own, operate, and maintain the system for a period of 15 to 20 years. The Solar PV proposal for Triton Regional High School can be evaluated in **Appendix A.**

Renewable Energy Measures (REMs)				
REM #1	**Description**	**Annual Utility Reduction**		
		Direct Current Rating (DC)	**Electric Consumption (kWh)**	**Percentage of Current Utility**
REM #1	Blue Sky Power Solar Array Proposal	347 kW / Alternate 168 kW	677,871 kWh	51%

Triton Regional High School Final Assessment

Triton High School has considerable ECMs to analyze and decide on which ones to add to their Energy Savings Improvement Program (ESIP). This program allows for financing options on any combination of the energy conservation measures proposed.

Some ECMs that should be considered in pursuing this further are the conservation measures that impact energy consumption immediately and improve the infrastructure of the facility, for example AC unit replacements and new boiler installations. Typical boiler payback periods range from 30-40 years but for this facility the current system is old and inefficient, so the proposed systems identified by CEG would be paid back in a 18 year plan.

The ECM project calculations summary is displayed on the following page:

Table 1

ESIP – Total Entity Project Summary

Triton Regional High School

Energy Savings Improvement Program – Potential Energy Efficiency Project						
ECM Identification	**Annual Energy Savings ($)**	**Project Cost ($)**	**INCENTIVES***		**Costumer Cost**	**Simple Payback**
			Smart Start	**Direct Install**		
ECM #1	$10,001	$46,454	$26,270	$0	$20,384	2.0
ECM #2	$3,624	$14,100	$0	$0	$14,100	3.9
ECM #3	$18,412	$340,656	$11,585	$0	$329,071	17.9
ECM #4	$1,946	$41,850	$1,828	$0	$40,022	20.7
ECM #6	$1,863	$12,604	$510	$0	$12,094	6.5
ECM #8	$1,216	$16,381	$0	$0	$16,381	13.5
Design / Construction Extras (15%)		$70,837			$70,837	
Total Entity Project	**$37,052**	**$543,082**	**$40,193**	**$0**	**$502,889**	**13.6**

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Total Triton HS Energy Cost (Annual): $412,027

Est. Total Triton HS Energy Savings: $37,052

Overall Triton HS Reduction: 9.0%

2.2.2 Timber Creek Regional High School

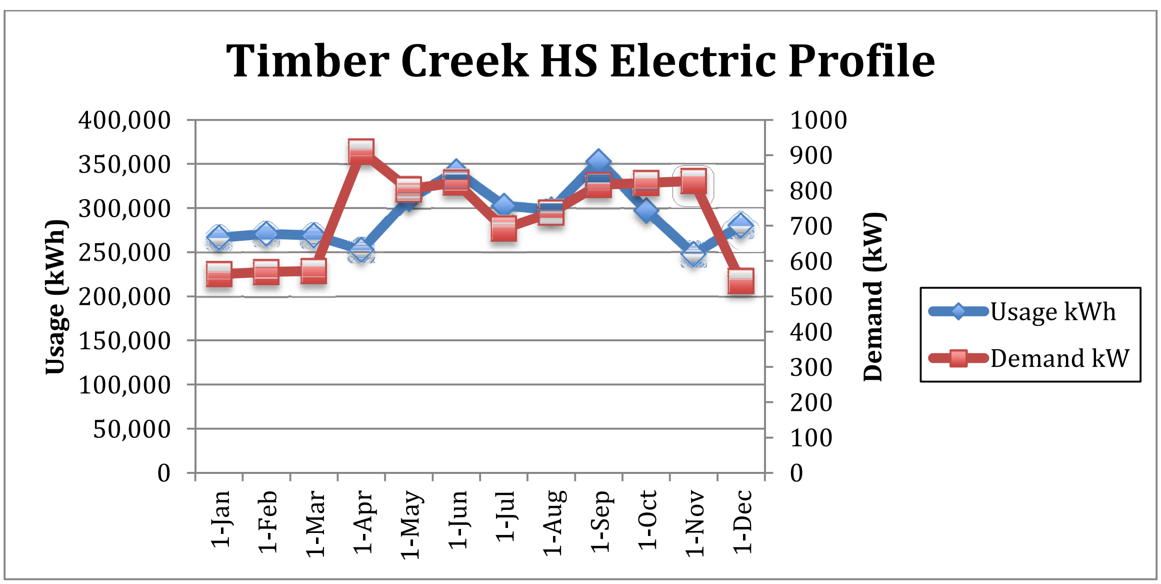
501 Jarvis Road

Erial, NJ 08081

The graph below is a detailed analysis of the annual consumption at Timber Creek High School.

Timber Creek Regional High School Annual Consumption			
Month of Use	**Consumption kWh**	**Demand**	**Total Bill**
January 09	266,435	563.0	$34,711
February 09	270,936	569.5	$35,245
March 09	269,060	571.7	$35,212
April 09	252,589	910.4	$33,568
May 09	311,039	802.8	$39,708
June 09	341,445	823.0	$45,552
July 09	302,413	691.9	$40,366
August 09	298,570	736.9	$39,992
September 09	352,936	816.1	$47,404
October 09	297,732	821.2	$40,175
November 09	248,046	826.6	$34,184
December 09	280,144	543.2	$37,752
Totals	**3,491,345**	**910.4 Max**	**$463,871**
Average Demand: 723.0 kW average			
Average Rate: $0.133 $/kWh			

The line Chart below depicts the monthly usage profile between the dates of January 2009 – December 2009.



Energy Provider

Electricity – Atlantic City Electric

Natural Gas – South Jersey Gas

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	264,000 sf two story facility. Building opened in 2002 as an energy-efficient building model.	The roof is a Firestone EPDM rubber roof with R-19 rigid insulation board.	Exterior walls are brick/block construction with a ¾-inch air space and R-19 interior batt insulation.	The windows are in excellent condition and appear to be well maintained; double pane, ¼" insulated, low-e, glass with vinyl frames.

Condition Assessment

Timber Creek is in supreme condition.

	Description	**Hours**
Facility Use And Occupancy	The high school is comprised of classrooms, administrative offices, gym, auxiliary gym, band room, choir room, media center, auditorium, kitchen, café, facility dining rooms, shop classes, etc.	Timber Creek's occupancy is 1,594 students and professionals. The facility is open between the hours of 5:30 AM to 11:30 PM. The building is used during the summer for sporting events, camps and other activities.

Major Energy Consuming Measures

HVAC Systems The central hot water heating is sited in the high schools boiler room and consists of two (2) Bryan Model No. RV600-W-FDG cast iron sectional hot water boilers each rated at 4,800 MBH output. The heat is distributed throughout the facility by two secondary water pumps, except for the Auditorium. Two gas-fired rooftop units rated at 800 MBH output heat the Auditorium. Two Trane gas-fired rooftop units heat the make-up air for the kitchen and culinary art rooms.

Two Trane Electric, water-cooled, rotary chillers with a nominal cooling capacity of 405-tons, delivers cooling each. These towers are rated at 1,140 GPM and the chilled water is circulated via two 100 HP pumps rated at 2,280 GPM at 130 FT HD and the condenser is pumped to the cooling towers by two 50 HP pumps rated at 2,280 GPM at 65FT HD. Lastly, the Auditorium is cooled by two 50-Ton packaged rooftop air conditioning units.

Exhaust System

Timber Creek is exhausted by rooftop units, unit ventilators and centrifugal roof exhausters for bathrooms and specialty classrooms (e.g. art rooms, chemistry rooms, biology rooms, etc.) all have their own dedicated exhaust systems. The kitchen exhaust systems utilize two 9 feet by 4 feet commercial exhaust hoods. The hoods are utilized for heat and smoke exhaust over cooking ovens, steamers and gas fired ranges in the kitchen. The two commercial exhaust hoods are controlled by wall-mounted switches.

Domestic Water

For the facilities domestic hot water it is produced by a LAARS gas-fired hot water heater rated at 750 MBH input and two (2) A.O. Smith Cyclone XHE, high-efficiency, gas-fired hot water heaters rated at 200 MBH output each that feed four (4) large storage tanks. The hot water is distributed throughout the high school by two (2) ½ HP, in-line, hot water circulation pumps. These pumps are controlled by an aqua stat. The insulation within the piping is in good condition.

Lighting

Timber Creek is very well maintained and efficient. The majority of the fixtures are T-8 lamps, fluorescent tube lay-in fixtures and electronic ballasts. The exit signs in the facility are LED lamps as well.

2.3.2a Recommended ECMs

ECM Summary Table

Energy Conservation Measures (ECMs)				
ECM #	**Description**	**Annual Utility Reduction**		
		Electric Demand (kW)	**Electric Consumption (kWh)**	**Natural Gas (therms)**
ECM #1	Lighting Upgrade	7.1	19754.0	0.0
ECM #2	Lighting Controls	29.3	76043.0	0.0
ECM #3	Computer Monitor Replacement	0.0	51744.0	0.0
ECM #4	Kitchen Hood Controls	0.0	4685.0	1204.0
ECM #5	Kitchen Dishwasher Booster Heater	24.0	6458.0	-269.0
ECM #6	Walk-in Cooler/Freezer Controls	0.0	4156.0	0.0
Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)				
Renewable Energy Measures (REMs)				
REM #1	**Description**	**Annual Utility Reduction**		
		Direct Current Rating (DC)	**Electric Consumption (kWh)**	**Natural Gas (therms)**
REM #1	Blue Sky Power	1,130 kW	3,491,345 kWh	0.0

ECM #1: Lighting Upgrade

Description:

As discussed prior in the description of the building, Timber Creek is the newest high school in the BHPRSD and was used as an example to the region on being an energy efficient building. The majority of the lighting fixtures at Timber Creek are 32-watt, T-8 lamps and electronic ballasts.

The fixtures already in place are energy efficient, but with new technology there is the potential to upgrade to the Super Saver T-8 25-watt lamps. These 25-watt lamps provide adequate lighting and have approx. 4,000 more burn-hours than the average 32-watt T-8 fixture that has a life span of 20,000 burn-hours.

Once again, this ECM is not a huge capital investment neither a necessity to hire a contractor to install these fixtures. The replacement of the existing fixtures to the Super Saver lamps can be done in house by the custodial staff and save on installation cost.

Energy Savings Calculations

From the NJ Smart Start Incentive Appendix, the following incentives are warranted:

Replacement of T-8 lamps to Super Saver T-8 Lamps (25-watt) is $10 per fixture.

Smart Start Incentive = (# of T-8 fixtures x $10 per fixture)

Smart Start Incentive = (2,179 fixtures x $10 per fixture) = $21,790

Timber Creek High School ECM #1 Continued:

ECM #1 Energy Savings Summary	
Installation Cost ($):	$34,690
NJ Smart Start Incentive ($):	$21,790
Net Installation Cost ($):	$12,900
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$2,672
Total Yearly Savings ($/yr.):	$2,672
Estimated ECM Lifetime (yr.):	15
Simple Payback	4.8
Simple Lifetime Savings	$40,080
Net Present Value	**$18,998.16**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #2: Lighting Controls Upgrade

Description:

Some of the lights throughout the high school are left on unnecessarily. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses. After noting during the visit to Timber Creek, it was noted that a vast number of employees still leave the lights on is a waste of energy. So it is energy efficient to adapt lighting controls in many of the rooms throughout the building.

The U.S. Department of Energy funded a study to investigate energy savings reached through various types of building system controls. The reference 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 concluded that commercial facilities have the potential to achieve significant energy savings through the use of building controls and sensors. The study reported that average savings from occupancy sensors for lighting control ranged from 20% - 28%.

This ECM involves the replacement of standard wall switches to sensor wall switches for classrooms, offices, conference rooms, and bathrooms. The savings resulting from this execution for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

Energy Savings = (% Savings x Controlled Light Energy (kWh/Yr.))

Savings = Energy Savings (kWh) x Average Electricity Cost ($/kWh)

Lighting Controls - Cost and Incentives

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

Dual Technology Occupancy Sensor – Remote Mount	$250 per Installation
Dual Technology Occupancy Sensor – Switch Mount	$150 per Installation
Dual Technology Occupancy Sensor with 2 Pole Powerpack	
- Remote Mount	$300 per Installation

Costs above include material and labor.

NJ Smart Start Incentive warrants the following incentive:

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

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

Smart Start Incentive = (# of wall mounted x $20) + (# of ceiling mount x $35)

Smart Start Incentive = (134 wall mount x $20) = $2,680

Timber Creek High School ECM #2 Continued:

ECM #2 Energy Savings Summary	
Installation Cost ($):	$32,900
NJ Smart Start Incentive ($):	$2,680
Net Installation Cost ($):	$30,220
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$10,114
Total Yearly Savings ($/yr.):	$10,114
Estimated ECM Lifetime (yr.):	15
Simple Payback	3
Simple Lifetime Savings	$151,710
Net Present Value	**$90,520.28**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #3: Computer Monitor Replacement

Description:

The computers throughout Timber Creek utilize a mixture of CRT Computer Monitors and flat panel LCD computer monitors. Computers are located in the offices, computer labs, lounges, and classrooms. The CRT monitors are outdated and have several disadvantages to them, for example, larger desk space needed to use a CRT monitor, more energy consumption, poor picture, distortions, and electromagnetic emissions.

This ECM demands the replacement of all CRT monitors with LCD flat panel monitors. The different in energy consumption between CRT and LCD monitors are substantial. Another pro to this ECM the installation can be done in house, so the equated figures below do not incur installation cost.

Energy Savings Calculations:

Number of CRT monitors: 308

Weeks per Yr.: 40

Hrs. / week: 84 (12 hours per day cumulative average)

$$\textit{Electric Usage} = \frac{\text{\# of Computers x Monitor Power (W) x Operating (hrs.)}}{\text{1000(W/kW)}}$$

Energy Cost = Electric Usage (kWh) x Ave Electric Cost ($/kWh)

Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
# Of Computers	**308**	**308**	
Electric Usage (kWh)	77,616	25,872	51,744
Monitor Power Cons (W)	75	25	50
Energy Cost ($)	$10,323	$3,441	$6,882

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Net Cost per flat panel LCD monitor is estimated to be $100. Installation costs are not equated in the figures above since in-house staff can accomplish this task.

Installation Costs: # Monitors x Cost per Monitor

308 Monitors x $100 per monitor

$30,800

ECM #3 Energy Savings Summary	
Installation Cost ($):	$30,800
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$30,800
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$6,882
Total Yearly Savings ($/yr.):	$6,882
Estimated ECM Lifetime (yr.):	15
Simple Payback	4.5
Simple Lifetime Savings	$103,230
Net Present Value	**$51,356.87**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #4: Kitchen Hood Controls

Description:

The Timber Creek High School Kitchen is uses two exhaust hood systems that are manually controlled by a wall switch. The size of the range hood is 4'x20', these hoods are both situated in the kitchen and the art culinary room.

Standard kitchen hood exhaust systems consist of a switch that relays that interlock kitchen grease hood exhaust with 100% outside air and provide make-up air for this system. This hood is operational for 4 hours per day.

Energy Conservation Measure number four recommends the replacement of the existing hood exhaust systems to be swapped with a Melink Kitchen Hood Variable Air Volume Controller. This is an advanced kitchen hood system, when operation the fan will fluctuate its performance to meet the smoke/vapor coming off the range. Also the fan will increase based on the hood exhaust temperature, so it doesn't over heat nor run at 100% until needed.

Energy Calculations Summary:

It is appropriate to note that the calculation simulates the exhaust fans and make-up air fixtures are manually turned off for approx. 8 hours per day.

Kitchen:

Energy Calculations – Natural Gas			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Make up air unit Total Heating Energy	1,384	1,024	
Boiler Efficiency (%)	80%	80%	
Heating Fuel Value	100,000	100,000	
Gas Cost ($/Therms)	$1.11	$1.11	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Fan Energy Annual kWh	1,384	1,024	360
Electric Energy Cost ($)	$1,537	$1,137	$400

Energy Calculations – Electric			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Supply Fan HP	2	2	
Fan Energy, Annual	2,652	1,314	
Electric Cost ($/kWh)	$0.133	$0.133	
Energy Savings Calculations			
ECM Results	Existing	Proposed	Savings
Fan Energy Annual kWh	2,652	1,314	1,339
Electric Energy Cost ($)	$353	$175	$178

Culinary Arts Room:

Energy Calculations – Natural Gas			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Make up air unit Total Heating Energy	1,384	1,024	
Boiler Efficiency (%)	80%	80%	
Heating Fuel Value	100,000	100,000	
Gas Cost ($/Therms)	$1.11	$1.11	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Fan Energy Annual kWh	1,384	1,024	360
Electric Energy Cost ($)	$1,537	$1,137	$400

Energy Calculations – Electric			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Supply Fan HP	2	2	
Fan Energy, Annual	2,652	1,314	
Electric Cost ($/kWh)	$0.133	$0.133	
Energy Savings Calculations			
ECM Results	Existing	Proposed	Savings
Fan Energy Annual kWh	2,652	1,314	1,339
Electric Energy Cost ($)	$353	$175	$178

Total installed cost of the kitchen hood control system for Timber Creek kitchen range and culinary arts kitchen -- $27,051.

ECM #4 Energy Savings Summary	
Installation Cost ($):	$27,052
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$27,052
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$1,960
Total Yearly Savings ($/yr.):	$1,960
Estimated ECM Lifetime (yr.):	15
Simple Payback	13.8
Simple Lifetime Savings	$29,400
Net Present Value	**($3,653.65)**

ECM #5: Dishwasher Booster Heater

Description:

Tankless style hot water heaters provide improved efficiencies compared to the standard hot water heaters. In addition, heating with natural gas is far less expensive than domestic hot water heated with electric heat.

Currently the dishwasher uses an electric booster heater to provide approx. 180 ^{o}F hot water for sterilization. A tankless hot water heater would allow the utilization of natural gas to heat the tank versus the current electric heat being used now. This will allow for more space since the requirements for boosting production would be perpetuated because of the natural gas.

The energy conservation measure would require the domestic water booster for the commercial kitchen be replaced with a Takagi commercial hot water heater model number TATM32 with remote temperature controller.

Energy Savings Calculations:

Booster HW Heat (BTU)

= Washer (gal/min) x 8.55 (lbs/gal) x use (min/wk) x (wk/yr.) x temperature rise (^{o}F)

x 1.0 (BTU/Lb x ^{o}F)

$$\text{Electric Booster Energy} = \frac{\text{Booster HW Heat (BTU)}}{\text{Electric Heat Value (BTU/kWh)}}$$

$$\text{Gas Booster Energy} = \frac{\text{Booster HW Heat (BTU)}}{\text{kWh eff. (\%) x Gas Heat Value (BTU/Therm)}}$$

Electric Energy Cost = Energy Use, kWh x Cost of Electricity ($/kWh)

Natural Gas Energy = Energy Use, Therms x Cost of Natural Gas ($/Therm)

Instant Domestic Hot Water Heater Booster Calculations			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	Electric Booster Heater	Natural Gas HWH	
Estimated Dish Washer Use (GPM)	3.5	3.5	
Dish Washer Use (min/week)	300	300	
Dish Washer Use (week/yr.)	42	42	
Booster Temp Rise (^{o}F)	60	60	
Domestic HWH Efficiency (%)	100%	82%	-18%
Booster HW Heat Required (MMBTUs)	22,041	22,041	
Electric Cost ($/kWh)	0.133	0.133	
Gas Cost ($/Therm)	1.11	1.11	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Proposed Booster Dom. HW Natural Gas Usage (Therms)	0	269	-269
Electric Booster Energy (kWh)	6,458	0	6,458
Electric Energy Cost ($)	$859	$0	$859
Gas Energy Cost ($)	$0	$298	-$298
Total Energy Cost ($)	**$859**	**$298**	**$561**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

There is no maintenance savings due to implementation of this ECM.

ECM #5 Energy Savings Summary	
Installation Cost ($):	$10,250
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$10,250
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$561
Total Yearly Savings ($/yr.):	$561
Estimated ECM Lifetime (yr.):	15
Simple Payback	18.3
Simple Lifetime Savings	$8,415
Net Present Value	**($3,552.82)**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #6: Walk-in Cooler/Freezer Controls

Description:

The two (2) refrigerant walk-in cooler/freezers currently being operated are there to preserve perishables. There are fans that circulate the cold air around the food at all times. These evaporator fans run continuously with a 1/15 HP motor that emits heat that needs to be removed from the refrigerator.

This ECM would be proposing Timber Creek to install a evaporator fan controller than features two-speed operation of the evaporator fans – high speed during cooling, and low speed when not cooling manufactured by Fridgitek. Note the estimated energy savings assumes that the cooler/freezer is not open for 10 hours a day.

Energy Savings Calculations:

Installing controllers on each of the two evaporator fan motors in the two walk-in cooler/freezers would save approx. 346.35 kWh/month x 12 months = 4,156 kWh/yr.

Annual Energy Cost Savings = 4,156 kWh x $0.133/kWh = $533/year.

ECM #6 Energy Savings Summary	
Installation Cost ($):	$4,518
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$4,518
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$553
Total Yearly Savings ($/yr.):	$553
Estimated ECM Lifetime (yr.):	15
Simple Payback	8.2
Simple Lifetime Savings	$8,295
Net Present Value	**$2,083.88**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

2.3.2b Solar PV Proposal

The access to renewable energy generation is not restricted for municipalities and business; schools have been going green as well. Many districts have been reaching out to experts on the processes of lowering their energy bill by not reducing consumption. The Black Horse Pike Regional School District reached out to the Township of Gloucester for the opportunity to enter into a shared services agreement. The district and the Township are in the process of awarding a professional solar contractor who will own and operate the solar systems and sell the generated power to the District for a discounted price, than what they are paying now to the utility.

Blue Sky Power has evaluated potential solar PV systems for all BHPRSD High Schools as well as Gloucester Township Public Schools to be accompanied into the Gloucester Township Solar PPA. During Blue Sky Power's evaluation of Timber Creek, it was identified that there would be an option for a roof mount system for Timber Creek pending upgrades since the current roof conditions are fair but requires a new warranty and some upgrades. As a result, Timber Creek is being proposed ground-mounted systems with an alternate bid for carport systems and the roof-mount.

During the feasibility study conducted by Blue Sky Power on the potential PV systems it was identified that there are two potential systems that can be implemented. The ground-mounted system would have a DC rating of 1,130 kW DC. The roof mount and carport systems would have a DC rating of 724 kW and 222 kW respectively.

Given the large amount of capital required by the school to invest in a solar PV system it is not recommended that BHPRSD go a Direct Purchase route. It is more advantageous for the school to enter into a Power Purchase Agreement (PPA), where the end user (Triton) would enter into a contract to purchase power at a reduced price and the Owner/Generator would own, operate, and maintain the system for a period of 15 to 20 years. The Solar PV proposal for Timber Creek Regional High School can be evaluated in **Appendix A.**

Renewable Energy Measures (REMs)				
REM #1	**Description**	**Annual Utility Reduction**		
		Direct Current Rating (DC)	**Electric Consumption (kWh)**	**Percentage of Current Utility**
REM #1	Blue Sky Power Solar Array Proposal	1,130 kW Alternates 724 kW / 222 kW	2,491,921 kWh	100%

Timber Creek Regional High School Final Assessment

Timber Creek has less ECMs to consider than the other two (much older) schools in Triton and Highland. The Energy Savings Improvement Program (ESIP) allow for financing options of any combination of the energy efficient projects proposed.

Gloucester Township is currently in phase two of the process by identifying which ECMs that would like to be included in the package. The ECMs being highly considered are the ones that will have a greater Net Present Value as well as a short payback period.

Timber Creek is not a very old building so there are not that many capital improvements proposed for this location.

The ECM project calculations summary is displayed on the following page:

Table 1

ESIP – Total Entity Project Summary

Timber Creek High School

Energy Savings Improvement Program – Potential Energy Efficiency Project						
ECM Identification	**Annual Energy Savings ($)**	**Project Cost ($)**	**INCENTIVES***		**Costumer Cost**	**Simple Payback**
			Smart Start			
ECM #1	$2,672	$34,690	$21,790	$0	$12,900	4.8
ECM #2	$10,114	$32,900	$2,680	$0	$30,220	3.0
ECM #3	$6,882	$30,800	$0	$0	$30,800	4.5
ECM #4	$1,960	$27,052	$0	$0	$27,052	13.8
ECM #5	$561	$10,250	$0	$0	$10,250	18.3
ECM #6	$553	$4,518	$0	$0	$4,518	8.2
Design / Construction Extras (15%)		$21,031			$21,031	
Total Entity Project	**$22,742**	**$161,241**	**$24,470**	**$0**	**$136,771**	**6.0**

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Total Timber Creek HS Energy Cost (Annual):	**$564,586**
Est. Total Timber Creek HS Energy Savings:	**$22,742**
Overall Timber Creek HS Reduction:	**4.0%**

2.2.3 Highland Regional High School

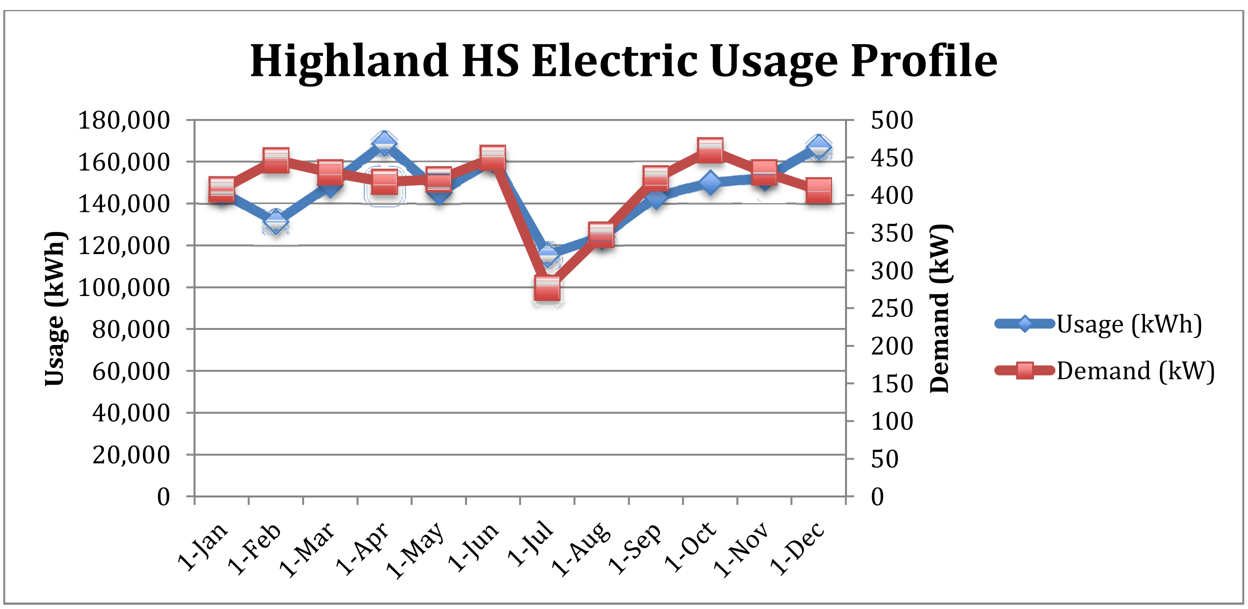
450 Erial Road

Blackwood, NJ 08012

The annual electric usage of Highland HS is displayed below.

Highland Regional High School Annual Electric Consumption			
Month of Use	**Consumption kWh**	**Demand**	**Total Bill**
January 09	145,440	408.0	$19,182
February 09	131,200	446.4	$18,055
March 09	148,960	430.4	$19,482
April 09	168,640	417.6	$21,777
May 09	141,600	420.8	$18,591
June 09	160,960	449.6	$21,580
July 09	115,520	276.8	$16,954
August 09	124,160	347.2	$16,954
September 09	143,360	422.4	$19,615
October 09	150,080	459.2	$20,727
November 09	152,160	430.4	$20,549
December 09	167,040	406.4	$22,587
Totals	**1,749,120**	**459.2 Max**	**$235,319**
	Average Demand:	**409.6 kW average**	
	Average Rate:	**$0.135 $/kWh**	

The line chart that follows shows the annual usage at Highland High School.



Energy Provider

Electricity – Atlantic City Electric

3rd Party Provider – South Jersey Energy

Natural Gas – South Jersey Gas

3rd Party Provider – Hess Corporation

Facility Description	Stories and Area (sf)	Roof	Walls	Windows
	220,065 square foot, two-story building, the HS was built in 1965.	Majority of the roof is built-up with a light color stone covering that includes a 2-inch rigid insulation and 2-inch insulrock on bulb tees.	The amount of insulation within the walls is unknown.	¼ insulated glass with vinyl frames. Also blinds are used so they reduce heat loss.

Condition Assessment

Highland Regional High School is in fair condition.

	Description	**Hours**
Facility Use And Occupancy	Building was originally built in 1965 and has received additions in 1986, 1990 and 1999, the building has a gym, café, classrooms, offices, custodial rooms, bathrooms, etc.	Highland houses 1,390 students and faculty. The building is in use from 6:00 AM to 11:00 PM for school hours, afterschool programs and custodial services.

Major Energy Consuming Measures

HVAC Systems

The central heating system is located in the facility's original boiler room and consists of two (2) 1967 H.B. Smith cast iron sectional hot water boilers each rated at 6,522 MBH output. These boilers being used are 13 years beyond their ASHRAE life and are 70% efficient. The hot water is distributed by volume end suction pumps feeding three major ends in the facility and is located in the same original boiler room. A 1988 Wiel-McLain cast iron boiler that is rated at 810 MBH output and feeds a two in-line water feeds heats the gym, which was added in 1986. A 1999 vintage packaged rooftop unit heats the weight room and hot water duct units heat the Library and Classroom additions.

Cooling for the Library, Classroom additions, the 1999 weight room, the 2008 auditorium HVAC replacement, and the 2010 café renovation. The original 1965 building is heating, but the A-wing is excluded from heating and cooling. Parts of Corridor A at the high school are cooled by direct expansion, indoor, water-cooled condensing systems. The cooling media is from the domestic water supply and the wastewater discharges to the sanitary system. The School District is charged for cooling process for both water and sewer.

A 50-ton packaged rooftop unit cools the library. This unit is recommended to be brought back to its original setting by reprogramming it to operate as a variable air volume system with the proper operation of the compressors. Self-contained heating and cooling by a 10-ton packaged rooftop air conditioning unit with DX cooling cool the 1990 classroom addition. Two (2) 30-ton packaged rooftop air conditioning units installed in 2008 while (3) 15-ton packaged rooftop units cool the café cool the Auditorium.

Exhaust Systems

Packaged rooftop units, unit ventilators and centrifugal roof exhausters exhaust High Regional High School. Dedicated exhaust is provided for toilet rooms, a maintenance staff based on temperature and occupancy comfort manually controls specialty areas. Wall switches control the bathroom exhausts. The commercial kitchen air is exhausted by two (2) 12 feet by 4 feet commercial exhaust hoods. Wall switches control these hoods.

Domestic Water

During the heating season, the domestic water for the kitchen, restrooms, office lounge, etc. are provided by a 6-foot diameter by 12-foot long storage tank with an internal heating exchanger fed by the heating hot water boilers two (2) in-line circulation pumps. In the off-season, the domestic water is produced by H.B. Smith cast iron boilers rated at 785 MBH output that feeds into the heat exchanger tank. Pumps circulate the hot water through the facility and are controlled by an aqua stat.

Lighting

Timber Creek is very well maintained and efficient. The majority of the fixtures are T-8 lamps, fluorescent tube lay-in fixtures and electronic ballasts. Storage rooms and closets are lit with compact fluorescent lamps. The exit signs are lit by incandescent lamps.

2.3.3a Recommended ECMs

ECM Summary Table

Energy Conservation Measures (ECMs)				
ECM #	**Description**	**Annual Utility Reduction**		
		Electric Demand (kW)	**Electric Consumption (kWh)**	**Natural Gas (therms)**
ECM #1	Lighting Upgrade	25.8	77844.0	0.0
ECM #2	Lighting Controls	31.1	80350.0	0.0
ECM #3	Computer Monitor Replacement	0.0	17136.0	0.0
ECM #4	Condensing Boiler Installation	0.0	0.0	15697.0
ECM #5	AC Unit Replacement	46.0	46185.0	0.0
ECM #6	Library AC Unit Upgrade	1.0	40749.0	643.0
ECM #7	Café AC Unit Controls Upgrade	0.0	27360.0	1012.0
ECM #8	Water Cooled CU Replacement	7.0	5583.0	0.0
ECM #9	Water Conservation	0.0	0.0	0.0
ECM #10	Premium Efficiency Motors	2.5	10677.0	0.0
ECM #11	Valve Blanket Insulation	0.0	0.0	513.0

ECM #12	Kitchen Hood Controls	0.0	1339.0	355.0
Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)				
Renewable Energy Measures (REMs)				
REM #1	**Description**	**Annual Utility Reduction**		
		Direct Current Rating (DC)	**Electric Consumption (kWh)**	**Natural Gas (therms)**
REM #1	Blue Sky Power	613 kW	1,749,120	0.0

ECM #1: Lighting Upgrade

Description:

The majority of the lighting throughout the Highland High School is provided by lighting fixtures that are the standard 32-watt, T-8 Lamps and electronic ballasts. There are still some spaces for example, custodial closets that use the 40-watt, T-12 lamps and incandescent lamps. Both gyms, are lit by (60) 400- watt metal-halide (MH) fixtures with poor lumen maintenance (approx. 30% reduction in lighting output at 40% of rated lamp life)

This ECM includes the replacement of all 32-watt, T-8 and 40-watt, T-12 with the new Super Saver T-8 lamps throughout the entire facility. These 25-watt lamps provide adequate lighting and have approx. 4,000 more burn-hours than the average 32-watt T-8 fixture that has a life span of 20,000 burn-hours.

Also this ECM demands the replacement of the existing Gymnasium and Auxiliary Gym light fixtures with T-5 high-bay light fixtures which would include six, 4-foot T-5 High Output (HO) lamps. These T-5 HO lamps have 10,000 more hours compared to the small life of the 400-Watt MH lamps that already have 10,000 hours. This would save in maintenance along with energy consumption costs in the future.

Lastly, all exit signs that are lit by 7-watt Compact Fluorescent Lamps (CFLs) or incandescent bulbs need to be replaced with LED technology units.

Energy Savings Calculations

From the NJ Smart Start Incentive Appendix, the following incentives are warranted:

Replacement of T-8 lamps to Super Saver T-8 Lamps (25-watt) is $10 per fixture.

Smart Start Incentive = (# of T-8 fixtures x $10 per fixture)

Smart Start Incentive = (1,233 fixtures x $10 per fixture) = $12,330

For replacement of 400-watt MH fixtures to T-5 Lamps

Smart Start Incentive = (# of T-5 fixtures x $100 per fixture)

Smart Start Incentive = (60 fixtures x $100 per fixture) = $6,000)

For LED exit sign: $20/LED exit sign (<= 75kW facility connected load) and $10/LED exit sign (>= of LED exit facility connected load)

Smart Start Incentive = (# of LED fixtures x $10 per fixture)

Smart Start Incentive = (75 fixtures x $10 per fixture) = $750

ECM #1 Energy Savings Summary	
Installation Cost ($):	$57,752
NJ Smart Start Incentive ($):	$19,080
Net Installation Cost ($):	$38,672
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$15,968
Total Yearly Savings ($/yr.):	$15,968
Estimated ECM Lifetime (yr.):	15
Simple Payback	2.4
Simple Lifetime Savings	$239,520

Net Present Value	$151,952.95

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #2: Lighting Controls Upgrade

Description:

Some of the lights throughout the high school are left on unnecessarily. In some situations lights are left on due to the error that it is better to keep the lights running than to continuously switch the lights on and off. Although the increased switching of the lamps reduces lamp life, the energy savings outweigh the lamp replacement costs. Once again, it makes sense to keep the lights off if there are two-minute intervals between the room uses. After noting the vast number of employees that work in the Highland Regional High School leave the room still lit, it is important to implement lighting controls in many of the rooms throughout the building.

The U.S. Department of Energy funded a study to investigate energy savings reached through various types of building system controls. The reference 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 concluded that commercial facilities have the potential to achieve significant energy savings through the use of building controls and sensors. The study reported that average savings from occupancy sensors for lighting control ranged from 20% - 28%.

This ECM involves the replacement of standard wall switches to sensor wall switches for classrooms, offices, conference rooms, and bathrooms. The savings resulting from this execution for the energy management controls are estimated to be 20% of the total light energy managed by occupancy sensors.

Energy Savings = (% Savings x Controlled Light Energy (kWh/Yr.))

Savings = Energy Savings (kWh) x Average Electricity Cost ($/kWh)

Lighting Controls - Cost and Incentives

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

Dual Technology Occupancy Sensor – Remote Mount $250 per Installation

Dual Technology Occupancy Sensor – Switch Mount $150 per Installation

Dual Technology Occupancy Sensor with 2 Pole Powerpack

- Remote Mount $300 per Installation

Costs above include material and labor.

NJ Smart Start Incentive warrants the following incentive:

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

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

Smart Start Incentive = (# of wall mounted x $20) + (# of ceiling mount x $35)

Smart Start Incentive = (39 wall mount x $20) + (125 ceiling mount x $35) = $5,155

ECM #2 Energy Savings Summary	
Installation Cost ($):	$41,800
NJ Smart Start Incentive ($):	$5,155
Net Installation Cost ($):	$36,645
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$10,847
Total Yearly Savings ($/yr.):	$10,847
Estimated ECM Lifetime (yr.):	15
Simple Payback	3.4
Simple Lifetime Savings	$162,705
Net Present Value	**$92,845.78**

ECM #3: Computer Monitor Replacement

Description:

The computers throughout Highland High School utilize a mixture of CRT Computer Monitors and flat panel LCD computer monitors. Computers are located in the offices, computer labs, lounges, and classrooms. The CRT monitors are outdated and have several disadvantages to them, for example, larger desk space needed to use a CRT monitor, more energy consumption, poor picture, distortions, and electromagnetic emissions.

This ECM demands the replacement of all CRT monitors with LCD flat panel monitors. The different in energy consumption between CRT and LCD monitors are substantial. Another pro to this ECM the installation can be done in house, so the equated figures below do not incur installation cost.

Energy Savings Calculations:

Number of CRT monitors: 102

Weeks per Yr.: 40

Hrs. / week: 84 (12 hours per day cumulative average)

Electric Usage = $\frac{\text{\# of Computers x Monitor Power (W) x Operating (hrs.)}}{\text{1000(W/kW)}}$

Energy Cost = Electric Usage (kWh) x Ave Electric Cost ($/kWh)

Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
# Of Computers	**201**	**102**	
Electric Usage (kWh)	25,704	8,568	17,136
Monitor Power Cons (W)	75	25	50
Energy Cost ($)	$3,470	$1,157	$2,313

Highland Regional High School ECM #3 Continued:

Net Cost per flat panel LCD monitor is estimated to be $100. Installation costs are not equated in the figures above since in-house staff can accomplish this task.

Installation Costs: # Monitors x Cost per Monitor

102 Monitors x $100 per monitor

$10,200

ECM #3 Energy Savings Summary	
Installation Cost ($):	$10,200
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$10,200
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$2,313
Total Yearly Savings ($/yr.):	$2,313
Estimated ECM Lifetime (yr.):	15
Simple Payback	4.4
Simple Lifetime Savings	$34,695
Net Present Value	**$17,412.44**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #4: Condensing Boiler Installation

Description:

The central heating system for Highland Regional HS consists of three (2) 1967 H.B. Smith cast iron sectional hot water boilers each rated at 6,522 MBH output that serve the building's heating hot water circulation. These boilers are currently 13 years past their ASHRAE service life and are fired by natural gas.

Continuing along, the 1986 gymnasium addition constructed is heated by a 1988 H.B. Smith 28a cast iron sectional hot water boilers, which is rated at 810 MBH output. The boiler has roughly 8 years of service life left for this particular cast iron boiler.

During the winter seasons when boilers are used the most, the domestic hot water for the kitchen, restrooms, office lounge, etc. are delivered by a 6-foot diameter by 12-foot long storage tank with an interior heat exchanger feed by the heating hot water boilers via two (2) in-line circulation pumps. Along the visit, a maintenance director stated that the storage tank is always in need of repair. On the opposite side, during the summer seasons the water is produced by one H.B. Smith cast iron sectional boiler rated at approx. 784 MBH outputs that feeds the same heat exchanger/tank. The summer boiler has roughly 4 years left on its service life.

High efficiency boilers peak performance is 99% depending on returning water temperature. With the current building operations, the annual average for a new boiler would be 88% versus the current boiler installed in the central part of the building that is at 70%. For the gym addition, the boiler is operating at an efficiency of 80%. This is an increase of 8% to 18% efficiency for comfort heating and 25% increase in domestic hot water. Note the new modular boiler sets also have the ability to be controlled by a digital boiler sequencer to optimize plant efficiency, which could yield further savings than what is calculated in this ECM.

This ECM involves the installation of three condensing boilers, gas-fired boilers to replace one of the existing 3,200 MBH boilers located in the original boiler room. This consolidation would include one of the 6,522 MBH boilers, the 810 MBH gym boiler and the 784 summer domestic hot water boiler. The domestic hot water would be accounted for by the gas-fire instantaneous domestic hot water modular boilers as a complete standalone system. The existing storage tank with exchanger would no longer be necessary. The existing second 6,522 MBH boiler will remain as a back-up.

Lastly, the core of these proposed ECMs are Aerco model number BMK-3.0LN and BMK-1.5LN boilers or equivalent for the comfort heating and Aerco model number INN-1060 or equivalent for the domestic hot water. These replacements are accounted for only one-for-one swap that takes into consideration the current capacity of the existing boilers.

Energy Savings Calculations:

Building Heat Required = Existing Natural Gas (Therms) x Heating Eff. (%) x Fuel Heat Value (BTU/Therm)

Proposed Heating Gas Usage = Building Heat Required (BTU) / Heating Eff. (%) x Fuel Heat Value (BTU/Therm)

Energy Cost = Heating Gas Usage (Therms) x Ave Fuel Cost ($/Therm)

Condensing Boiler Calculations – Central Building			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing cast iron boiler	New Condensing boiler	
Existing Natural Gas (Therms)	76,433	64,274	
Boiler Eff. (%)	74%	88%	14%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Gas Cost ($/Therm)	1.08	1.08	
Energy Savings Calculations			
Natural Gas Usage (Therms)	76,433	64,274	12,120
Energy Cost	$82,548	$69,415	$13,133

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Condensing Boiler Calculations – Domestic Hot Water			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Existing cast iron boiler	New Condensing boiler	
Existing Natural Gas (Therms)	16,001	12,464	
Boiler Eff. (%)	74%	95%	21%
Natural Gas Heat Value (BTU/Therm)	100,000	100,000	
Gas Cost ($/Therm)	1.08	1.08	
Energy Savings Calculations			
Natural Gas Usage (Therms)	16,001	12,464	3,537
Energy Cost	$17,281	$13,461	$3,820

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Installation costs of the new condensing boilers, demolition, flue piping, gas piping modifications, etc. is estimated to be $421,638.

Installation Cost of the new condensing boilers, demolition, fuel piping, boiler water piping adjustments, gas piping adjustments, electric wiring, etc. is estimated to be $340,656.

From **NJ Smart Start Program Incentives Appendix,** the installation of new condensing boilers allows the following incentive: $1.00 per MBH.

Gas Fired Boilers > 300 MBH – 1500 MBH

2 boilers at 1060 MBH each

Smart Start Incentive = (Boiler MBH x $1.75) = 2,120 x $1.75 = $3,710

Gas fired boilers > 1500 MBH – < 4000 MBH

2 boilers at 3000 MBH and (1) boiler at 1500 MBH

Smart Start Incentive = (Boiler MBH x $1.75) = 7,500 x $1 = $7,500

Accumulated Smart Start Incentive = $11,210

Installation Cost ($):	$421,638
NJ Smart Start ($):	$11,210
Net Installation ($):	$410,428
Energy Savings ($/yr.):	$16,953
ECM Lifetime (yr.):	30
Simple Payback	24.2

Lifetime Savings ($): **<u>$508,590</u>**

ECM #5: AC Unit Replacement

Description:

Different shares of Highland Regional HS are cooled by direct expansion outdoor, air-cooled condensing systems. Some of the existing AC units have passed their ASHRAE lifespan. The estimated service life for a condensing unit is twenty (20) years and fifteen (15) years for a packaged rooftop unit. Other systems operating at Triton are within the useful life but are not as efficient as the latest available technology on the market.

Proposed by Concord Engineering Group (CEG), the replacement of the packaged and split system condensing units on the roof with new equipment at equal capacities with R-410a refrigerant and replacement of the DX coil in the matching air handlers as required to accommodate higher pressure refrigerant, which is being proposed. This ECM incurs the cost of running new refrigerant lines.

In reviewing the facility, it was noticed that refrigerant gas R-22 currently in use at Highland HS. This machinery is currently being phased out gradually and can only be maintained and repaired by old R-22 supplies. So as time passes the price for R-22 parts will increase. This will force the replacement of the R-22 to a R-410a system, evaporator coils, and air handling unit along with the refrigerant pipes and fittings.

This ECM requires the replacement on a one-for-one basis with highly efficient systems.

Implementation Summary					
ECM Inputs	**Service For**	**# of Units**	**Cooling Capacity, BTU/hr.**	**Total Capacity, Tons**	**Replace Unit With**
SS-3	Conference Rm A203	1	15,000	1.3	Mitsubishi
SS-6	Nurse/Exam Rooms	3	18,000	1.5	Trane Equipment
SS-4	2nd Floor Admin Offices	1	22,000	1.8	Mitsubishi
RTU-2/RTU-3/RTU-7	Faculty café/Room F216/ Librarian’s Office	3	24,000	2.0	Trane Equipment
SS-5	2nd Floor Admin Offices	2	30,000	2.5	Mitsubishi
RTU-4/RTU-11	Kitchen (Room	3	36,000	3.0	Trane Equipment

	F128)/Science Room				
SS-1	Three Offices near C103	1	36,000	3.0	Trane Equipment
RTU-9	Choral Room	1	48,000	4.0	Trane Equipment
SS-2	Room F211	1	48,000	4.0	Trane Equipment
RTU-8	Café	1	90,000	7.5	Trane Equipment
RTU-1	Weight Room	1	120,000	10.0	Trane Equipment
RTU-10	Auditorium	1	360,000	30.0	Trane Equipment
Total		**20**	**847,000**	**70.6**	

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

This ECM is based on installation of high efficiency indoor and outdoor Trane equipment with R410a refrigerant.

Energy Savings Calculations:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{SEER_{old}} - \frac{1}{SEER_{new}}\right) \times \frac{\text{Operating Hours}}{1000(\text{W/kWh})}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

ECM Inputs	Cooling Capacity, BTU/hr.	Annual Cooling Hrs.	Existing Units (S)EER	Split Units (S)EER	# of Units	Energy Savings kWh	Demand Savings kW
SS-3	15,000	1,000	8 SEER	16 SEER	1	983	0.9
SS-6	18,000	1,000	9 SEER	13 SEER	3	1,846	1.8

SS-4	22,000	1,000	10 SEER	16 SEER	1	825	0.8
RTU-2/RTU-3/RTU-7	24,000	1,000	6 SEER	15 SEER	3	7,200	7.2
SS-5	30,000	1,000	10 SEER	16 SEER	2	2,250	2.3
RTU-4/RTU-11	36,000	1,000	6 SEER	15 SEER	3	10,800	10.8
SS-1	36,000	1,000	7 SEER	17.5 SEER	1	3,086	3.1
RTU-9	48,000	1,000	6 SEER	15 SEER	1	4,800	4.8
SS-2	48,000	1,000	6 SEER	17.5 SEER	1	5,257	5.3
RTU-8	90,000	1,000	10.1 SEER	13 SEER	1	1,988	2.0
RTU-1	120,000	1,000	11 SEER	12.5 SEER	1	1,309	1.3
RTU-10	360,000	1,000	9.5 SEER	10.3 SEER	2	5,887	5.9
Total					**20**	**46,185**	**46.2**

Smart Start Incentive = (Cooling Tons x $/Ton Incentive)

Split System AC Units Rebate Summary				
Unit Description	**Unit Efficiency**	**Rebate $/ton**	**Proposed Capacity Tons**	**Total Rebate $**
5.4 Tons or less Unitary	>= 14 SEER	$92	38.6	$3,550
5.4 tons to 11.25 tons Unitary AC and Split Systems	>=11.5 SEER	$73	17.5	$1,278
20 tons to 30 tons Unitary AC and Split Systems	>=10.5 SEER	$79	60.0	$5,740
Total			**116.1**	**$9,567**

Cost & Savings Summary							
ECM Units	**Installed Cost**	**# of Units**	**Total Cost**	**Rebates**	**Net Cost**	**Energy Savings**	**Pay Back Years**
SS-3	$2,700	1	$2,700	$115	$2,585	$127	20.4
SS-6	$1,500	3	$4,500	$414	$4,086	$249	16.4
SS-4	$5,700	1	$5,700	$169	$5,531	$111	49.7
RTU-2/RTU-3/RTU-7	$8,850	3	$26,550	$552	$25,998	$972	26.7
SS-5	$5,700	2	$11,400	$460	$10,940	$304	36.0
RTU-4/RTU-11	$8,850	3	$26,550	$828	$25,722	$1,458	17.6
SS-1	$9,000	1	$9,000	$276	$8,724	$417	20.9
RTU-9	$9,600	1	$9,600	$368	$9,232	$648	14.2
SS-2	$9,000	1	9,000	$368	$8,632	$710	12.2
RTU-8	$13,800	1	$13,800	$548	$13,253	$268	49.4
RTU-1	$16,125	1	$16,125	$730	$15,395	$177	87.1
RTU-10	$43,500	2	$87,000	$4,740	$82,260	$795	$103.5
Total		**20**	**$221,925**	**$9,567**	**$212,358**	**$6,235**	**34.1**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

There is no noteworthy maintenance savings due to implementation of this ECM.

Highland Regional High School ECM #5 Continued:

ECM #5 Energy Savings Summary	
Installation Cost ($):	$221,925
NJ Smart Start Incentive ($):	$9,567
Net Installation Cost ($):	$212,358
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$6,235
Total Yearly Savings ($/yr.):	$6,235
Estimated ECM Lifetime (yr.):	15
Simple Payback	34.1
Simple Lifetime Savings	$93,525
Net Present Value	**($137,924.97)**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #6: Library AC Unit Upgrade

Description:

As previously discusses within the high school, the maintenance and library staff has indicated the fluctuation of temperature throughout the room. There is a 50-ton packaged rooftop unit conditions the library at the high school. It is equipped with a direct expansion with cooling and hot water heat. The unit has recently been overridden from its original purpose of being a volume system with terminal boxes and electric reheat located above the ceiling serving independent zones. The unit is equipped with standalone controls integral to the Tran Intellipak system and operates in the past with this unit maintaining proper humidity levels in the library. The existing system is equipped with a full economizer however it is not equipped with demand-controlled ventilation.

When CO_2 Sensors are implemented to maintain indoor air quality, they continuously monitor the air in a specified area. Clearly people exhale CO_2 repeatedly, the difference between the indoor CO2 concentration and the outdoor concentration is that the outdoor system indicates the occupancy or activity level in a space and thus its ventilation requirements are arranged. The CO_2 sensor being used read and monitored by the air handling system control panel, which automatically increases the ventilation in the Library.

This ECM would bring the packaged rooftop unit back to its original functionality by having it operate as a variable air system including the proper operation of the compressors. This conservation measure would also mandate that the controls be reprogrammed back to the original settings and integrate the existing building automation at the school.

Recommended by Concord Engineering Group (CEG) for this ECM to happen, further humidity investigation in the Library area is perused before the design phase execution.

Energy Savings Calculations:

Cooling & Heating Energy Savings:

Seasonal energy consumption of the system in the cooling and heating modes was calculated using Trane System Analyzer Software. The results are displayed further below:

Energy Calculations – Electric			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV Systems	VAV Systems	
RTU-6 Cooling Capacity (Tons)	50	50	
RTU-6 Efficiency (EER)	10.0	10.0	
RTU-6 Supply Fan HP	25	25	
Cooling & Fan Energy, Annual kWh	148,064	107,315	
Electric Cost ($/kWh)	$0.135	$0.135	

Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Cooling & Fan Energy Annual kWh	148,064	107,315	40,749
Electric Energy Cost ($)	$19,989	$14,488	$5,501

Energy Calculations – Electric			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV Systems	VAV Systems	
RTU-6 Total Heating Energy (Themrs)	1,787	1,144	
Boiler Efficiency (%)	74%	74%	
Heating Fuel Value	100,000	100,000	
Gas Cost ($/Therm)	$1.08	$1.08	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Heating Energy, Therms	1,787	1,144	643
Heating Energy Cost ($)	$1,930	$1,236	$694

The concept of installation of new controls, terminal boxes, water piping modifications, ductwork modifications, etc. is tallied up to be $72,181.

There are no current incentives for this potential replacement of the Library AC unit.

ECM #6 Energy Savings Summary	
Installation Cost ($):	$72,181
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$72,181
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$6,196
Total Yearly Savings ($/yr.):	$6,196
Estimated ECM Lifetime (yr.):	15
Simple Payback	11.6
Simple Lifetime Savings	$92,940
Net Present Value	**$1,786.45**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #7: Cafeteria AC Unit Controls Upgrade

Description:

Currently at Highland High School's cafeteria there are three (3) 15 ton York Roof top units with direct expansion cooling and hot water heating coils mounted in the supply air duct. The thermostats currently controlling the systems are non-programmable and run 24/7. The occupancy levels in the cafeteria vary due to the current events, but mostly they are every other day and the center is closed on the weekends.

With this staggered occupancy level schedule, the new programmable thermostats have the capability to set back automatically based on pre-set schedules. Also, the new programmable thermostats have the ability to track seasons and adjust their morning warm up to ensure the space temperatures are met by the scheduled time frame.

Highland Regional High School ECM #7 Continued:

Occupied Heating = 70°F

Unoccupied Heating = 60°F

Occupied Cooling = 70°F

Unoccupied Cooling = 84°F

Heat Energy Savings

Total Hours / Week = 168

Available Setback Hours / Week = 128

Baseline Hot Water Gas Use: 2.5 Therms (average June through Sept)

Existing Heating Natural Gas: 2,783 Therms – (2.5 Therms x 12 Months)

=1,387 Therms

$$\text{Set Back Heating Energy} = \text{Existing Gas (Therms)} \times \frac{HDD_{88°F}}{HDD_{68°F}} \times \frac{\text{Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

$$\text{Non Set Back Heating Energy} = \text{Existing Gas (Therms)} \times \frac{\text{Non Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

Heat Cost Savings = Energy Savings (Therms) x Cost of Gas ($/Therm)

Highland Regional High School ECM #7 Continued:

Programmable Thermostat Heating Energy Calculations			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Standard on-board thermostat controls	Programmable thermostats (10 degree set back)	
Total Heating Energy (therms)	4,074	4,074	
Heating Degree Days (70°F / 60°F)	6,029	4,064	1,965
Hours of setback per week	0	128	
Energy Savings Calculations			
Heating Energy, Therms (non setback)	4,074	3,063	1,012
Heating Energy Cost	$4,400	$3,308	$1,093

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

$$\text{Set Back Cooling Energy} = \text{Cooling Energy (kWh)} \times \frac{HDD_{82°F}}{HDD_{72°F}} \times \frac{\text{Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

$$\text{Non Set Back Cooling Energy} = \text{Cooling Energy (kWh)} \times \frac{\text{Non Set Back Hrs. Per Week}}{\text{168 Hrs. Per Week}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Gas ($/kWh)

Programmable Thermostat Heating Energy Calculations			
ECM Inputs	Existing	Proposed	Savings
ECM Inputs	Standard on-board thermostat controls	Programmable thermostats (10° setback)	
RTU-5 Cooling Capacity Tons **(3 Units)**	45	45	
RTU-5 Total Efficiency (EER)	12.1	12.1	
Full Load Cooling Hrs.	800	800	
Cooling Energy, kWh (non set back)	45,302	45,302	
Cooling Degree Days (82°F / 72°F)	246	51	195
Hours of setback per week	0	128	
Energy Savings Calculations			
Cooling Energy, kWh	45,302	17,942	27,360
Electric Energy Cost	$6,116	$2,422	$3,694

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Highland Regional High School ECM #7 Continued:

Cost of Implementation: $23,988

Energy Savings:

Installation Cost:	$23,988
Energy Savings ($/yr.):	$4,786
Estimated ECM Lifetime (yr.):	15
Simple Payback	5.0
Lifetime Savings:	**$71,790**
Net Present Value:	**$33,146.96**

ECM #8: Water-Cooled Condensing Unit Replacement

Description:

Portions of Corridor A at the high school are cooled by a direct expansion, indoor, water-cooled condensing systems. The cooling media is from the domestic water supply and the waste water discharges to the sanitary system. Throughout the designated zones there are 10 units of this style in Highland. The units are original to the building existence and have all surpassed their ASHRAE designated life span. The estimate service life for a water-cooled air conditioner is 15 years. Energy savings are not tallied with replacing air units, but when the unit ages it become less efficient, sometimes do to clogged condensers, internal parts erosion and deposits of oil.

This ECM requires Highland to replace the water-cooled systems with a new variable refrigerant volume direct expansion air-cooled condensing equipment.

In reviewing the facility, it was noticed that refrigerant gas R-22 currently in use at Highland HS. This machinery is currently being phased out gradually and can only be maintained and repaired by old R-22 supplies. So as time passes the price for R-22 parts will increase. This will force the replacement of the R-22 to a R-410a system, evaporator coils, and air handling unit along with the refrigerant pipes and fittings.

Implementation Summary						
ECM Inputs	**Service For**	**# of Units**	**Cooling Capacity, BTU/hr.**	**Cooling Capacity, Tons**	**Total Cooling Capacity, Tons**	**Replacement Based on**
UV	Corridor A	10	24,000	2.0	20.0	Mitsubishi PURY – P240 and PFFY – P24

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

- Mitsubishi design is based on the R410a refrigerant.

Seasonal Energy consumption of the air conditioners during cooling mode is calculated with the equation below:

Energy Savings Calculations:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{SEER_{old}} - \frac{1}{SEER_{new}} \right) \times \frac{\text{Operating Hours}}{1000(\text{W/kWh})}$$

$$\text{Demand Savings, kW} = \frac{\text{Energy Savings (kWh)}}{\text{Hours of Cooling}}$$

Cooling Cost Savings = Energy Savings, kWh x Cost of Electricity, ($/kWh)

Energy Savings Calculations							
ECM Inputs	**Cooling Capacity, BTU/hr.**	**Annual Cooling Hours**	**Existing Units EER**	**Proposed EER**	**Energy Savings kWh**	**Demand Savings kWh**	**Cost Savings $**
UV	24,000	800	10	14.1	5,583	7.0	$754

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Highland Regional High School ECM #8 Continued:

Energy Saving Calculations:

Water Cons = Occupancy (Days/yr.) x Use (Flush/Persons per Day) x Fixture (Gal/Flush)

Water Cost = Water Cons (gallons) x Avg Cost ($/1000 gallons) / 1000(gallons)

Water Conservation Calculations			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM inputs	Existing Water Cooled Units	Air Cooled Units	
Condenser Water GPM	40	0	40
Cooling Load Hours	800	800	
Water Cost ($/1000)	$5.70	$5.70	
Energy Savings Calculations			
ECM Results	1,920,000	0	1,920,000
Water Cost ($)	$10,944	$0	$10,944

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Under the NJ Smart Start Incentive program set by the State, the replacement of AC units with high efficiency AC units drops under the category "unitary HVAC Split System" and warrants an incentive based on efficiency (SEER) noted below. The program incentives are calculated as follows:

Smart Start Incentive = (cooling / tons X $ / Ton Incentive)

AC Units Rebate Summary				
Unit Description	**Unit Efficiency**	**Rebate $/Ton**	**Proposed Capacity Tons**	**Total Rebate $**
5.4 Tons or less Unitary AC and Split Systems	>= 14 SEER	$92	20.0	$1,840

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #8 Energy Savings Summary	
Installation Cost ($):	$158,825
NJ Smart Start Incentive ($):	$1,840
Net Installation Cost ($):	$156,985
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$11,698
Total Yearly Savings ($/yr.):	$11,698
Estimated ECM Lifetime (yr.):	15
Simple Payback	13.4
Simple Lifetime Savings	$175,470
Net Present Value	**($17,335.04)**

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

ECM #9: Water Conservation

Description:

Highland Regional HS utilizes an array of old and new plumbing fixtures. The existing urinals are automatically flushed by a time clock device that cycles every 15 minutes for a total of 28 flushes per day. There are newer fixtures that consume less water than today's requirements by the State that can add up to substantial water reduction at Highland Regional.

This ECM recommends the replacement of all existing water closets and urinals within Highland Regional. The projected retrofitting includes the installation of low flow flushometer style water closets that utilize 1.28 gallons per flush and the ultra-low flushometer style urinals that utilize 1/8 gallon per flush. For the foundation of this calculation includes LEED rating system analysis to estimate the occupancy usage for students within the school.

The water cost per gallon was estimated on other facilities served by the Municipality.

Energy Saving Calculations:

Water Cons = Occupancy (Days/yr.) x Use (Flush/Persons per Day) x Fixture (Gal/Flush)

Water Cost = Water Cons (gallons) x Avg Cost ($/1000 gallons) / 1000(gallons)

Highland Regional High School ECM #9 Continued:

Water Conservation Calculations			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	Existing Fixtures	Low Flow Fixtures	
Total # of Students	1,169	1,169	
% Male to Female	50%	50%	
Occupied days / Yr.	180	180	
***WC uses / day / Person**	0.6	0.6	
Urinal Uses / day / Person	NA	0.4	
Total Urinal Flushes / Day	840	234	
Total WC Flushes / Day	350.7	350.7	
Urinal Gallons / Flush (GPF)	1.0	0.125	0.875
WC Gallons / Flush (GPF)	3.5	1.28	2.22
Water Cost ($/1000)	$5.70	$5.70	
Energy Savings Calculations			
ECM Results	**Existing**	**Proposed**	**Savings**
Water Consumption	527,541	86,062	441,479
Water Cost ($)	$3,007	$491	$2,516

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

***WC –** Water Closet

The cost of installation of 40 water closets (WC) and 30 low flow urinals throughout the facility is estimated to be $52,124.

Highland Regional cannot apply for rebates, since there are no current NJ Smart Start incentives in place for low flow plumbing fixtures.

ECM #9 Energy Savings Summary	
Installation Cost ($):	$52,124
NJ Smart Start Incentive ($):	0
Net Installation Cost ($):	$52,124
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$2,516
Total Yearly Savings ($/yr.):	$2,516
Estimated ECM Lifetime (yr.):	30
Simple Payback	20.7
Simple Lifetime Savings	$75,480
Net Present Value	**($2,809.29)**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #10: Install NEMA Premium Efficiency Motors

Description:

The improved productivity of the NEMA Premium efficient motors is attributed to a better design with the use of improves materials to reduce production loss. NEMA motors would replace existing electric motors that drive the hot water pumps in the old boiler room and supply fans in some of the heating and ventilating equipment. These motors being proposed (NEMA Premium) operate 24 hours a day and the electricity used to power the motors represent 95% of its total lifetime operating cost. So this ECM will reflect significant energy and dollar savings.

The electric motors running the hot water pumps in the old boiler room and supply fans in some of the heating and ventilating equipment are candidates for replacing with premium efficiency motors. These standard efficiency motors run considerable amount of time annually.

This ECM projected would replace all motors over 5 HP or more with NEMA Premium efficiency motors.

Implementation Summary								
Equipment Identification	**Function**	**Motor HP**	**Pole**	**RPM**	**Frame Type**	**Hours of Operation**	**Existing Efficiency**	**NEMA Premium Efficiency**
Zone 1 (P-2)	Hot Water Pump	20	4	1,750	TEFC	4,320	88.5%	93.0%
Zone 2	Hot Water Pump	10	4	1,750	TEFC	4,320	89.5%	92.4%
HV-1	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%
HV-2	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%
HV-3	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%
HV-4	Hot Water Pump	5	4	1,740	TEFC	4,320	82.0%	90.2%

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Energy Savings Calculations

Electric Usage, kWh = <u>HP x LF x 0.746 x Hours of Operation</u>

Motor Efficiency

Where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor *Motor Efficiency = Motor Nameplate Efficiency*

Electric Usage Savings, kWh = Electric Usage $_{Existing}$ – Electric Usage $_{Proposed}$

Electric Cost Savings = Electric Usage Savings x Electric Rate ($/kWh)

Implementation Summary							
Equipment Identification	**Motor HP**	**Load Factor**	**Existing Efficiency**	**NEMA Premium Efficiency**	**Power Savings kW**	**Energy Savings kWh**	**Cost Savings**
Zone 1 (P-2)	20	90%	88.5%	93.0%	0.73	3,189	$430
Zone 2	10	90%	89.5%	92.4%	0.24	1,023	$138
HV-1	5	90%	82.0%	90.2%	0.37	1,616	$218
HV-2	5	90%	82.0%	90.2%	0.37	1,616	$218
HV-3	5	90%	82.0%	90.2%	0.37	1,616	$218
HV-4	5	90%	82.0%	90.2%	0.37	1,616	$218
TOTAL					**2.5**	**10,677**	**$1,441**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Project Cost, Incentives and Maintenance Savings:

The Smart Start incentive are calculated and presented below:

Motor Replacement Summary						
Equipment Identification	**Motor Power HP**	**Installed Cost**	**Smart Start Incentive**	**Net Cost**	**Total Savings**	**Simple Payback**
Zone 1 (P-2)	20	$4,635	$125	$4,510	$430	10.5
Zone 2	10	$2,560	$100	$2,460	$138	17.8
HV-1	5	$1,519	$60	$1,459	$218	6.7
HV-2	5	$1,519	$60	$1,459	$218	6.7
HV-3	5	$1,519	$60	$1,459	$218	6.7
HV-4	5	$1,519	$60	$1,459	$218	6.7
Totals:		**$12,604**	**$510**	**$12,094**	**$1,863**	**6.5**

ECM #10 Energy Savings Summary	
Installation Cost ($):	$13,271
NJ Smart Start Incentive ($):	$465
Net Installation Cost ($):	$12,806
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$1,441
Total Yearly Savings ($/yr.):	$1,441
Estimated ECM Lifetime (yr.):	18
Simple Payback	8.9
Simple Lifetime Savings	$25,938
Net Present Value	**$7,012.81**

ECM #11: Valve Blanket Insulation Installation

Description:

The main purpose of a boiler is to provide hot water throughout the facility during heating season. This season is approx. 6 months and the valves are heated up to 180°F continuously. Insulated piping, which is being recommended, has a heat loss that is a fraction of the heat loss on un-insulated valves.

Based on Highland's survey, approx. 25 pipe valves are un-insulated. This ECM requires that all exposed, un-insulated valves be blanketed.

Energy Savings Calculations:

The following calculations are based on ASHRAE 2009 Fundamentals – "Insulation for Mechanical Systems"

Bare Steel Piping Heat Loss 6" Pipe: 373 BTU/HR per Linear FT

$$\text{Heat Loss } \textit{BTU/HR per linear FT} = \frac{1}{\textit{R-value}} \times \textit{Pipe Dia (FT)} \times 3.14 \times (\textit{Pipe Temp}(^{o}\text{F}) - \text{Ambient Temp }(^{o}\text{F}))$$

Heat Loss BTU/HR = Heat Loss BTU/HR per linear FT x Length of Un - Insulated Pipe

$$\textit{Energy Use, Therms} = \frac{\text{Heat Loss BTU/HR x Operating Hours}}{\text{Heating System Eff. (\%) x Fuel Heat Value BTU/Therm}}$$

Heating Energy Cost Savings = Energy Use, Therms x Cost of Natural Gas ($/Therm)

Valve Blanket Insulation Calculations			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	Bare Pipe	Insulated Blanket	
Length of Un-Insulated Pipe Valves	25	25	
Pipe Diameter (in)	6	6	
Blanket Insulation R-Value	0	6	6
Temperature Diff. Pipe to Ambient (^{o}F)	100	100	
Pipe Heat Loss – 6" Pipe (BTU/Hr/FT)	373	26	347
Heat Loss (BTU/hr.)	9,326	654	8,671
Heating System Operating Hrs.	4,380	4,380	
Energy Loss (kBtus)	40,844	2,865	37,978
Heating System Efficiency (%)	74%	74%	
Fuel Heat Value (BTU/Therm)	100,000	100,000	
Nat Gas Cost ($/Therm)	1.08	1.08	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Natural Gas Usage (Therms)	552	39	513
Energy Cost ($)	$596	$42	$554

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

Highland Regional High School ECM #11 Continued:

ECM #11 Energy Savings Summary	
Installation Cost ($):	$10,000
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$10,000
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$554
Total Yearly Savings ($/yr.):	$554
Estimated ECM Lifetime (yr.):	24
Simple Payback	18.1
Simple Lifetime Savings	$13,296
Net Present Value	**($617.71)**

Concord Engineering Group, Inc. 9C10098 (March 14th 2011 Draft)

ECM #12: Kitchen Hood Controls

Description:

The Highland High School Kitchen is uses two exhaust hood systems that are manually controlled by a wall switch. The size of the range hood is 4'x20', these hoods are both situated in the kitchen.

Standard kitchen hood exhaust systems consist of a switch that relays that interlock kitchen grease hood exhaust with 100% outside air and provide make-up air for this system. This hood is operational for 4 hours per day.

Energy Conservation Measure number four recommends the replacement of the existing hood exhaust systems to be swapped with a Melink Kitchen Hood Vairable Air Volume Controller. This is an advanced kitchen hood system, when operation the fan will fluctuate its performance to meet the smoke/vapor coming off the range. Also the fan will increase based on the hood exhaust temperature, so it doesn't over heat nor run at 100% until needed.

Energy Calculations Summary:

It is appropriate to note that the calculation simulates the exhaust fans and make-up air fixtures are manually turned off for approx. 8 hours per day.

Kitchen:

Energy Calculations – Natural Gas			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Make up air unit Total Heating Energy	1,365	1,010	
Boiler Efficiency (%)	74%	74%	
Heating Fuel Value	100,000	100,000	
Gas Cost ($/Therms)	$1.11	$1.11	
Energy Savings Calculations			
ECM RESULTS	**Existing**	**Proposed**	**Savings**
Fan Energy Annual kWh	1,365	1,010	355
Electric Energy Cost ($)	$1,475	$1,091	$383

Energy Calculations – Electric			
ECM INPUTS	**Existing**	**Proposed**	**Savings**
ECM Inputs	CAV	VAV	
Supply Fan HP	2	2	
Fan Energy, Annual	2,652	1,314	
Electric Cost ($/kWh)	$0.133	$0.133	
Energy Savings Calculations			
ECM Results	Existing	Proposed	Savings
Fan Energy Annual kWh	2,652	1,314	1,339
Electric Energy Cost ($)	$358	$177	$181

ECM #12 Energy Savings Summary	
Installation Cost ($):	$10,671
NJ Smart Start Incentive ($):	$0
Net Installation Cost ($):	$10,671
Maintenance Savings ($/yr.):	$0
Energy Savings ($/yr.)	$564
Total Yearly Savings ($/yr.):	$564
Estimated ECM Lifetime (yr.):	15
Simple Payback	18.9
Simple Lifetime Savings	$8,460
Net Present Value	**($3,938.00)**

2.3.3b Clean Energy Measures

The access to renewable energy generation is not restricted for municipalities and business; schools have been going green as well. Many districts have been reaching out to experts on the processes of lowering their energy bill by not reducing consumption. The Black Horse Pike Regional School District reached out to the Township of Gloucester for the opportunity to enter into a shared services agreement. The district and the Township are in the process of awarding a professional solar contractor who will own and operate the solar systems and sell the generated power to the District for a discounted price, than what they are paying now to the utility.

Blue Sky Power has evaluated potential solar PV systems for all BHPRSD High Schools as well as Gloucester Township Public Schools to be accompanied into the Gloucester Township Solar PPA. During Blue Sky Power's evaluation of Highland, it was identified that the roof could hold a ballasted roof-mount system. As a result, Highland is being proposed an alternate of holding a small carport canopy system adjacent to the school in a side parking lot.

During the feasibility study conducted by Blue Sky Power on the potential PV systems it was identified that there are two potential systems that can be implemented. The ballasted roof-mounted system would have a DC rating of 613 kW DC. The carport canopy systems would have a DC rating of 45 kW.

Given the large amount of capital required by the school to invest in a solar PV system it is not recommended that BHPRSD go a Direct Purchase route. It is more advantageous for the school to enter into a Power Purchase Agreement (PPA), where the end user (Triton) would enter into a contract to purchase power at a reduced price and the Owner/Generator would own, operate, and maintain the system for a period of 15 to 20 years. The Solar PV proposal for Highland Regional High School can be evaluated in **Appendix A.**

Renewable Energy Measures (REMs)				
REM #1	**Description**	**Annual Utility Reduction**		
		Direct Current Rating (DC)	**Electric Consumption (kWh)**	**Percentage of Current Utility**
REM #1	Blue Sky Power Solar Array Proposals	613 kW / Alternate 45 kW	790,530 kWh	77%

Highland Regional High School Final Assessment

Highland High School has considerable ECMs to analyze and decide on which ones to add to their Energy Savings Improvement Program (ESIP). This program allows for financing options on any combination of the energy conservation measures proposed.

Some ECMs that should be considered in pursuing this further are the conservation measures that impact energy consumption immediately and improve the infrastructure of the facility, for example the AC unit replacements for the library and cafeteria, also the new boiler installations. Typical boiler payback periods range from 30-40 years but for this facility the current system is old and inefficient, so the proposed systems identified by CEG would be paid back in a 18 year plan.

The ECM project calculations summary is displayed on the following page:

Table 1

ESIP – Total Entity Project Summary

Highland Regional High School

Energy Savings Improvement Program – Potential Energy Efficiency Project						
ECM Identification	**Annual Energy Savings ($)**	**Project Cost ($)**	**INCENTIVES***		**Costumer Cost**	**Simple Payback**
			Smart Start	**Direct Install**		
ECM #1	$15,698	$57,752	$19,080	$0	$38,672	2.4
ECM #2	$10,847	$41,800	$5,155	$0	$36,645	3.4
ECM #3	$2,313	$10,200	$0	$0	$10,200	4.4
ECM #4	$16,953	$421,638	$11,210	$0	$410,428	24.2
ECM #6	$6,196	$72,181	$0	$0	$72,181	11.6
ECM #7	$4,786	$23,988	$0	$0	$23,988	5.0
ECM #8	$11,698	$158,825	$1,840	$0	$156,985	13.4
ECM #9	$2,516	$52,124	$0	$0	$52,124	20.7
ECM #10	$1,441	$13,271	$465	$0	$12,806	8.9
ECM #11	$554	$10,000	$0	$0	$10,000	18.1
ECM #12	$564	$10,671	$0	$0	$10,671	18.9
Design / Construction Extras (15%)		$130,868			$70,837	
Total Entity Project	**$73,836**	**$1,003,318**	**$37,750**	**$0**	**$965,568**	**13.1**

Concord Engineering Group, Inc. 9C10076 (Jan. 21st 2011 Draft)

Total Highland HS Energy Cost (Annual): **$349,133**

Est. Total Highland HS Energy Savings: **$73,836**

Overall Highland HS Reduction: **21.1%**

3.0 Gloucester Township Property Evaluation

The implementation and utilization of renewable energy resources can be a cost saving project with sufficient rewards with the right planning and analysis. With the current situation in the State of New Jersey, with the harmonization of the Board of Public Utilities and the Office of Clean Energy, these parties encourage the use of renewable energy sources by offering incentives through Solar Renewable Energy Credit ("SREC") program and Customer On-Site Renewable Energy (CORE) program. With these current programs in place that are backed by the State of New Jersey, these incentives make sustainable energy projects reasonable and realistic.

Blue Sky Power with the assistance of Remington and Vernick ("R&V") was authorized by Gloucester Township to evaluate both municipal owned landfills for the feasibility of installing renewable energy foundations. The purpose of this EMP is to once again guide the Township in the direction to conceptualize these wholesale projects into realization. The two sites being described comprehensively in this EMP are Owens Corning located on Somerdale Road and GEMS landfill located at the northwest corner of Erial Road and Hickstown Road. Following the detailed analysis of the landfill properties, this section will conclude with a brief layout and description of the N.I.K.E Missile Bases located on the eastern edge of the Township. The Owens Corning site is located in PSE&G service area and both GEMS Landfill and the Missile bases are located in the Atlantic City Electric service area.

This Energy Master Plan wants to guide the Township for ownership of the solar panel installation. This would put the cost incurred from construction, installation, operation and maintenance upon the Township. In return, the Township would own the SRECs obtain from electricity generation as well as select tax benefits. The Township would not pay a lease or another utility company for the solar power generated on both landfill properties since they are the operating owner of Owens Corning and have an equity share of GEMS shared with the Landfill Trustees.

There are many scenarios that will be listed from PJM interconnection, PSE&G interconnection at the Owens Corning location and ACE interconnection for the GEMS Landfill site plus N.I.K.E Missile bases. In contrast to selling the electricity generated to above utility companies Gloucester Township may opt to setup a "Community Solar Program", selling to a collective group of small business owners or nearby residents as a Township Utility Company. As an illustration, once electricity is distributed off of property boundaries, the Township being the owner-operator is then regulated as a generator of electricity or a third-party supplier.

Blue Sky Power's knowledge in regulatory work, financing options and project management will play a vast role in assisting the Township in the most viable option for the greatest benefit for the municipality in the short and long-term future. Blue Sky Power will look at certain tax-exempt, low-interest financing municipal bonds as well as the certain loan programs offered by PSE&G and ACE. Also with the help of Blue Sky Power, experts will oversee the engineering and installation of the clean energy project and monitor the required municipal land use approvals and filings with Atlantic City Electric, PSE&G, the New Jersey Board of Public Utilities and other state and federal agencies.

In the latter half of this section there is a brief description of the vacant land that the Township of Gloucester still owns and operates. These are potential viable properties that can be a prospective solar or renewable energy site for later use. It is important to keep in consideration the possible means of selling electricity; once again the generated electricity can go to many end users identified within the site's radius keeping in mind economical costs. The same possible results can be applied to the other Township owned properties just like the proposed installations to both landfills.

For example, the first hypothetical solution for the township would be to reduce cost to their own buildings, but if there are no potential nearby end users then interconnection is always viable in this circumstance.

3.1 Owens Corning Landfill

3.1.1 Background

The Owens Corning Landfill is located at 300 Somerdale Road between Chews Landing Road and North Warwick Road in Somerdale within Gloucester Township. The blocks on the site are 8601/8602 Lots 4,5,6/5. Forested areas border directly to the south, east, and northwest perimeters of Owens Corning while there are residential housing to the north and southwest of the property. The site is owned and operated by Owens Corning, but the operation history is unknown. With regards to the landfill, it has been closed down and covered with topsoil administered by the NJDEP. Owens Corning is not an EPA (Environmental Protection Agency) regulated site and is considered to be an industrial landfill. The materials identified on site are off specification materials from the production of fiberglass insulation.

A properly engineered cap was installed due to NJDEP demands on the landfill in 2003. There are also five (5) groundwater-monitoring wells that were installed along the perimeter of the landfilled area in order to determine if the materials on site are contaminating the groundwater.

The NJDEP has recently stopped the groundwater sampling and analysis of Owens Corning and anticipates issuing a No Further Action (NFA) letter for the property upon the filing of the deed notice with the County. The NFA identifies that Owens Corning landfill has been appropriately closed and will only be focused to the requirements in the deed notice for further use.

As stated before that Owens Corning owns and operates the landfill at the current moment, but Owens Corning and the Township of Gloucester have agreed to terms about the sale of the property. Owens Corning presently pays taxes on the site to the Township and when the time is right, Owens Corning have agreed to sell the property to the Township for one dollar.

3.1.2 NJDEP Requirements

The proper closure of the landfill was conducted with the oversight of the NJDEP Landfill Remediation and Redevelopment Office of Brownfield Reuse. A memorandum of agreement ("MOA") was established between the NJDEP and Owens Corning for NJDEP. According to the case manager regarding Owens Corning, a solar panel field on site would demand a new MOA. This new memorandum would need a modified Remedial Action Workplan that would include a draft of a new deed notice. A new MOA would also have to be submitted with a new responsible party. In conclusion, the responsible party would have to maintenance the array system and have complete access to most of Owens Corning in compliance with the guidelines set forth by the NJDEP.

3.1.3 Owens Corning – Solar Array System

Detailed Analysis

The Owens Corning Landfill sits on Blocks 8601/8602, Lots 4,5,6/5. The site area is approx. 20 acres and based upon site visit and landfill cap typography by Remington & Vernick. The optimal acres suitable for a solar panel system are 12 acres. There are no current electrical utility uses at the site; therefore Owens Corning would be used for wholesale generation to the grid and to potential end users. Keep in mind that the perimeter of the property encompasses forests, but the shade does not approach the selected areas for solar panels. An as-built survey and an aerial photo are provided in **Appendix B** for further evaluation.

Potential End Users

One potential end user is identified within a 1-mile radius were evaluated for the Owens Corning On-Site Generation:

- Chews Elementary School

The Chew Elementary site listed was chosen because of the close proximity to Owens Corning. The school is a public entity, so tax income is used to pay electricity at the school. If properly connected with PSE&G and the facilities around, it would provide long-term cost savings to tax payers and the school administration.

<u>Chews Elementary School:</u>

The Chews Elementary School is located at 600 Somerdale Road in Blackwood, New Jersey. The school is located approximately 0.3 miles away from Owens Corning. The utility bills gathered by Blue Sky Power on Chews Elementary shows that the school consumed 549,200 kWh (kilowatt-hours) of electricity for an annual consumption from June 2009 to May 2010. The cost of this demand is $81,437 with an average cost of $0.175 per kWh.

Solar Panel Design:

Gloucester Township with the assistance of Blue Sky Power have entertained bids through the public bidding process for a lease agreement to install solar panels for electricity generation on the site of Owens Corning. The Township received two bids regarding Owens Corning for solar installation. Blue Sky Power and the Township identified that the average size of energy output would generate 3.1 MW DC. Remington and Vernick identified in their study certain considerations for designing and developing the array system, certain limits pose hurdles on the existing Owens Corning site, such as:

1.) During constructing, the developer must use low ground pressure equipment on the cap so it limits the disturbances on the existing soft soil.

2.) Also a limit within the in the construction, the mounting system on the solar array system will have to be designed in order to be flexible so that it moves with the subsidence and settlement of the landfill.

3.) The solar panel system will have to be erected so that the existing storm water management system for the landfill is not disturbed.

4.) Cap should be able to handle an additional load attributed to solar panel installation (approx. 15 psf)

3.1.4 Restrictions

The unrestricted use of this landfill is prohibited. The closure of the landfill must be maintained in compliance with the statutory requirement for Deed Notices and engineering controls in accordance with N.J.S.A. 58:10B-13. Following this further, the solar panel system must be constructed so that monitoring, maintenance, and the periodic certification requirements outlined in the Deed Notice for the property are not bargained.

3.2 GEMS Landfill

3.2.1 Background

The GEMS landfill is on the Block of 14003, Lot 26. The acreage of GEMS is approximately 72.63 acres; of those 72.63 acres Remington & Vernick came to the conclusion based on the typography of the site that 19.4 acres is suitable for a solar panel array installation. In contrast to Owens Corning, GEMS Landfill uses electricity on site for their onsite groundwater pump and treatment system, gas collection and treatment system, and site trailers, whereas Owens Corning does not. The utility company provider for GEMS is Atlantic City Electric (ACE). Lastly, there are no shading hazards from the surrounding trees and the ground has healthy natural grassy vegetation.

3.2.2 GEMS – Solar Array System

Detailed Analysis

Potential End Users

There are four (4) potential end users within a one-mile radius of GEMS Landfill

- GEMs Phase II Trust (operation of site treatment systems)
- Erial Volunteer Fire Company
- Erial Elementary School
- Camden County College ("CCC"), Blackwood Campus

These possible end users were chosen strictly on the fact that it is close to the GEMS campus.

<u>GEMS Phase II Trust:</u>

The GEMS Phase II Trust is accountable for the operation and maintenance of the groundwater pump system and gas collection system at the landfill. They are responsible for the payment of the electricity use at GEMS. From the information gathered by Remington & Vernick, they concluded that the annual consumption of electricity at the GEMS facilities is 660 MWh at a total of $96,000. These estimates were based on a review of GEMS' utility bills for July, August and September of 2008. The average cost of electricity is estimated to be $0.15 per kWh.

Erial Volunteer Fire Company:

There Erial Volunteer Fire Company is located at 1946 Williamstown Erial Road in Sicklerville, NJ. The Volunteer Fire Company's headquarters is approximately 0.8 miles away from the GEMS landfill property. The energy provider for the Fire Company is Atlantic City Electric and the bills collect from the Fire Company were from November 2007 to October 2008. Remington & Vernick came to the conclusion that 150.2 kWh of electricity was consumed at a rate of $0.16 per kWh for a total of $24,656.

Erial Elementary School:

The Erial Elementary School is located at 20 Essex Avenue in Sicklerville. The school is located approximately 0.9 miles from GEMS. The current service provider at the school is Atlantic City Electric. The electricity bills that have been collected from the business administrator's office were that of June 2009 to May 2010. The annual consumption for the school was 624,100 kWh of electricity costing $88,357 with an average cost of $0.1420 per kWh.

Camden County College, Blackwood Campus:

The Camden County College, Blackwood Campus is located on College Drive in Blackwood, NJ. The school is located approximately 1 mile from the GEMS Landfill site. The College's electric provider is too Atlantic City Electric. Also, the College is a participant in the existing cooperative energy agreement with Reliant Energy. Therefore, they are locked into a supplied amount of electricity for a two-year period at a fixed price of $0.1084/kWh. Building on that, ACE also provides the CCC campus with a utility bill charging for the delivery of the electricity supplied by Reliant. Remington & Vernick gathered electricity invoices from ACE about the Blackwood campus and investigated their electricity consumption from August 2007 to August 2008. Their findings showed that the Blackwood campus consumed 8,500 MWh of electricity costing the university $9 million with an average cost of $0.12/kWh.

Solar Panel Design:

While discussing potential Clean Energy Capital Projects with the Township, Remington & Vernick and Blue Sky Power considered the installation of solar panels on the property of GEMs Landfill. There were two studies done by Remington & Vernick both with the intent of identifying the potential of implementing a solar power facility on location. The most recent one presented in April 2011, identified certain areas of the landfill that are more viable for solar panels than others. Certain considerations need to be acknowledged when considering solar generation. Of those considerations a key point would be shading issues from nearby trees and most importantly, GEMS being a landfill, the hurtle of ballasting a system rather than penetrate the cap for hazardous reasons.

In the study the Northwest tract of the property is a 14.3 acre area roughly flat with surrounding trees to the north, west and south. Persistent to the northwest tract, 5.6 acres of flat land sits below the gas and water facilities. The Northwest and West Tracts identified in the report are ideal locations for installation because they are outside of the landfill limits. Three other positions were identified in the report but they are within the landfill limits. An aerial layout depicts the locations described by Remington and Vernick in **Appendix B.**

Some parameters are in play that the developer rewarded construction should be prepared to assess and work around. These parameters are listed:

1.) The solar panel system will have to be erected so that the existing storm water management system for the landfill is not disturbed.

2.) With EPA enforcement, the natural habitat must be preserved. With the EPA presence, the solar array system will have to be elevated at a certain height (3 feet above grade surface) in order to avoid the coverage by overgrown vegetation and shading.

3.) Also a limit within the in the construction, the mounting system on the solar array system will have to be designed in order to be flexible so that it moves with the subsidence and settlement of the landfill.

4.) Throughout the GEMS Landfill property there are gas extraction wells, the solar panel system will have to be built around the extraction wells for array efficiency.

5.) Cap should be able to handle an additional load attributed to solar panel installation (approx. 15 psf)

<u>GEMS Landfill Inverter Location:</u>

A Satcon PowerGate Plus 1 MW Commercial Solar PV Inverter would be recommended for the Landfill solar panel installation. Three (3) inverters would have to be installed to handle the 2.6 MW solar panel system capacity outputs. The inverters would have to be housed in a constructed building for temperature control, since there is no presence of a utility building at GEMS. One limitation to constructing a building for GEMS solar array system is that it has to be built off location so that the foundation can support the weight of the building.

3.2.3 Restrictions

The unrestricted use of this landfill is prohibited. The closure of the landfill must be maintaining compliance with the statutory requirement for Deed Notices and engineering controls in accordance with N.J.S.A. 58:10B-13. Following this further, the solar panel system must be constructed so that monitoring, maintenance, and the biennial certification requirements outlined in the Deed Notice for the property are not bargained.

3.3 Solar Energy Usage Options

The proposed options on both landfill sites are not for Township usage. Currently at the Owens Corning site, there is no energy usage on site. For GEMS, there is a small energy consuming gas collection system and a groundwater treatment pump currently being used on that Landfill. The energy generated by both systems on GEMS and Owens Corning is going to be for wholesale use only. The implementation of a solar panel generation system on the landfills can be utilized as follows:

1.) Generate electricity to sell on the PJM Market or back to the service utility
2.) Generate electricity for the potential end users proposed
3.) Generate electricity under a "Community Solar" Program

3.3.1 Generate electricity to sell on the PJM Market or back to the service utility

3.3.1.1 Electricity to be generated and sold on The PJM Market

The planned concepts for the Owens Corning and GEMS landfill sites would be tied into the current electricity grid. The electricity generated could be sold to PJM or the utility company used on both sites. The utility company currently at Owens Corning is PSE&G and for GEMS Landfill the utility company is ACE. The process would be much lengthier for a Utility Scale project than a PPA project. The reason for such a long delay of commissioning for Utility Scale proposals requires feasibility studies from the potential utilities that you would be connecting into. For example, at Owens Corning a PJM interconnection would require feasibility studies from PSE&G and PJM. These feasibility studies can take up to a year.

PJM Interconnection Market and PJM Interconnection Requirements

The electricity generated on both landfill sites can be sold on the PJM Wholesale Energy Market at the wholesale price otherwise known as the locational marginal price (LMP). The LMP changes radically from $20 per MWh to $200 per MWh generated on an hourly basis. Also, the Township can gain revenue on the Capacity Market described in the PJM interconnection. The terms in the Capacity Market describes the owner of the solar panel system will receive $197 per MW capacity per day. For a solar panel system, the money being paid to the owner is based on a 38% of the installed capacity. This capacity for Owens Corning would be 3.1 MWs and GEMS Landfill capacity would be 5 MW solar array systems.

For the Township to be interconnected with PJM and sell capacity on the market, the Township has to become a PJM member as well as enter into the PJM Operating Agreement. Listed below are the requirements a party must fulfill to be a member:

- Submit the necessary documents and application and membership fees;
- Share in the costs of PJM's operations;
- Meet the definition of a transmission owner, generation owner, other supplier, electric distributor or end-user customer, as described in the agreement;
- Participate in Regional Transmission Expansion Planning (RTEP) process;
- Plan and operate its facilities in cooperation with other PJM members to ensure reliability;
- Comply with any orders needed to deal with emergency conditions on the grid.

Above are the preliminary steps to become a PJM member. With respect to the proposed project at Owens Corning, Gloucester Township recently went out for a lease agreement for an awarded bidder to install a solar system on the landfill property for monthly lease payments. Regarding PJM interconnection, it becomes the awarded contractor's responsibility to fulfill the requirements of selling electricity on the PJM grid.

3.3.1.2 Electricity to Be Generated and Sold Back to the Utilities

The power generated to be sold back from the Solar Panels at Owens Corning and GEMS are required to be able to be interconnected with the distribution lines in close proximity to the Landfill sites. Also the interconnection between the inverters and utility grid must not be utilized within PJM Interconnection jurisdictional lines. Lastly the voltage from the solar panels would have to be at a certain distribution level, so that the power being sold back to the utility companies can be simply distributed amongst third party consumers.

If the utility companies (PSE&G and ACE) can purchase the electricity generated from the proposed solar panel installation system there would be a fixed rate negotiated between both parties.

3.3.2 Generate Electricity to Neighboring End Users

Electricity generated form the solar panel system on the landfill sites can be sold to the nearby end users identified earlier (i.e. schools, fire stations, universities). This plan would also involve additional work to install electrical lines from the system to the end users. Rather than the installation of a whole new power line system, the owner and wholesaler of the generated energy from the solar panel system could reach an agreement with the utility company in that location to utilize their existing transmission lines. The addition of lines usually comes with a tariff or fee when using the present utility companies system.

Incidentally, once the electricity is supplied across a public roadway or property boundary to other end users, a BPU rule is applied that the operator of the electrical generating system must be licensed as a third party supplier, and operate as a generator of electricity and be regulated as such. As a result, the option of selling electricity to nearby end users would also involve the additional procedures associated with licensing and generator operation. Thus, the owner of the solar panel system would operate as an individual utility company, where that would be the Township who would provide energy to their customers/end users.

With the current plan in motion, the Phase II Trust would not be a receiver on the load generated by the solar panels. The solar panels are installed for a wholesale purpose only; the Phase II Trust may reach a PPA with the Township to offset their facilities energy budget. Likewise for the case of Owens Corning and Chews Elementary School, both locations are next to each other on the same side of the road, the Owens Corning Landfill can easily service the Chews Elementary School without being exposed to the additional requirements of licensing and generator operation. The price of the electricity would not be limited to the LMP.

Interconnection Requirements

Under this scenario where electricity generated from the solar panels will be traveling across property boundaries, the awarded bidder that would own the system would be forced to become a licensed generator of electricity. The awarded bidder of the Owens Corning solar site would have to involve dialogue about the following:

- Become a Licensed Third Party Supplier under the NJBPU
- Becoming a generating entity and fulfilling the requirements for generator operation requirements

Once again, with the absence of selling the electricity generated to the service utility company rather than to PJM, membership is not required. But coordination might be necessary since the solar panel installations are located within the PJM service area.

3.3.2.1 Generated Electricity for Chews E.S. (PPA) – Owens Corning Landfill

For this scenario, the capacity being determined for solar panel installation at Owens Corning would be a 3.1 MW system. The load from the 3.1 MW to offset Chews E.S. utility consumption would be 500 kW, bringing down the utility interconnection to 2.6 MW on PJM or PSE&G's grid. The benefit of this scenario for the Township would be their role as the owner/operator of the solar array system and would sell electricity to Chews ES at a premium in the terms of a PPA. Along with the PPA between both parties, Gloucester Township (the Township) would be able to collect tax credits as well as revenue from the SREC sales (if applicable).

If the Township decides not to own and operate the solar panels, they can lease out the property to a developer who will enter into an agreement with Chews Elementary School. The only revenue realized to the Township would be in the form of a monthly lease payment.

3.3.3 Implementation Options

The Township possesses various options on deciding on particular solar energy usages per landfill site. Since it has been determined that solar electrical energy has the potential to satisfy three different options; sell electricity to the utility company/PJM Market, sell to potential end users, and Community Power. The succeeding section will examine the various developments available to Township to finance, install, and operate the solar panel systems on the designated landfills or potential lease the land to awarded contractors for utility scale installations.

Projected Scenarios

Scenario A; C: Sell Electricity to the Grid – Third Party Solar Developer Ownership (Lease Agreement)

Scenario B: Sell Electricity to Chew Elementary School (PPA) – Third Party Ownership (Lease Agreement)

Scenario D: Sell Electricity to Potential End Users (Operate as a Utility Company) – Township Ownership

Note: No agreement will be offered to GEMS Phase II Trust due to both Landfill sites being proposed as a wholesale-generated site.

3.3.4 Generate Electricity under a "Community Solar" Program

As discussed both sites, Owens Corning and GEMS are identified as being a wholesale project of electricity. With the adoption of "Community Solar" which is also known as "Community Renewables" or "Community Power", is a community based solar program that would allow residents or small commercial businesses to buy into a centrally located project as opposed to individual home installations as a means of reducing costs. Allowing local communities neighboring the landfills buy into a centralized project may be more efficient and cost effective way of installing a renewables than installing thousands of "behind-the-meter" projects at individual locations, as required und there the current net metering rules.

3.3.5 Lease Agreements

Under a lease agreement, a developer and operator of a solar panel system would construct and settle to operate and maintain the solar array system on the landfill property and pay the Township a leasing fee for the use of the landfill property. The lease agreement would depend on the size and volume of the installed solar panel system. The advantage of this to the Township would be there are no upfront costs to make the unusable land available for an outside developer. A huge disadvantage unfortunately would be the fact that the developer/owner of the solar panel system receives SREC ownership as well as the revenue generated from the sale of the electricity produced.

3.3.6 Township Ownership

In this scenario Gloucester Township would own the installed power system outright. This ownership incurs cost of construction, installation, operation, and maintenance of the solar panel array system. In return to owning and operating, Gloucester Township would reap the benefits of the SRECs obtained by the State of New Jersey. As stated before, this scenario allows for interconnection between PJM, PSE&G, and ACE. Certain requirements are entailed in each interconnection as well as regulations if electricity is distributed off of the selected property boundaries.

Some options identified by Blue Sky Power for Township ownership would be low-interest financing municipal bond as well tax-exempt benefits. Furthermore, there are existing programs and rebates offered by the utility companies and State respectively that make solar array systems even more enticing. For example, the current PSE&G loan program granted at an 11.11% interest rate that would be covered by the SREC revenue and the NJCEP rebate which assists in making a solar installation viable. With the information gathered by Remington and Vernick and the assistance of Blue Sky Power, the options presently practical will become reality.

3.4 Capacity and Cost Evaluations

3.4.1 Landfill Solar Proposals

The above scenarios will be identified in terms of capacity, cost and revenue.

1.) Owens Corning Landfill

Scenario A: Sell Electricity to the Grid – Third Party Solar Developer Ownership (Lease Agreement)

2.6 MW Capacity

2.) Owens Corning Landfill – Chews Landing ES End User Agreement

Scenario B: Sell Electricity to Chew Elementary School (PPA) – Third Party Ownership (Lease Agreement)

0.5 MW Capacity

3.) GEMS Landfill

Scenario C: Sell Electricity to the Grid–Third Party Solar Developer

Ownership (Lease Agreement)

4.9 MW Capacity

Scenario D: Sell Electricity to Potential End Users (Operate as a Utility Company) – Third party Developer Ownership (Lease Agreement)

4.9 MW Capacity

The following summarizes the electrical and solar panel evaluations for each landfill and proposed installation scenarios:

Table 1: Landfill Electrical and Solar Installation Summaries

Landfill	Potential Solar Installed Capacity (MW DC)	Potential Annual Electricity Generation (kWh)	Total End-User Annual Electricity Consumption (kWh)	Total End User Annual Electricity Costs ($)
Owens Corning	3.1	2,677	-	-
GEMS	19.4	3,480	10,039,000	$9,500,000
OC-CL ES	0.5	585	549,200	$81,437

Remington & Vernick January 2009 (Landfill Report pg. 34)

Once again both of the landfill sites will be used as a wholesale generation site; GEMS Phase II is excluded from this report. The Owens Corning generation for the Chews Landing Elementary School would not require PJM Interconnection or be regulated as a utility company because both parties are on the same side of Somerdale Road. These scenarios are evaluated under a Third-Party Lease model and a Third-Party PPA between the municipality and the end users (Elementary School – Scenario B

A simple cost-benefit approach was done for the scenarios where the Township would be the owner of the installed array system. Unfortunately the cost-benefit model provided negative feedback in regards to the Township owning both solar proposals on GEMs and Owens Corning, it proved to be more advantageous for the Township to enter into a long-term land lease agreement with a Third-Party solar developer. The fees for PJM, PSE&G, and ACE interconnection are excessive and cumbersome.

The procured cost and revenue evaluations did not involve detailed costs related with PJM Interconnection requirements and regulations as a utility company. In addition, the evaluations did not include costs for installation of additional utility lines or the use of existing utility lines. (For the future use of the current power lines on site, an application to the current utility company would have to be approved.) The length for interconnection approval with the local utilities can reach up to two to three months before receiving confirmation of interconnection. The confirmation receipt recommends upgrades to the interconnection point that the system owner would have to incur. Furthermore, PJM interconnection is coupled with the local utilities and can reach up to eight to twelve months for approval.

Solar Panel System Warranty

The average lifetime of any specified solar panel is 25 years from the POS. This is based further in the analysis of each given scenario. Along with the solar panel warranties, the PVPowered inverters can have a warranty of 10 years that can also be extended to 20 years. PVPowered utility scale inverters are the most prevalent inverters on MW projects. To have a successful system, an inverter will most likely be replaced once in the lifetime of the 20-year warranty.

In more detail, solar panel warranties for material defects and workmanship are one year from the date of purchase as well as the warranty period for power output. The power related warranty continues for a total of 25 years from the same date. There is a 10-year warranty for a 90% minimum rated power output and the remaining 15 years at an 80% minimum rated power output.

Ownership Operation and Maintenance

The operation and maintenance involved with a solar panel system consists of the following tasks:

- Washing the solar panels to remove built up soilage and to enhance output (Biannually)
- General inspections of structures, inverters, wiring connections, modules (Monthly)
- In the winter – Snow Removal
- Cutting of the lawn during the vegetation season

Fees and Permits

The third-party solar contractor in Scenario A would be demanded to apply to the current utility company and/or PJM for their approval to allow interconnection so that generated power can be easily distributed to the grid. A Feasibility Report then follows the application, and if accepted, the project is submitted into a queue. Within the queue a fee is applied depending on the position of the project, ranging from $1,300 to $3,600. With the current incentives in place from State governments, PJM applications have increased and on average the approval of a project with interconnection demands can take up to two years. In the R&V cost-benefit analysis $4,000 were accounted for in fees and permits.

Onsite Permits and NJDEP Costs

With the current issues surrounding both landfills, further work and costs will be endured to allow installation of solar panels on Owens Corning and GEMS:

- Formulation, submittal, and approval of a new Memorandum of Agreement, remedial action work plan, and deed notice for the Owens Corning Landfill site.
- Formulation and submittal of landfill disruption permits for the caps on both Owens Corning and GEMS.

- Meetings with the EPA and DEP to discuss design and the environmental parameters that the installation needs to be knowledgeable at both landfill sites.
- Formulation and submittal of reports and other submittals that may be demanded for both Owens Corning and GEMS.

The costs estimated to for these permitting regulations are estimated to be $65,000 per landfill site.

3.4.1.1 Owens Corning Landfill/Chews Elementary School

The Chews Landing sits 250 yards north of Owens Corning Landfill on the same side of Somerdale Road. The two parties can enter into a PPA agreement because there are no other properties that are crossed between the two, thus the Township does not have to obtain a utility license and become regulated as a generator of electricity. As disclosed prior in the landfill report, heavy sanctions and fees are correlated to becoming a licensed generator.

Scenario B: Third-Party Ownership – Sale of Electricity to Chews ES

Blue Sky Power reviewed the opportunity of Township ownership and the large amount of capital costs incurred by solar installations in conjunction with the sudden decline in the SREC market it would not be beneficial for the Township to own and operate the systems. The third-party developer would operate as a utility company on a wholesale project, while leasing the land for a 20-year agreement. For example, the Township received a proposal for the Owens Corning landfill site for the option of a PPA agreement with Chews Elementary school with a $0.05 kWh rate for 15 years. The Chews School 2010 energy consumption totaled 549,200 kWh. A simple 500 kW solar array layout out of the max 3.1 MW proposal at Owens Corning would be sufficient in offsetting the elementary school's needs. Blue Sky Power identified, the total cost savings for Chews School would be $809,655 at the end of the 20-year PPA term.

To emphasize the benefit, table 2 summarizes the cost and revenue evaluations performed for the Chews Landing Elementary School end user agreement. The estimated fees, permitting, and construction for the project would be incurred by the 3rd-party supplier at $12,000,000. Lastly, the Township will not receive the tax and SREC benefits but only a monthly lease installment from the third party solar generator.

Table 2: Scenario E Owens Corning Landfill End User Cost and Revenue Evaluation Summary – Chews Landing Elementary School

Potential End User	Competitive Rate Cost/kWh	PPA Term	End User Cost Savings after PPA Term
Chews Landing ES	$0.05	15 years	$809,655

3.4.2 GEMS Landfill

In the following section, tables 4 and 5 will summarize the cost and revenue estimations performed for the GEMS Landfill. Identified by Remington & Vernick the projected costs of fees, permitting, and construction would total $26,195,226 (R&V.) This cost estimate is for the development of the entire area identified and feasible for a solar field.

<u>Township Ownership – Sale of Generated Electricity to Grid/PJM</u>

The Remington & Vernick feasibility study finished and the identified 19 acres viable to successfully implement a solar generation system.

The Township of Gloucester is considering the route of leasing the land for solar development similar to Owens Corning. In the summer of 2011, the Township decided to pursue the redevelopment avenue under the Local lands and Buildings Law, with respect to GEMs Landfill. The study would address the complexities of land lease combined with Power Purchase Agreements. The Local Redevelopment and Housing Law allow municipalities the power and flexibility necessary to transform underutilized lands which meet certain statutory criteria as the GEMs Landfill, into productive assets for the community.

Implementing a comprehensive set of planning tools and techniques afforded to municipalities only under the Redevelopment Law, municipalities can enter into partnerships to transfer land directly to public or private entities in order to complete certain defined goals outlined by the Township municipality. With the redevelopment alternative, the Township can address issues related to land use, interconnection, and also negotiate business terms to ensure the greatest yield for the Township.

<u>Third Party Ownership – Sale of Electricity to End Users</u>

Energy generated would be provided to potential end users in a negotiated competitive rate. Remington and Vernick finished an analysis of possible end user's annual utility bills to procure a competitive rate for the Erial Volunteer Fire Company, Erial Elementary School, and Camden County College (CCC – Blackwood Campus). This scenario involves using a competitive rate of $0.12 to $0.16 (cost/kWh) being offered to the end users versus a least competitive rate. This rate is currently the same rate being offered to the identified end users, but their current plan with the utility companies involves a fixed annual 3% escalation rate. The benefit would be substantial to all end users at a total of $13,474,123 cost savings at the end of the 25-year solar panel warranty. Also recognized in the cost savings, $3,472,846 would be comprised of publicly funded facilities (Erial ES, Erial Volunteer Fire Company). Lastly, if the installed solar panel system were to be directed towards CCC - Blackwood Campus at a $0.12 per kWh the campus would realize a $12,580,198 cost savings at the end of the 25 year solar panel warranty (R&V).

Scenario B and D: Third Party Ownership

Contrast to Township Ownership, there would be the event of a third party developer who would own and operate the solar panel installation system rather than that of Gloucester Township. The third party developer has the same options as that of the Township if they were to own the installed solar system, but the Township would only receive monthly lease payments from the agreed upon developer.

3.5 Combined Landfill Site Study per Scenario

Table 9: Scenario B and D Cost and Revenue Summary – End User Savings

Facility	Competitive Rate/kWh	Warranty	End User Total Savings after Warranty Exp.[1]	PPA Term	End User Total Savings after PPA Term[1]
Chews ES	$0.05	25 years	$1,349,425	15 years	$809,655
Erial ES	$0.08	25 years	$960,725	15 years	$576,435
CCC Blackwood (23%Supplement)	$0.12	25 years	$7,018,514	NA	NA
Total for all Facilities[2]			**$9,328,664**		**$1,386,090**
CCC Blackwood (41%Supplement)	$0.12	25 years	$12,580,198	NA	NA

NOTE:

[1] Assumed with a competitive rate scenario (depending on the current market)

[2] $2,310,150 total for publicly funded facilities

NA – Not Available

3.6 Further Consideration on Select Scenarios

PJM and Grid Interconnection

Throughout the landfill assessment concluded by Remington & Vernick (R&V) it offers great understanding on each potential circumstance the Township should choose the route of leasing the land for a 3rd party developer to incur the fees of being regulated by PJM.

Starting with PJM Interconnection, the encouraging possibilities are marginal. There are extensive and complex interconnection and membership requirements with PJM that make the initial startup costs of the project unattractive. With the average selling rate in the PJM Market being $0.07/kWh and the probability of the rate not increasing will extend the net profitability of installing a system, another proponent on why the Township should not be the sole proprietor of the installed the solar system.

In opposition to PJM, the 3rd party developer may opt to link with the servicing utility company at the individual landfills. Currently at Owens Corning, PSE&G are the operating utility and at GEMS it is Atlantic City Electric (ACE). With the interconnection upgrades needed to access the current utilities' systems the cost will be marginal and will increase the current startup costs listed in this EMP. The presence of PJM is still required if there were to be a link between the Township's generated electricity to the service grid.

3.7 Vacant Township Properties

3.7.1 N.I.K.E Missile Bases

Gloucester Township houses two (2) former N.I.K.E. Missile Bases ("NMB") on the eastern edge of the Township. During the Cold War Era, North America implemented a defense system to prevent nuclear-armed aircrafts from entering into the North American Continent. New Jersey played a significant role in this defense by having around a dozen NMB installations throughout the state. The two bases previously held interceptor aircraft missiles, anti-aircraft gun batteries, surface to air missiles and command and control facilities on site. These sites were manned 24 hours a day in case of a foreign threat, namely the former Soviet Union.

The NMB in the Garden State were in two distinct groups. The sites in Northern Jersey were associated with the New York Defense Area and the sites in the southern region of New Jersey were affiliated with the Philadelphia Defense Area. The NMB remained in service in New Jersey from 1954 until 1974.

At the moment, there are two former NMB in the Township of Gloucester. The smaller of the two NMB sites lies on the very edge of Gloucester Township along Cross Keys Road in Sicklerville, which borders Winslow Township. The other NMB is located in Erial on Williamstown Erial Road.

The smaller NMB has approximately 4,100 square feet and the larger NMB has approximately 4,500 square feet of optimal space. Both of these locations would demand excavation to implement a solar panel system. The potential for both of these sites are optimistic with prime location adjacent to two large shopping plazas. The Township could opt to implement a large solar array installation and enter into a PPA with the developer of the retail spaces.

In **Appendix B**, it is an aerial depiction of the location of the two NMB in Gloucester Township. The photo also shows how the designated NMB's neighbor retail spaces as well as residential communities.

3.7.2 Other Township Properties

The township has numerous property sites that are potential candidates to installing solar systems or once again leasing out the land for a monthly installment to a third party developer. Many of these sites may not be well suited for solar; however below is an inventory of such properties. In the 2011 Revised NJ Energy Master Plan, the State has indicated that productive reuse of contaminated sites is preferable to developing Greenfields for solar projects. The list of Township properties is as follows:

900 W Front Street	700 Hickstown Road	6 Bryce's Court
481 Fresno Drive	800 Hickstown Road	553 Cross Keys Road
490 Floodgate Road	900 Hickstown Road	22 Daffodil Drive
301 Somerdale Road	414 Loch Lomond Drive	44.5 Aberdeen Drive
343 Somerdale Road	400 Hickstown Road	1100 Williamstown Road
251 Somerdale Road	1100 College Drive	28.5 Easton Drive
401 4th Avenue	40 Little Mill Road	2525 Erial Road
21 Spring Ridge Court	2570 Erial Road	3.5 Montrose Road
510 Almonesson Road	1150 Hickstown Road	1100 Johnson Road
1417 Old Black Horse Pike	88 Walnut Street	430 Turnersville Road
247 Little Gloucester Road	1870 Sicklerville Road	80 Broadacres Drive
63 S. Brookline Drive	51 Tombleson Avenue	1729 Erial Road
60 Somerdale Road	177 Jarvis Road	1773 Erial Road
78 Dorset Place	261 Jarvis Road	1801 Erial Road

42 Roberts Drive	119 Jarvis Road	400 Hickstown Road
600 Bee Lane Easement	36 East Meadowbrook Circle	380 Hickstown Road
990 Sherbrook Blvd.	1 Ashland Avenue	Hickstown-Peter Cheeseman Rd
59.5 Monroe at Roosevelt	18 Galena Court	31 Mayapple Road
1215 Chews Land-Clem Road	9 Kenwood Drive	130 Mullen Drive
10 Windy Drive Open Space	67 Cedar Grove Drive	401 Turnersville Road
405 Turnersville Road	1075 Williamstown Road	

There are 62 properties total that the Township owns and is vacant. The majority of the sites need renovation, leveling and significant site work for potential projects to be possible.

3.8 Conclusion

The Township of Gloucester is primarily focused on becoming a major player in the market of clean energy. With the assistance of Blue Sky Power, Owens Corning's bid process is almost concluded at the end of summer 2011. The potential of getting a lease agreement with an awarded solar developer in harmony with a PPA between awarded bidder and Chews ES simultaneously is very obtainable. The GEMS Landfill will be redeveloped with respect to a solar proposal for the future. The Township is also considering in leasing out the landfill to avoid high capital costs and lucrative interconnection fees.

The Energy Master Plan released mid-2011 identifies the renovation of landfills for solar development as a goal by Chris Christie and to avoid the renovation of farmlands for renewable generation. Gloucester Township holds many vacant properties for the opportunity to enter into lease agreements. The clean energy initiative will inspire investment to Gloucester Township and will contribute to the overall state Renewable Portfolio Standard.

4.0 Energy Procurement

Blue Sky Power is assisting Gloucester Township in the efforts to satisfy the obligation of a municipality to aggregate its own energy use with that of its inhabitants in order to negotiate decreased rates for energy provision which is authorized under New Jersey law, N.J. Stat. Ann. 48:3-93.1. This authorization is subject to regulations promulgated by the Board of Public Utilities, beginning at N.J.A.C. § 14:4-6.1. The administrative code allows municipalities to aggregate energy use in one of three ways, aggregating the government's own energy use, aggregating the energy use of multiple municipalities, or a government-private program which aggregates its own energy use with the usage of residents. *Id*.

In order to establish a government-private aggregation program a municipality must authorize this program through the appropriate ordinance or resolution. *Id*. § 14:4-6.4. Such an energy aggregation program must comply with public contracts laws. N.J.A.C. 5:34-7. *Id.* Upon creation of public-private aggregation programs all residents within the geographic boundaries of the municipality, who do not already have an agreement with a third party supplier, are automatically included in the aggregation unless they choose to opt-out. *Id*. § 14:4-6.3. Any non-resident energy consumer within municipal boundaries may enter the aggregation program by choosing to opt-in. *Id*.

There are two types of public-private aggregation programs, Option 1, which requires the local distribution company to notify the residents of the intent to aggregate and their ability to opt-out, and to record residents' decisions regarding their participation, and Option 2, in which the municipality takes on these responsibilities. *Id*. 14:4-6.4. In order to establish either type of aggregation program, a municipality must enter into an LDC aggregation agreement with each applicable LDC, which can be found on the BPU website. *Id*. 14:4-6.5. This agreement lays out the requirements of the LDC and the municipality with regards to the aggregation. *Id*. at 14:4-6.7. Following the notification period, the lead agency will beginning the bidding process, and the awarding process, the requirements of which can be found at N.J.A.C. 14:4-6.8 and N.J.A.C. 14:6-10.

A government-private aggregation cannot charge rates that exceed the combined cost of basic generation service and compliance with the renewable energy portfolio standards, unless the usage of alternative energy sources exceeds the required amount. *Id*. 14:4-6.9.

A municipality that decides to pursue energy aggregation will have ready supply of energy consumers for any energy it produces. While it is possible that residential energy consumers might choose to utilize municipally generated energy, aggregation eliminates the uncertainty of an unknown market.

It is not clear whether a municipality that aggregates will be able to negotiate decreased energy rates for its residents through bulk purchasing power. There is very little direct evidence for or against such a possibility, and the implicit evidence available does not clearly point to one conclusion. On one hand, the lack of government-private energy aggregation in New Jersey, despite the increased ability of to pursue such an endeavor since the governing laws were diminished in 2003, seems to indicate that there aggregation is not an effective strategy. However it is quite possible that municipalities are either unaware of aggregation or unwilling to make the effort decrease energy costs.

On the other hand, the existence of municipally owned public utilities that do not generate any energy seems to indicate the aggregation could be successful. These entities purchase energy supply in bulk from suppliers and the residents pay less for energy than the state average. Further, articles exist that report business aggregates have been able to bargain for lower energy rates.

4.1 Conclusion

A municipality can aggregate its energy and the energy of its residents in order to negotiate bulk rates. By aggregating a municipality will increase its bargaining power with energy suppliers, in order to decrease the cost of energy. Aggregation is also a useful tool to ensure a ready market for municipally generated energy. However, it is unclear if aggregation is a useful tool in practice as there is no indication that any municipalities have aggregated, while business aggregation has created lower rates.

5.0 Clean Energy Capital Projects

Introduction

During early 2011, a list of Clean Energy Capital Projects was compiled by Blue Sky Power to assist Gloucester Township in focusing on energy efficiency, clean energy and sustainability. With today's increasing energy costs, local governments have constrained budgets. With the introduction of State and Federal incentives and emerging technologies, Gloucester Township has the opportunity to take the lead in becoming less dependent on traditional forms of energy. To become less dependent upon the current trend of rising energy costs, the Township created a list of energy efficiency measures for further analysis and implementation. The list includes energy efficiency improvements within the Energy Improvement Savings Program ("ESIP"), Direct Install retrofitting, single-stream recycling, and lastly on-site clean energy generation. All Clean Energy Capital Projects will make an immediate impact on the environment by reducing CO_2 emissions as well as and advancing clean energy development within Gloucester Township for years to come.

New Jersey has taken the lead on confronting the energy crisis that is currently forcing governmental entities to be smarter on the push to conserve energy in order to reduce costs and emissions. The State encourages residents and business owners to make the switch from being energy consumers to energy conservationists. Today there are many helpful avenues for homeowners and commercial building owners to make the transition into becoming conscientious of energy consumption by having incentives (e.g. solar grants and tax credits) granted by the State through the Board of Public Utilities. For example, the NJ Direct Install program administered by the BPU's Office of Clean Energy would allow Gloucester Township to only be responsible for 40% of the total cost of retrofitting six (6) Township buildings.

5.1 Energy Savings Improvement Program – ESIP

Gloucester Township has commissioned and completed an energy audit through the State's ESIP, P.L. 2009, c. 4; A-1185. An energy audit is the first step in the ESIP program, which is an effective mechanism for public entities to plan and implement energy conservation measures, known as "ECMs," at their buildings and facilities. The ESIP process is lengthy due to the legislation and regulations that contain specific processes and requirements that public entities must adhere to in order to reap the economic benefits that the Program is intended to deliver. The term "retrofitting" can be defined as an upgrade that will have better output than the existing fixture or system but simultaneously decreasing energy usage.

Some of the ECMs that can be undertaken under the ESIP program include distributed energy generation (e.g., solar, cogeneration, wind); major HVAC upgrades; energy efficiency (e.g. lighting, thermostats), Energy Management System and building envelope upgrades.

The ESIP program can be guided along by an Energy Services Company ("ESCO") or Energy Consultants who coordinates the process, including construction and the provision of cost savings guarantees, or can be coordinated by Gloucester Township and/or its own independent advisors, otherwise known as "self-perform." While the ESCO route leaves much of the planning and analysis to the private company, the ESCO charges a fee that comes from the energy savings – known as "performance contracting." Depending on the project, it is not unusual for the savings to go entirely to the ESCO, while the public entity pays the same rates it did previously for its energy, but realizes the benefits of having new equipment installed – greater building comfort, reliability of equipment and associated reductions in maintenance expenses, as well as other benefits.

Under the self-perform option, the public entity can take advantage of the beneficial financing mechanisms under the legislation, which afford the Township the opportunity to issue Refunding Bonds or Bond Anticipation Notes to fund the improvement costs and costs for professionals. These bond issuances do not affect debt limits. A sale and leaseback of the improvements (i.e., capital lease) is also an option, with the Township regaining ownership of the assets at the expiration of the lease term.

The ESIP process can be broken down into the following nine (9) steps:

1. Perform an independent energy audit for all facilities. This may not be performed by the ESCO. The costs for this audit are generally fully reimbursed by the State of New Jersey.
2. Hire a professional manager or an ESCO to prepare an Energy Savings Plan (ESP);
3. Develop the ESP. The ESP will be a detailed list of the selected measures Gloucester Township would like to implement. The detailed ESP must include final cost upgrades as well as a reduction in emission measurements after ECM installation;
4. Independent third party review of the Energy Savings Plan and verification of the savings calculations;
5. Gloucester Township makes decisions on which ECMs to complete, approves the plan, and files notice with the New Jersey Board of Public Utilities (BPU).
6. The independent engineer or ESCO designs the systems and prepares construction specifications;
7. Gloucester Township advertises for formal bids and selects a contractor;
8. Completion of construction contacts and financing documents;
9. Construction, systems commissioning and final testing.

Blue Sky Power estimates that steps 1-8 above will take between ten and twelve months to fully complete, with a construction and testing period to follow.

A disadvantage to ESIP route is that it can be more time consuming, specifically for implementing clean energy projects, than pursuing a Power Purchase Agreement ("PPA"). The ESIP process requires approximately two to three months longer for completion.

5.1.1 Energy Conservation Measures

Energy Conservation Measures ("ECMs") are attributed to drop in energy consumption, have it electricity or natural gas. With government spending leading the way in domestic research and development, building upgrades have been hitting the market cheaper and faster.

Gloucester Township must decide on certain ECMs they would like to implement on their facilities. When determining the Energy Conservation Measures for the Township facilities, the Township can categorize two different ECMs they would like to perform:

Fast Payback Energy Conservation Measures

Most upgrades can be implemented immediately and see a fast payback rather than capital upgrades that desire more time to break even. Some of the "fast payback ECMs" can be performed in house and desire little mechanical expertise. These ECMs can be detailed as computer monitor replacements, light fixture upgrades, lighting controls, and thermostat controls. By having certain ECMs being installed in house it further reduces the payback phase.

Capital Improvement Energy Conservation Measures

Contrary to "Fast Payback", Capital Improvement ECMs take much longer to be identified as an immediate upgrade but could be branded as an infrastructure renovation. These improvements are linked to HVAC systems, boilers, ventilation systems, motors, and kitchen appliances.

5.1.2 Energy Management System

In 2011, Gloucester Township decided to go through the public bidding process for the services of a professional contractor to install an Energy Management System ("EMS"). An EMS is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems, which ultimately optimizes that buildings energy usage. In today's society commercial buildings are the largest consumers of energy in the United States. For example, the Township facilities are open on average 12 hours a day for five days a week and the Police portion of the Municipal building is open 24/7/365. With an EMS installation, the administrator can have each facility automated according to occupancy levels.

The hub of the EMS would be based inside the Department of Public Works building so facility personnel can manage the system and control temperature, lighting and other energy demanding appliances in every room of the Township's buildings that will be operational with the Energy Management System. Facilities that are coordinated by an EMS, allow the district to monitor the little things that focuses on environmental controls (ventilation, temperature, and CO_2 composition). With occupancy levels being monitored and the fluctuation of natural air being used to warm or cool rooms will allow the Township to witness savings of up to 40%. If the EMS includes lighting the energy savings approach 70% of the current utility consumption.

5.2 Direct Install Program

The Direct Install program allows small to medium-sized facilities the opportunity to upgrade to high efficient equipment through a turnkey process. The Direct Install program offered by New Jersey Office of Clean Energy allows local governments, institutions, and commercial buildings to retrofit their facilities with energy efficient appliances and only be liable for 40% of the total cost.

Gloucester Township, a local government entity, received EECBG for specific energy upgrades. Persistent with the energy audit the Township decided to go with six (6) buildings worthy to be administered in the Direct Install Program: Academy Hall, Township Library, Recreation Center, Senior Center, and Municipal Building. The State has identified select contractors to handle all Direct Install program applications per county and the Camden County contractor is Hutchinson Mechanical Services.

Hutchinson performed a SOW on all six (6) buildings to be administered in the Direct Install Program: Academy Hall, Township Library, Recreation Center, DPW, Senior Center, and Municipal Complex. The process of getting admitted for the Direct Install financing, the Scope of Worksheet has to be balanced between capital improvements (e.g. HVAC, economizers) and simple installations (e.g. lighting fixtures, lighting controls). Subsequently, this negates the Municipal Complex since the building lighting has recently been retrofitted with all new fixtures.

The total Direct Install cost allocated of the 5 buildings tallies up to $57,528.28. The Township is responsible for 40%, so the total out of pocket expense equals $23,011.31. The energy audit performed for all three high schools identified the necessary upgrades of the high output light fixtures in the gymnasiums and cafeterias. These fixtures use four times the average energy than a typical florescent light fixture and include a much longer life span, cutting cost on maintenance.

All of the proposed retrofits will have an immediate impact on reducing the energy consumption at the facility resulting in lower energy costs, but it also shows residents and students the effectiveness of energy conservation. New technologies being installed in everyday life will hopefully inspire young generations on innovation.

5.3 Single-Stream Recycling

Gloucester Township Municipal Utilities Authority started the initial process to change recycling patterns from a dual-stream recycling method to a single-stream recycling method. Single-stream recycling is the process where all fiber products (e.g. paper, cardboard) and commingle (e.g. glass, metal, plastic) are collected all together, rather than the dual-stream where all commodities are separated between fiber and commingle.

In the past, Townships that changed to single-stream recycling experienced an increase tonnage of recyclable material effect since it is a simpler way of recycling for the residents. Previously, a resident separated the commodities themselves, between fibers and commingles. The hassle for most residents was the obligation to commit to the separation process of the two different commodities. The well-being of the environment is not on the majority of the residents' attention. With the introduction of having one single bin for all recyclable materials, it increases the resident's awareness and they feel that they can recycle anything that maybe decomposed and reused again. With today's harshness of global warming many politicians have been pushing for all recyclable products to be returned to recycling plants to be remanufactured into reusable products.

The current push by politicians is to force manufactures from the beginning to make products that can be reused later on in life. This process is called "cradle-to-cradle". The new push for reusable products is currently the opposite of how manufactures make products today. Where products cannot be broken down later on and then re-built into something different, which is called "cradle-to-death". These typical practices by many manufactures in that past have led to a strain on capacity at operational landfills. Landfills let off toxic methane gas into the earth's atmosphere during the process of incineration. The more people recycle then the less environmental impact for the children of tomorrow.

Blue Sky Power visited Gloucester Township Municipal Utilities Authority on June 30, 2011 and was given a tutorial on the current upgrade progression to single-stream. During the visit BSP received valuable information on the numbers the GTMUA has been experiencing so far after switching over to single-stream recycling. Single-stream recycling is still in the preliminary stages, according to Glenn Engelbert, the Utilities Authority Recycling Coordinator. Engelbert has been able to show that Gloucester Township recycles more commingle at 2340 tons than that of fiber at 1872 tons.

Single-stream recycling is very advantageous for multiple reasons. According to Engelbert a key reason for switching would be that single-stream generates a profit of $50,000 more than dual-stream. The total spawns from a $5,000 state incentive program from switching over to single-stream as well as an extra $45,000 from an increase in recycling revenue. Since the tonnage increases per commingle and fiber from Township residents being more proactive, the Utilities Authority can predict that single-stream recycling will be able to offer more to sell to the Materials Recycling Facility. This is a simple cause-and-effect scenario; where the resident now embraces the ease of putting all commodities into one bin thus the trucks pick more up per household for the MUA to make additional revenue.

In conjunction with the automated process on the trucks and within the facilities, there is a new emerging technology in the recycling bins as well - a Radio Frequency ID (RFID) chip. The RFID chip is an emerging technology used in my different business sectors to keep track of certain shipments regarding weight and expected time of arrival. The embedded RFID chip in the trash bins report information back to the Utilities Authority to file into a database of recycling patterns per resident. The GTMUA with the help of RFID chips have the ability to identify certain households that have not been recycling, consequently the Township can warn that household to start and then if the problem still occurs - later be fined.

5.4 On-Site Clean Energy Generation

With the climate for solar power generation in New Jersey being a great cash cow for institutions, local governments, and businesses – Gloucester Township has identified many opportunities to generate clean power from renewables on the Township properties. There are many forms of clean power generation ranging from: Wind, Solar, Hydro, and Geothermal. Unfortunately, many of these renewables demand a large capital cost and the right area for installation. For instance, wind generation demands wind meters/second to be near 6.5 m/s to consider wind generation. In New Jersey the only area for the optimal wind generation would be off the coast of the Jersey Shores. The only ideal and affordable renewable power generator would be solar generation.

In recent months with the help of government intervention and increase of demand, solar panels have been decreasing in price – making solar projects more appealing. As of May 31, 2011 there are 9,566 solar installations in the State of New Jersey completed or under construction. According to the U.S. Department of Energy in 2010, New Jersey is second to only California with the most electricity generated from the sun with a total of 259.9 MW compared to California's 1,021.7 MW.

Gloucester Township owns and operates a multitude of facilities and properties across their jurisdiction that could embrace solar generation. The services of Blue Sky Power allow Gloucester Township to reach out to qualified firms for the opportunity to enter into a Power Purchase Agreement. Blue Sky Power drafted two Solar PPA RFPs for two separate projects for solar power generation.

The first solar RFP is for the lease or purchase of the Owens Corning landfill site, located at 300 Somerdale Road in Gloucester Township, New Jersey. The Owens Corning landfill site was closed under the supervision of the NJDEP in the late 1970s/early 1980s. At that time, the landfill was closed for operation and the site was covered with topsoil. Blue Sky Power identified that out of 22 acres that only 12 acres were viable for a solar installation. Taking the available optimal layout of a solar installation three to four megawatts of DC would be the maximum generation at Owens Corning. The proposed project has three options for the awarded contractor to perform with the site; a direct grid-connected utility scale solar facility, a net-metered proposal under a PPA with the Chews Elementary School; or both a direct grid-connected facility and a net-metered PPA with the adjacent School. Blue Sky Power identified that the School District can realize greater savings by entering into a $0.05 PPA rate for 15 years with no escalator. The generated electricity would be connected to a PV installation on Owen's Corning property and advises the Township's school district to be separate from that of the "shared services" Solar PPA.

In addition to the Owens Corning Solar RFP, there is a shared service Solar RFP between the Township, GTMUA, Black Horse Pike Regional School District and the Township Public Schools. The 13 buildings involved under the Solar PPA are as follows:

Gloucester Township Facilities

- Municipal Building
- Department of Public Works

Black Horse Pike Regional School District

- Triton Regional High School
- Timber Creek Regional High School
- Highland Regional High School

Gloucester Township Public Schools

- Ann Mullen Middle School
- Blackwood Elementary School
- C.W. Lewis Middle School
- Erial Elementary School
- Glen Landing Middle School
- J.W. Lilley Elementary School
- Loring Fleming Elementary School

Gloucester Township Municipal Utilities Authority

All facilities involved in the shared services Solar PPA have been allocated for 8.57 MW of PV installations to be mounted onto 14 buildings roofs or properties. At certain schools or facilities the proposed solar installations have the opportunity to offset the current utility consumption, consequently making those facilities completely "sustainable". The effect of solar generation on Township properties reduces CO_2 emissions on the environment in addition educating the students about clean energy.

At each location there will be a flat-screen monitor running real-time data from the solar panels down to the screen for students and faculty to study. In conjunction to witnessing the generation of the solar panels, the monitoring system will also be connected to a weather station on top of the school. This will allow the students to see how the weather patterns directly affect the PV generation.

Blue Sky Power recommends the Township schools to adapt curricula that would be easily tied into the current lesson plans. For example, environmental science can identify the impact on the climate and environment that renewable energy has on the earth. Also renewable energy can be slipped into adolescent social studies that would be driven by the current administration in the nation's capital. Renewable energy an

Renewable energy, especially solar photovoltaic, holds the potential to impact the young thinkers of tomorrow. Certain schools across the nation already have renewable energy curriculum mandated in the studies. With inspired teaching of renewable energy and energy efficiency, students will have the ability to learn about the impact they can have on the futures to come.

5.5 Sustainability

Gloucester Township recently adopted a Green Team. The objective of the Green Team is to establish Gloucester Township a member of Sustainable Jersey. New Jersey is the first State to establish an organization to promote sustainability. The Sustainable Jersey program links certification with strong state and private financial incentives. The is a certification program for municipalities in New Jersey that want to go green, save money, and take steps to sustain their quality of life over the long term. The goals set forth by Sustainable Jersey are listed below:

- Identifies concrete actions that municipalities can implement to become "certified" and be considered leaders on the path to sustainable communities;
- Provides clear “how to” guidance and tools to enable communities to make progress on each action;
- Provides access to grants, and identifies existing and new funding opportunities for municipalities to make progress toward the actions;
- Encompasses the 3 equal, interrelated components of sustainability:
    - Prosperity-support your local economy and use community resources
    - Planet-practice responsible environmental management and conservation
    - People-embrace social equity and fairness

The Green Team consists of a Green Team member and a Municipal Staff member. The team will submit requirements set forth by the Sustainability Jersey party that the Township will have to fulfill to receive points. These points account for the advancement the Township is taking to becoming a member of Sustainable Jersey. Medals are granted for a certain number measures that have been awarded for the Township’s responsiveness to the demand for sustainability. For a municipality to receive a silver medal or bronze medal a Township must receive 350 points or 150 points respectively.

5.5.1 Sustainable Jersey Points achieved by the Township

Blue Sky Power has observed the Green Teams success and listed the Township’s Sustainability Jersey measures already achieved:

1. **Formation of a Green Team**
    a. Gloucester Township adopted its first Green Team in the summer of 2011.

2. **Community Education and Outreach**
    a. Gloucester Township's sustainability outreach program encompasses many areas and involves many forms of communication with residents. One of the outreach initiatives involved a presentation to religious leaders of our community of the film "Renewal". This first showing took place at the bi-monthly Magisterium meeting.
3. **Green Challenges and Community Programs**
    a. Gloucester Township's Green Challenge Program, dubbed "The Green Team Pledge" encourages the community's households to participate in challenge consisting of four different actions with the goal of simple lifestyle changes that can have a big impact on our environment.
4. **Energy Audits for One Building**
    a. The audit was commissioned through the Local Government Energy Audit Program as administered by the NJ Board of Public Utilities. Included in the audit was the Township Municipal Building that gave a detailed analysis of usage along with recommended ECMs.
5. **Inventory and Upgrade of All Buildings**
    a. In the beginning of 2011, Concord Engineering Services performed an energy audit on seven Township facilities. The audit was commissioned through the Local Government Energy Audit Program as administered by the NJ Board of Public Utilities. Included in the audit were the Township Municipal Building, Academy Hall, Township Library, Department of Public Works, Monroe Swimming Facility, Township Senior Center, and the Recreation Center. The audit described the usage and analysis of all Townships owned and operated buildings.
6. **Water Conservation and Education Program**
    a. Sustainable Gloucester Township held our first Rain Barrel Workshop with a focus on educating our community about water conservation through innovative methods. In order to achieve this goal our Green Team held a meeting to organize the Rain Barrel Workshop. This program was advertised on our municipal website, municipal electronic marquees, at the Gloucester Township Day Green Team booth, through email newsletters and on a local cable channel.
7. **Community Visioning**
    a. On May 11, 2011, the community joined Gloucester Township Mayor David Mayer and Councilwoman Michelle Gentek. The township understands that the best way to move forward as a community is to engage in discourse that evaluates the present state of affairs. As a diverse range of residents gave their input, they became engaged and invested in the process that is most foundational to local sustainability: community visioning.

8. **Solar**
    a. Beginning in 2011, the Gloucester Township Municipal Building has been utilizing the natural energy from the sun as power. Funded in part through the Energy Efficiency Block Grant, the municipality was able to construct solar panels on top of the building's roof which allowed municipal land to remain unaltered. Plans are also underway for the local school boards to also install solar power for almost all of the school buildings, as well as the Department of Public Works building.
9. **Other (Project Porchlight)**
    a. In 2010, at the Mayor and Council booth at the Gloucester Township Day fair, Project Porchlight was represented by our elected officials. Mayor and Councilwoman Gentek drove to Trenton to pick up the light bulbs and meet with the Project Porchlight representative, Vicky Allen. On Gloucester Township Day, June 5, 2010, each light bulb was distributed to a resident and accounted for. Approximately 120 CFL bulbs were distributed to our community members. Information was also handed out on how to recycle in the township, generating green awareness.

5.6 Conclusion

The necessary steps are being taken to ensure Gloucester Township's ability to go Green. The projects that Gloucester Township is administering lay the foundation for more clean energy projects to come. With the adoption of single-stream recycling and the retrofitting of facilities directed by the Direct Install program, the Township of Gloucester can realize profits stemming from energy savings and an influx of recycling revenue from the adoption of single-stream recycling.

Gloucester Township noticed the need for change and has been on the forefront of attacking the increase of high energy prices and the need for being socially responsible.

6.0 Clean Energy Production

Clean Energy Production is the idea of a developer generating energy by solar, wind, rain, tides, biomass and/or geothermal. Clean Energy Production can also be referenced as Renewable Energy. All of these resources can be naturally replenished, thus getting its name Renewable Energy. Currently in New Jersey there is an increase push for renewable generation production from the State Legislator described in the State Energy Master Plan. The drafted Master Plan from the State Government describes a detailed 30% increase by 2020 under the Renewable Portfolio Standard ("RPS"). In New Jersey by 2020, the State would like to be supplied by 900 MW of biomass capacity, at least 3000 MW of offshore wind capacity, 200 MW of onshore wind capacity and 2,120 GWh (approximately 1,800 MW) of solar energy production. Lastly, there is a push to reduce consumption by 20% by 2020 this would yield an annual electricity savings of nearly 20,000 GWh per year and annual heating savings of nearly 110 trillion BTUs.

The push for Clean Energy Production is due to the current trends in today's society. Some of the recognizable inclinations are that of volatile energy pricing, increase in energy demand, and global warming. The highlighted goals of the New Jersey Energy Master Plan are as follows:

- Maximize Energy Conservation and Energy Efficiency

Being conscientious in energy consumption through conservation is the most cost-effective way in energy efficiency. New technologies allow homeowners or businesses to be cost-effective in the long-term that will help reduce the gap between supply and demand in today's society of rapid increase in electricity rates. Energy Conservation and Energy Efficiency has started in 2009 with a statewide building code to mandate new building construction to be energy efficient. Also an important step is to help educate the public in outreach programs on the subject of conservation and energy efficiency.

- Reduce Peak Electricity Demand

Peak demand is in reference to the increase in electricity demand that bears a surge in price. During peak demand, wholesale electricity prices may increase by anywhere from 100% to 1,000%. Consumer's specific actions can influence these volatile market prices by being energy efficient. The scheduled goal set by the former Governor Corzine to reduce consumption by 20,000 GWh in 2020 will help reduce the peak demand by 5,700 MW. The reduction in peak demand will require targeting commercial and industrial customers with a peak demand of 500 kW or greater and help to develop incentives to reduce that demand.

- Strive to exceed the current RPS and meet 30% of the State's Electricity needs for Renewable sources by 2020.

With the generation of energy by renewable sources, this allows the State to continue to reduce the impact of greenhouse gas emissions and rely on free fuel sources such as wind and solar. With the existence of the State's Renewable Portfolio Standard ("RPS") it provides help in clean energy production development and will increase the goal from 22.5% to 30% by 2020. Some leading factors in clean generation are to not incinerate biomass by 2020 and to have a 50 MW carve out for "new and emerging technologies".

- Develop a 21st century energy infrastructure

To make 2020 a plausible triumph the energy infrastructure must be improved. The State must work with the utilities to ensure that the foundation, on which these actions will rest, is solid. With the current trend in today's society with energy consumption, by 2020 NJ Homes and Businesses will use 97,800 GWh of electricity annually, up from Corzine's goal of 78,300 GWh. With a development plan for a combined heat and power cogeneration facilities by 2020 will provide 10,000 GWh, leaving 68,300 GWh to be supplied. Also contributing to Corzine's goal is 30% generated electricity from renewable sources leaves about 47,800 GWh of demand left to be fulfilled by the current generation.

- Invest in innovative clean energy technologies and businesses to stimulate the industry's growth in New Jersey.

Former Governor Corzine's Economic Growth Strategy obligated itself by encouraging the development and conception of clean energy solutions for the future. Corzine also identified that clean energy production technology is a potent cornerstone of the Edison Innovation Fund. Some steps in fulfilling these goals are to implement job training programs to ensure that the New Jersey base workforce will be a leader in manufacturing and installation work. Also the State must establish an Energy Institute of New Jersey to encourage the basic and applied energy research efforts at the colleges and universities in the State.

6.1 Renewable Energy Production

6.1.1 Solar

Power is being generated presently on the roof of Township Municipal Hall. Early 2011, the Township led by David Mayer, Mayor of Gloucester Township, financed the project by allocating some of the Energy Efficiency Conservation Block Grant received by the Department of Energy.

The solar system on the roof is a small 33 kW generating roughly ____ kWh. This is the first step for Gloucester Township pursuing on solar energy generation and reducing the Township's carbon footprint.

Solar development in the United States has sparked in recent years. During the first quarter of 2011, solar PV installations grew 66% from 2010's first quarter. Continuing in 2011's first quarter, 2.85 GW of solar energy was connected and online with another 1.1 GW under construction in the United States, this generation could power 570,000 and 220,000 homes respectively.

The price of solar systems dropped 15% from a year ago according to Solar Energy Industries Association. This is due to manufacturing scaling up the production of Photovoltaics making the modules cheaper and more efficient with better materials. Parallel to production, installing the systems have become more proficient with regards to a rise of trained professionals.

Solar installations will continue to increase with the demand from Capitol Hill to reduce the dependence on foreign oil as well as decreasing the burning of fossil fuels for energy. The current trend of increased wattage for solar panels will continue to rise making all the more sense for Gloucester Township to make the switch to renewables. In contrast, the Township would realize great returns from purchasing power from a solar developer rather than the increased rate from the current utilities. Blue Sky Power will continue to help the Township of Gloucester to become energy independent and to connect clean energy.

6.1.2 Wind

Gloucester Township is a unique player in making these goals obtainable. The Township can do their part by becoming a conscientious energy consumer as well as implementing new technologies for Clean Energy Production. Gloucester Township has two ideal landfill properties, Gems and Owens Corning to implement a textbook solar field for a wide array of potential solutions. Some prospective outcomes of the generated electricity could be between Community Power, Utility Scale and your basic distribution to identified end users who would enter into a Power Purchase Agreement.

In conjunction of proposing solar generating systems on Township and School District properties, Gloucester Twp. has asked Blue Sky Power to consider wind generation on location. Wind Turbines may use a horizontal or vertical axis propeller, or rotor, to capture the kinetic energy of the wind and convert it into rotary motion to drive a generator, which in most cases is designed specifically for the wind turbine. Horizontal axis wind turbines are the most predominant but happen to take up more room than vertical axis wind turbines. The rotor consists of three blades, usually made from wood or fiberglass. This composition gives the turbine needed strength and flexibility to harness the earth's wind.

The assembly of the wind turbine is mounted on top of a tower to avoid turbulence from variant wind speeds. For maximum output, turbines should be mounted at least 30 feet above any structure or natural feature within 300 feet of the installation. Smaller wind turbines can be erected at shorter heights.

The New Jersey Clean Energy Program adopted the New Jersey Renewable Energy Incentive Program ("REIP") to encourage domestic growth in the renewable energy market for Schools, Local Governments, State Governments and Institutions. Incentives for wind turbine installations are based on kilowatt hours saved in the first year. Under the REIP, systems sized under 16,000 kWh will receive $3.20 per kWh incentive. Wind systems producing over 16,000 kWh will receive $51,200 for the first 16,000 kWh and additional $0.50 per kWh up to a maximum cap of 750,000 kWh per year. The Township is exempt from any tax credits, because municipalities do not pay federal taxes. Thus, the School District is still eligible for more incentives.

For any wind project, it is key to note that the mean annual wind speed at the height of which the turbine will be situated. In the Gloucester Township New Jersey area, the annual wind speed is near 6.5 m/s, according to U.S. Department National Renewable Energy Laboratory. The aerial satellite images of the state and wind speed map are included in **Appendix D.** From the laboratories report, any area with an annual wind speed around 6.5 m/s and greater at 80-meter tower height are generally considered to be suitable for development.

6.2 Utility Scale

Gloucester Township is one of the largest municipalities in New Jersey. The Township has a vast stock of great land to conceivably install an impressive clean energy capital project that would generate energy for sale, on GEMS, Owens Corning Landfill, N.I.K.E missile and bases. The current statutes in place for small utility companies are vast and detailed. With certain parameters met, Gloucester Township would operate as a Municipal Owned Utility Company that would be eligible to sell the generated electricity as a third-party supplier under the NJBPU. Note that the solar panel system for GEMS and Owens Corning are not included in Blue Sky Power's introduced Shared Services Solar PPA.

To become a Third-Party Supplier under the NJBPU it is a lengthy process where an application needs to be accepted with lucrative fees applying. Towards the end of the granted utility window, the Township must reapply to become a Utility Company to sell electricity as a third-party supplier. For potential interconnection opportunities the same application and fees process needs to be rewarded for the ACE connection acceptance. With interconnection feasibility it requires patience since the process of being accepted into the grid is lengthy and can be challenging. Some interconnection acceptance requires upgrades to the infrastructure where the connection would be applied. Since the Township is entertaining lease payments for the Landfill properties, the awarded bidder will incur the cost of upgrades.

Lastly, another potential use of the generated electricity would be to sell the electricity to the current local utilities at a wholesale price. There are no current utility usages on location at Owens Corning; so net metering is not desirable. At Owens Corning the two to eight MWdc could be sold at $0.05/kw back to PSE&G. The GEMS landfill consumes energy on-site with facilities being operated by Phase II Trust of GEMS. The consumption at GEMS is so little, it is a superior option for the Township and more economical to sell as a wholesale versus being a net metered site.

By and large, the opportunities to lease out Gloucester Township's empty properties are great. The most recent draft of the New Jersey Energy Master Plan came out June 2011. In the draft, Governor Christie identified the need to lower the Renewable Portfolio Standard but to also increase the development of brownfields and landfills for renewable generation. This Plan promotes the Township of Gloucester to receive the most for their two landfills and potentially the two N.I.K.E missile bases.

7.0 Gloucester Township Preliminary Finance Structuring Options

7.1 Solar Energy Systems and Estimated Costs

Blue Sky Power has evaluated the potential for solar PV systems in the following buildings: 1) Gloucester Township Public Schools; 2) Black Horse Pike Regional School District; 3) Gloucester Township Department of Public Works; and 4) Gloucester Township Municipal Building (collectively, the "Properties"). Blue Sky Power has estimated a potential collective solar project size of approximately 10.5 MW for the Properties. The system sizes at the Ann Mullen and Glen Landing schools (both within the Gloucester Township Public Schools) were reduced from their maximum potential size because the potential output from solar systems would exceed actual electric use at these facilities. Blue Sky Power also did not include a solar PV system on the roof at Triton Regional High School based on the current poor roof conditions and uncertainty over the timing of roof replacement. The result is a potential project size of 9.50MW, as described below.

Blue Sky Power has evaluated the potential financial benefits to Gloucester Township based on two project sizes: 1) total potential size of 9.50MW, including 3.96MW of rooftop systems, 1.25MW of ground array systems and 4.29MW of carport structures; and 2) 5.46MW, including 3.96MW of rooftop systems, 1.25MW of ground array systems and 0.25MW (250kW) of carport structures. The reduced project size described in item 2) above is based on Gloucester Township's stated project cost limit for systems that it would finance, own and operate.

Estimated project construction costs are $3.75 per watt for rooftop systems, $4.10 per watt for ground array systems and $5.50 per watt for carport structures. Based on preliminary estimates, $2.5 million has been included in the development budget for necessary roof upgrades and/or repairs to accommodate the solar systems. A contingency has been added for unknown costs. Blue Sky Power estimates total construction costs of $47,320,000 ($4.98/watt) for the 9.50MW project and $24,502,200 ($4.49/watt) for the 5.46MW project. Additionally, soft costs such as legal, accounting and engineering fees, developer fees (PPA models only), construction period interest, and bond issuance or other permanent financing fees will be incurred, and are included in the estimated amounts in the budgets for the different finance structures discussed below. Total development costs are estimated at $51,420,000 ($5.41/watt) under a PPA for the 9.50MW project size. Depending upon the financing structure utilized, total development costs are estimated in a range from $25,562,200 ($4.68/watt) to $26,037,200 ($4.77/watt) for the 5.46MW project size.

Because of the limited scope of this initial assessment and the "conceptual" nature of the designs, the above summarized costs are estimates and represent the likely range of potential costs based on the chosen finance structure. Many economic factors may influence total system costs including site issues, final array designs, number of inverters, ease of interconnection, purchasing strategies, final material, labor and equipment costs and cost of capital and debt issuance in the various financing markets. The estimates set forth herein are therefore subject to change. Similarly, the projected system sizes set forth herein are estimates and are subject to change in the next stages of design.

7.1.1 Overview of Financing Incentives.

The following tax and economic incentive programs are critical components of one or all of the financing options discussed in Section II of the finance structuring discussion below:

- Federal Investment Tax Credit (ITC)/Treasury Cash Grant In Lieu of ITC;
- Bonus Depreciation;
- Solar Renewable Energy Certificates (SREC); and
- New Jersey School Debt Service Aid.

1. Federal Investment Tax Credit (ITC) or U.S Treasury Cash Grant:

The Federal Investment Tax Credit (ITC) reduces federal income tax for qualified tax-paying owners by 30% of qualified capital expenditures in solar systems. Roofing repairs, certain permanent financing related costs, and qualified long-term warranties are not eligible costs for purposes of the ITC. The system must be placed in service on or before December 31, 2016. The ITC is earned when the equipment is placed in service.

The U.S. Treasury Cash Grant allows qualified ITC eligible projects to receive the value of the ITC as a direct cash grant instead of the owner claiming a tax credit on its tax return. The cash grant is only available for solar systems placed in service before December 31, 2011, or which have met certain tests determining that meaningful progress has been made to develop the systems by such date. The U.S. Treasury cash grant is generally received about 3-4 months after the system has been placed in service. The U.S. Treasury cash grant and the ITC are only applicable to for-profit owners and thus are only incorporated in the Purchase Power Agreement (PPA) financing models with third party owners.

2. Bonus Depreciation:

Solar projects owned by a private investor are eligible for "bonus depreciation" until the end of 2012. The first year bonus depreciation allowance is 100% for systems that are placed in service before the end of 2011, allowing the taxpayer to expense the entire depreciable cost of the property this year. Systems placed in service in 2012 are eligible for 50% first-year bonus depreciation. The financing options presented herein are based on the assumption that all of the solar systems are placed in service in 2012, utilizing 50% bonus depreciation.

3. Solar Renewable Energy Certificates (SRECs):

The New Jersey Solar Renewable Energy Certificate (SREC) market-based program is a significant incentive vehicle for solar PV systems. A SREC is a tradable certificate that represents all the clean energy benefits of electricity generated for a solar electricity system. A SREC can be sold or traded separately from the power. It is sold once a solar facility has generated 1000kWh (1MWh) through either estimated or actual metered production. SRECs are the primary source of on-going operating revenue for a solar system. SREC demand is driven by electricity providers serving retail customers in the state, which under the New Jersey Renewable Portfolio Standard (RPS), are required to include 22.5% qualifying renewable energy in their total electricity sales by the year 2021. Electric suppliers buy and retire SRECs to meet their solar RPS requirements.

Blue Sky Power evaluated several methods for the sale of the SRECs generated by the proposed solar PV systems and Blue Sky Power based its financial models on the assumption that all SRECs will be sold on a monthly or quarterly basis on the spot market, with no short-term or long-term SREC contracts utilized. This assumption was based upon the current uncertainties in the SREC market and general unavailability of short-term or long-term SREC contracts at prices favorable to sellers of SRECs, and also upon uncertainty about the continuation of the SREC-Based Financing Program providing for ten year SREC contracts for buildings in Atlantic City Electric Company territory.

In the evaluations of all finance structures, SRECs are assumed to be sold for $300/SREC in years 1-4, $200/SREC in years 5-10, $150/SREC in years 11-12, and $100/SREC in years 13-15.

4. **New Jersey School Debt Service Aid:**

Blue Sky Power also explored the utilization of Educational Facilities Construction and Financing Debt Service Aid, which Gloucester Township would be eligible for at a 53.7911% aid rate if it is issuing tax-exempt bonds or CREB bonds pursuant to a favorable voter referendum. However, due to the budgetary uncertainty of when debt service aid will continue to be funded by the State of New Jersey, and competitiveness for limited resources, our projections assume no debt service aid from the State of New Jersey.

Blue Sky Power has also explored the utilization of Regular Operating Districts (ROD) grants and has determined that they are not available to fund solar and other renewable energy projects.

A. Atlantic City Electric Company Interconnection Issues:

The discussion herein assumes that there will be no issues with interconnection at any of the Properties, including those in locations serviced by Atlantic City Electric Company ("ACE"). There have, however, been issues with interconnection in certain locations serviced by ACE, where distribution circuits cannot service additional generation unless the solar developer pays significant costs for required off-site grid improvements. It is noted that for the 9.5MW PPA project 6.7MW are in locations serviced by ACE, and for the 5.46MW project 3.74MW are in locations serviced by ACE. The rest of the solar PV systems are in locations serviced by PSE&G. To the extent that interconnection is not available at a certain property, or that significant additional costs must be incurred for required off-site grid improvements, installing solar PV systems at certain properties may be infeasible, need to be reduced in scale, or only feasible at a higher PPA rate.

Until an interconnection study is completed by the solar PV developer in consultation with ACE, it cannot be determined if there will any interconnection issues, and if so, the magnitude of costs required to be incurred to allow interconnection to proceed at a particular property.

7.2 Solar Project Financing Options.

Based on the parameters detailed in Section I above, Blue Sky Power assessed the costs and benefits associated with the development of solar PV systems under the following finance structuring options:

A. Utilization of a Power Purchase Agreement (PPA) where the PV systems will be owned by a third party who would finance, own and maintain the systems and sell power to the Properties at agreed upon rates;

B. Tax Exempt Bond Financing- Gloucester Township as PPA provider;

C. New Clean Renewable Energy Taxable Bonds- Direct Payment (CREBs) - Gloucester Township as PPA provider; and

D. Tax Exempt Lease.

Chart 1 on page 6 summarizes the costs and cumulative economic benefits over the course of 15 and 30 years for each project size under these financing options. While the 5.46 MW size project was evaluated under each of the above financing options, the 9.5 MW size project was evaluated only under the PPA financing option with a third party investor, as the development and financing costs involved at this project size exceed the stated debt financing parameters of Gloucester Township. Pro-formas for each of these financing structures are included in **Appendix C.**

7.2.1 Power Purchase Agreement (PPA) with Third Party Owner.

Under the PPA structure, Gloucester Township would contractually lock-in electric rates for a fifteen year period. Under New Jersey law, fifteen years is the maximum allowable term for a PPA involving public entities. The solar PV system would be owned and operated by the PPA provider for fifteen years, after which Gloucester Township would have the option (but not the obligation) to purchase the system at fair market value. The PPA may also provide for earlier purchase options by Gloucester Township. Blue Sky Power has estimated the fair market value of the solar PV system after fifteen years to be $5.2 million for the 9.5MW system and $3.0 million for the 5.46MW system. Voter approval is generally not required for entering into a PPA, however it is advisable that such approach be confirmed by counsel and is subject to regulations promulgated by the New Jersey Board of Public Utilities. Gloucester Township would have minimal financial risk for the development and operation of the solar PV systems.

Based upon preliminary estimates, Blue Sky Power has estimated required roofing repairs and long-term warranties at Highland and Timber Creek Regional High Schools at $2.5 million. Since roofing repairs add significant costs to the project and are not eligible costs for purposes of the ITC, the electricity rates offered will be higher if the PPA provider pays directly for roofing repairs.

Blue Sky Power estimates the following offered PPA electricity rates as follows:

	9.5 MW	5.46 MW
With $2.5 million of roof repairs	$0.13/kWh	$0.117/ kWh
Without $2.5 million of roof repairs	$0.10/ kWh	$0.06/ kWh

Chart 1. Summary of Projected Development Costs and Cumulative Economic Benefits

Proposed Project Size	Project Breakdown	Costs			Total Cost (S/Watt)	Cumulative Economic Benefits- Gloucester Twp. and Schools	
		Type Of Financing	Soft Costs, Development and Loan Fees.	Hard Costs ($/Watt)		15 Years	30 Years
5.46 MW DC	▪Roof: 3.96 MW ▪Ground Arrays: 1.25 MW ▪Carports: 0.25 MW	Third Party PPA (Roof Costs paid by PPA provider)	$ 2,294,250	$ 24,502,200 ($4.49/Watt)	$ 26,796,450 ($4.91/Watt)	**$ 5,159,524**	**$28,640,647**
		Third Party PPA (Roof Costs paid by Gloucester Twp.)	$ 2,294,250	$ 22,002,200 ($4.03/Watt)	$ 24,296,450 ($4.45/Watt)	**$11,374,739**	**$34,855,862**
		Tax Exempt Bond Financing	$ 1,435,000	$ 24,502,200 ($4.49/Watt)	$ 25,937,200 ($4.75/Watt)	**$3,512,418**	**$29,636,661**
		CREBs	$ 1,535,000	$ 24,502,200 ($4.49/Watt)	$ 26,037,200 ($4.77/Watt)	**$3,812,538**	**$29,936,781**
		Tax Exempt Lease	$ 1,060,000	$ 24,502,200 ($4.49/Watt)	$ 25,562,200 ($4.68/Watt)	**$3,984,516**	**$30,108,761**
9.50 MW DC	▪Roof: 3.96 MW ▪Ground Arrays: 1.25 MW ▪Carports: 4.29 MW	Third Party PPA (Roof Costs paid by PPA provider)	$ 4,100,000	$ 47,320,000 ($4.98/Watt)	$ 51,420,000 ($5.41/Watt)	**$6,330,360**	**$45,888,134**
		Third Party PPA (Roof Costs paid by Gloucester Twp.)	$ 4,100,000	$ 44,820,000 ($4.72/Watt)	$ 48,920,000 ($5.15/Watt)	**$11,864,178**	**$51,421,953**

The projected electricity rates offered by a PPA provider are based on the assumption that construction of all of the solar PV systems will be completed in calendar year 2012. For each electricity described rate above Blue Sky Power assumes an annual escalation rate of 2.0%.

Some PPA providers may offer to share SREC revenue with Gloucester Township after year ten, though due to the uncertainty of SREC values after year ten, Blue Sky Power does not place any current value on this as a potential additional revenue stream.

The cumulative Net Cash Flows to Gloucester Township under the PPA options during a 15-year and a 30 year period are estimated as follows:

Roof Costs paid by PPA provider	**15-Year Financing and SREC Term**		**30-Year Useful life of Systems**	
System Size	**9.5 MW**	**5.46 MW**	**9.5 MW**	**5.46 MW**
Revenues & Savings	$6,330,360	$5,159,524	$56,963,597	$35,089,978
Operating Costs	N/A	N/A	($5,875,463)	($3,449,331)
Purchase Price Yr.16	N/A	N/A	($5,200,000)	($3,000,000)
Net Cash Flow	**$6,330,360**	**$5,159,524**	**$45,888,134**	**$28,640,647**

Roof Costs NOT paid by PPA provider	**15-Year Financing and SREC Term**		**30-Year Useful life of Systems**	
System Size	**9.5 MW**	**5.46 MW**	**9.5 MW**	**5.46 MW**
Revenues & Savings	$ 11,864,178	$11,374,739	$ 62,497,416	$41,305,193
Operating Costs	N/A	N/A	($5,875,463)	($3,449,331)
Purchase Price Yr.16	N/A	N/A	($5,200,000)	($3,000,000)
Net Cash Flow	**$11,864,178**	**$11,374,739**	**$51,421,953**	**$34,855,862**

Blue Sky Power estimates that for a PPA under either the 9.5MW or 5.46MW PPA project scenarios, if the PPA provider assumes responsibility for $2.5 million of roofing repairs, using a 4.00% annual discount factor, the net present value to Gloucester Township of electricity savings offered over a fifteen year PPA term will decrease by approximately $4.7 million. Thus, it would be more financially beneficial to consider other financing strategies to pay for the necessary roofing improvements than through financing as part of the PPA.

7.2.2 Tax Exempt Bond Financing:

Under the Tax-Exempt Bond Financing Structure, Gloucester Township would finance the entire $25,937,200 capital project cost for a 15 year term through issuance of a tax-exempt bond which would either be publicly sold or privately placed, at an estimated interest rate of 4.00%. Gloucester Township would develop, own and operate the solar PV system, and directly sell the generated energy to the Township schools and other facilities. Based upon stated limits on amounts Gloucester Township would seek to borrow under a bond financing, we evaluated this financing structure for a project size of 5.46 MW, and necessary roof upgrades and/or repairs are included in the development budget. Blue Sky Power estimated the repayment of bonds based upon debt service coverage of 1.05 from years one through ten. Voter approval under a referendum would be required for Gloucester Township to proceed under this financing option.

The Properties evaluated by Blue Sky Power currently incur electricity costs at a weighted average rate of $0.1422/kWh. Blue Sky Power has assumed that Gloucester Township would need to sell power to the Properties at a minimum rate of $0.135/kWh with annual increases of 2% to have enough revenue to pay operating expenses and debt service with approximately 1.05 debt service coverage throughout the fifteen year term of the bonds. This rate would represent an average decrease of 5.06% in electricity costs for the Properties. Beginning in year 16 after the bonds have been fully repaid, the electricity rate was reset to $0.09/kWh with annual increases of 2%, which would represent a substantial discount to expected electricity rates at that time. Based upon the above assumptions and the assumed SREC prices in Section I, the cumulative economic benefit to Gloucester Township is projected to be $3,512,419 during the first 15 years of project operations and $29,636,661 during the 30 year project useful life of the systems**.** As detailed in the schedule below, these amounts include net economic benefits to Gloucester Township, plus electricity savings realized by the Properties.

System Size **5.46 MW / $0.1422kWh rate**	**15-Year Financing and SREC Term**	**30-Year Useful life of Systems**
PPA and SREC Revenues	$33,011,234	$41,899,215
Less: Debt Service	($30,445,940)	($30,445,940)
Less: Operating Costs	($2,174,294)	($5,274,505)
Net Cash Flow- Gloucester Township	**$ 391,000**	**$ 6,178,770**
Add: Electricity Savings at Properties	$3,121,418	$23,457,891
Total Economic Benefits	**$3,512,418**	**$29,636,661**

If Educational Facilities Construction and Financing Debt Service Aid could be obtained under this financing scenario, Debt Service costs to the District would be decreased by $16,377,206 (53.7911% of total debt service), increasing Net Cash Flow under both the 15 Year and 30 Year columns above by the same amount.

7.2.3 New Clean Renewable Energy Taxable Bonds- Direct Payment (CREBs):

The third financing structure is based upon the same assumptions used in subsection B above, except that the bonds to be issued would be Clean Renewable Energy Bonds (CREBs), which are taxable, federally subsidized interest bonds. There are two types of CREB bonds - Direct Payment (New CREBs) and Tax Credit. The discussion herein will focus on New CREBs, which are the preferred option amongst bond investors. Voter approval under a referendum would be required for Gloucester Township to proceed under this financing option.

With New CREBs, the federal government reimburses the issuer 30% of its bond interest costs, with applications made to the U.S. Treasury 45 days before each interest payment date. Thus, if a New CREB is issued with a 5.00% interest rate, the effective interest cost to the issuer is 3.50%. The general goal of the 30% subsidy is to provide a net cost of capital to the issuer at a rate less than the currently available tax-exempt interest rate. Issuance of New CREBs is time and cost intensive, as costs of issuance are higher for issuing New CREBs as compared to standard tax-exempt bond issues (an additional $100,000 of bond issuance costs are assumed compared to the standard tax-exempt bond issuance described in subsection B above). Additionally, there are a finite amount of New CREBs available each year, with significant competition for allocations. However, the benefit of lower interest borrowing potentially outweighs the additional time and transaction costs.

Based upon the above assumptions and the assumed SREC prices in Section I, the cumulative economic benefit to Gloucester Township for using the New CREB financing option is projected to be $3,812,538 during the first 15 years of project operations and $29,936,781 during the 30 year project useful life of the systems**.** As detailed in the schedule below, these amounts include net economic benefits to Gloucester Township, plus electricity savings realized by the Properties.

If Educational Facilities Construction and Financing Debt Service Aid could be obtained under this financing scenario, Debt Service costs to the District would be decreased by $16,215,768 (53.7911% of total debt service), increasing Net Cash Flow under both the 15 Year and 30 Year columns above by the same amount.

System Size 5.46 MW / $0.1422kWh rat	15-Year Financing and SREC Term	30-Year Useful life of Systems
PPA and SREC Revenues	$33,011,234	$41,899,215
Less: Debt Service	($30,145,820)	($30,145,820)
Less: Operating Costs	($2,174,294)	($5,274,505)
Net Cash Flow- Gloucester Township	**$ 691,120**	**$ 6,478,890**
Add: Electricity Savings at Properties	$3,121,418	$23,457,891
Total Economic Benefits	**$3,812,538**	**$29,936,781**

7.2.4 Tax Exempt Lease:

Under the Tax-Exempt Lease Financing Structure, capital project costs would be approximately $25,562,200. Such amount is less than both the tax-exempt bond and CREBs models based upon lease financing costs being $375,000 to $475,000 less than bond issuance costs. The entire project cost, including roof upgrades, would be financed under the lease, amortized based on maintaining 1.10 debt service coverage from years one through ten based upon an assumed tax-exempt lease rate of 3.50%. With a Tax-Exempt Lease authorized through the State's Energy Savings Improvement Program, voter approval would likely not be required, thus expediting completion of the project. Gloucester Township would maintain ownership of the solar PV system and sell power to the school districts and other facilities. Utilization of a tax-exempt lease does not qualify for Educational Facilities Construction and Financing Debt Service Aid.

Based upon the above assumptions and the assumed SREC prices in Section I, the cumulative economic benefit to Gloucester Township under the Tax-Exempt Lease financing option is projected to be $3,984,517 during the first 15 years of project operations and $30,108,759 during the 30 year project useful life of the systems**.** As detailed in the schedule below, this amount includes net economic benefits to Gloucester Township, plus electricity savings realized by the Properties.

System Size 5.46 MW / $0.1422kWh rate	15-Year Financing and SREC Term	30-Year Useful life of Systems
PPA and SREC Revenues	$33,011,234	$41,899,215
Less: Lease Payments	($29,973,842)	($29,973,842)
Less: Operating Costs	($2,174,294)	($ 5,274,505)
Net Cash Flow- Gloucester Township	**($ 863,098)**	**$6,650,870**
Add: Electricity Savings at Properties	$3,121,418	$23,457,891
Total Economic Benefits	**$3,984,516**	**$30,108,761**

Under the tax-exempt bond financing, CREBs and tax-exempt lease financing options, no expenditures are assumed for a Replacement Reserve account to provide for inverter and other equipment replacement that might be required between years 10-15 and beyond. Many inverter manufacturers offer extended warranties of 15 or 20 years, which usually can be purchased for an additional cost during the construction phase. Nevertheless, it is safe to assume that during the 30 year life of a solar system, equipment will need to be replaced, which will reduce total economic benefits under each of the financing options discussed above, including a PPA if Gloucester Township purchases the systems at the end of year 15 or sooner and the inverters have yet to be replaced by the PPA provider.

7.3 Conclusion

Of the financing options presented above, the most savings and the greatest cumulative cash flow over a 15 year term can be realized through entering into Financing Option A, a PPA Agreement with a third party owner.

Each of the financing options presented in Section II offers the opportunity for Gloucester Township and its school districts to realize in excess of $28 million of combined economic benefits during a thirty year period, with significantly higher benefits if the schools separately paid for necessary roof upgrades and/or repairs to accommodate the solar systems. While the equity investors in a PPA have a higher investment return hurdle than Gloucester Township's cost of debt, the significant tax benefits discussed in Section I make the PPA a very viable and safe method of financing a significant solar PV project.

Given the significant risks of developing, owning and operating the solar PV systems, and the amount of debt Gloucester Township would need to incur in order to do so, it would not make sense for Gloucester Township to finance, own and operate the solar PV system even if the additional benefits were projected to be greater than under a PPA structure.

If Educational Facilities Construction and Financing Debt Service Aid could be accessed, a difficult assumption given the State of New Jersey's current budget picture, consideration of a Tax-Exempt Bond Issue or CREBs could have significantly more merit. It is also noted that competition for CREBs is significant and their availability is limited.

Each of the financing vehicles presented should be evaluated in conjunction with the Gloucester Township's budgetary priorities and required approval processes. Each financing option has certain benefits and risks, which we can help the Township and its counsel evaluate.

The figures presented herein are best estimates based on current market conditions, which may change frequently, and must not be considered final financing numbers. Once Gloucester Township has evaluated Energy Master Plan, we will answer any questions and advise the township further on how to assess the information provided and choose a path forward for pursuing a significant solar project.

Exhibit A

Shared Services Solar PPA Aerial Layouts

Exhibit B

Township Property Aerial Layouts

Exhibit C

Financial Pro-Formas

Exhibit D

New Jersey Wind Map Layout