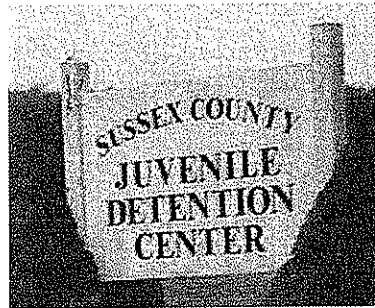


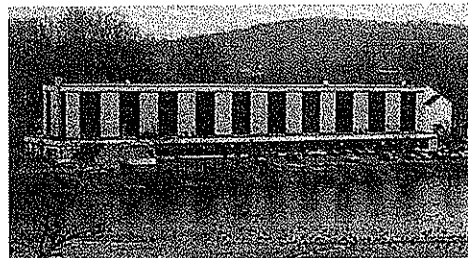
**COUNTY OF SUSSEX**  
**JUVENILE DETENTION CENTER**  
**HOMESTEAD NURSING HOME**  
**SOLAR ENERGY ASSESSMENT**

**Submittal Date:**  
December 2008

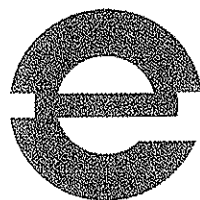
**Submitted to:**  
John Eskilson  
County Administrator  
Joseph J. Biuso  
Director -  
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**Submitted by:**  
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Jim Nagle  
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**ENERACTIVE**  
SOLUTIONS



## Executive Summary

In an effort to provide energy cost savings in an environmental manner, The County of Sussex has commissioned ENERActive Solutions to study the feasibility of installing a photovoltaic system at their Juvenile Detention Center and Homestead Nursing Home facilities located in Frankford, New Jersey. In addition, a cost/benefit analysis, financing options are to be considered for the proposed system(s). As part of this study we have specifically addressed the following:

- Optimum location of a solar generating system on the properties
  - Integrity and shadowing to be considered
- Concept layouts of roof, ground and or tracking mounted system
- High level electrical system requirement for interconnection with the electrical distribution system
  - Inverter location
  - Production voltage
  - Location of interconnect with local distribution system
  - Utility required protective relay
- Budget installation figures for complete turnkey project delivery
- Solar Renewable Energy Certificate (SREC'S)
  - SREC'S to be identified in life cycle economic pro-forma
- Development of complete project life cycle economic pro-forma with line items for:
  - Project Cost
  - Avoided Utility Energy Cost
  - Sales of Green Tags (Renewable Energy Certificates)
  - Project Simple Payback
  - Internal Rate of Return (IRR)
  - Net Present Value of Cash Flow
  - Financing Options including Power Purchase Agreement (PPA)

Our assessment has determined the following:

For the Juvenile Detention Center, a 150 kW solar plant, as modeled within this study, will generate approximately 167,560 kWh annually and save the County approximately \$25,972 in annual electric costs. The projected value of the Solar Renewable Energy Credits (SRECs) created by the project, with a current market value of \$83,781 per year (at \$0.50 kWh), will increase the total annual benefit to \$109,753. The system has a projected life expectancy of 25 years and is budgeted at a total installed turnkey cost of \$1,140,000 based on a ground mounted system. We have prepared a preliminary layout of the system in Sketch SK-1 attached.

For the Homestead Nursing Home, a 600 kW solar plant, as modeled within this study, will generate approximately 670,248 kWh annually and save the County approximately \$103,888 in annual electric costs. The projected value of the Solar Renewable Energy Credits (SRECs) created by the project, with a current market value of \$335,124 per year (at \$0.50 kWh), will increase the total annual benefit to \$439,012. The system has a projected life expectancy of 25 years and is budgeted at a



total installed turnkey cost of \$4,560,000 based on a ground mounted system. We have prepared a preliminary layout of the system also indicated in Sketch SK-1 attached.

The combined project will provide 837,810 kWh in electric savings which represents \$129,860 in annual savings. When combined with the combined \$418,905 dollars in SREC revenue the total project will generate \$548,766 in annual savings. The financial performance of the project results in an internal rate of return of 5.9% over a 15 year term.

The economics presented are based on a 15 year financing term and the value of SRECs at \$0.50/kWh. The current ceiling price in NJ is \$0.71/kWh making our value of \$0.50 conservative. It is important to highlight that recent contracts for SRECs are being executed for a 3 to 5 year duration and for approximately \$.60 and above. While it is likely that the credits will remain valuable, it is impossible to project their value past an initial contract period.



## Overview

The Sussex County JDC and Homestead Nursing site has available area which is suitable to accommodate the theoretical installation of significantly more than our recommended 750 kW of ground mounted photovoltaics. Our model represents a more moderate 750 kW system which is based on the current electrical load at the facilities and practical available square footage and the associated site logistics. While final engineering drawings would determine the actual boundaries, specific array locations, and utility infrastructure, we have provided a suggested location in attached Sketch SK-1.

Energy costs have increased noticeably over the past few years. Double digit increases in retail energy prices have resulted in a renewed interest in conservation (We recently calculated a 27% increase in electric cost for another client over the past 12 months). Although energy pricing in the past month has relaxed, oil did reach the \$145/barrel range and volatility will continue to plague energy markets with no foreseeable end in site. While energy cost increases have been outpacing inflation by three to five times, we have used a conservative energy cost inflation factor of 4% for our assessment. Inherently, any annual energy cost increase over 4% will result in more favorable financial performance.

Our assessment and model indicate two viable options for the Sussex County JDC and Homestead Nursing facility to finance the proposed photovoltaic project:

- Third party development with a Power Purchase Agreement (PPA)
- Direct ownership with complete purchase

Direct ownership would allow for 100% of the savings and 100% of the Solar Renewable Energy Certificates to flow directly to the County. However, as a public entity, the County would not be able to take advantage of the 30% Federal Tax Credit. It would also require a significant capital outlay. An alternate financing method which would allow the County to take advantage of the Federal Tax Credit is a Power Purchase Agreement (PPA) is discussed below.

The PPA is the current third party model that is readily available for financing solar projects. This would allow the County to drive down the system's upfront costs and have the system installed with little or no up front capital outlay. Based on our review, it is possible that a PPA could be entered into such that the payment structure for the Sussex County JDC and Homestead Nursing Facility would be available at approximately your current cost of electricity for the initial contract period. This option allows the third party financier to take advantage of the available Federal Tax Credits as well as the SREC's. This financing would deliver the goals of reduced/fixed energy costs and environmental stewardship for the life of the contract.

For illustrative purposes, we have solicited a budget proposal for a Power Purchase Agreement option on behalf of the Sussex County JDC and Homestead Nursing facility. Based on this sample offer, the County could agree to sign a 15 year Power Purchase



Agreement and be required to begin payments in year one at the proposed electric rate of \$0.154/kWh for the electricity generated by the system and each year that payment would escalate at approximately 3 to 4%. This would lock pricing in at a fixed rate each year and remove the facility from the volatility of the energy markets for a portion of their energy supply. At the end of the 15 year period the County would be able to purchase the system for the remaining net value of the equipment or extend the financing to completion. At the end of this term the County would own the system outright and receive 100% of the energy savings for the remainder of the life of the system.

We have included a budget for the proposed installed cost of the system as indicated below. This is in-line with systems of similar size and complexion, and includes an allowance for the unique attributes of the proposed ground mounted system. A breakdown of our cost estimate is as follows:

**Sussex County Juvenile Detention Center  
Photovoltaic Budget Cost  
175 kW Ground Mounted System**

Photovoltaic Panels	\$	2,625,000.00
Misc. Equip	\$	900,000.00
Electricians & Labor	\$	1,125,000.00
Invertors & Installation	\$	337,500.00
Contingency	\$	262,500.00
Permit	\$	-
Design, Engineering Project Management and Commissioning	\$	450,000.00
<b>Total Install Cost</b>	<b>\$</b>	<b>5,700,000.00</b>

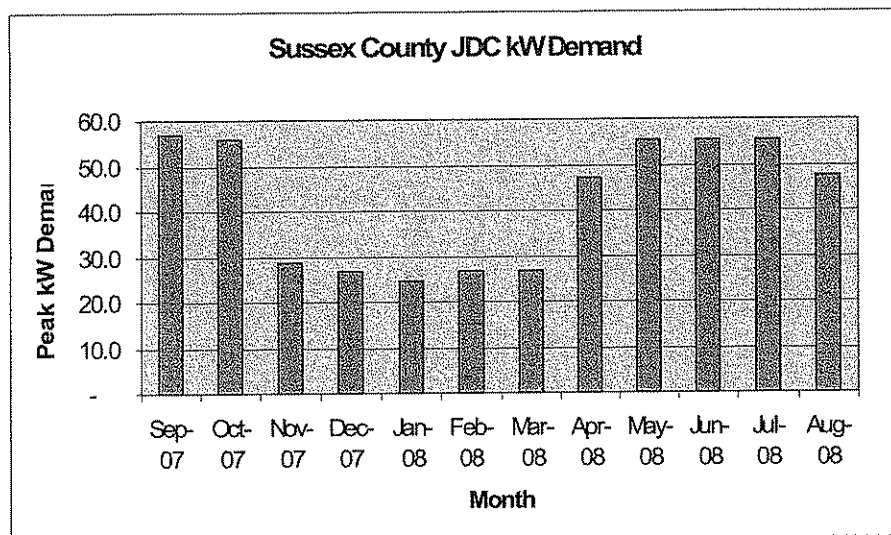
We have included prevailing wage labor for a portion of the project in an effort to provide the most cost accurate estimate for the project.



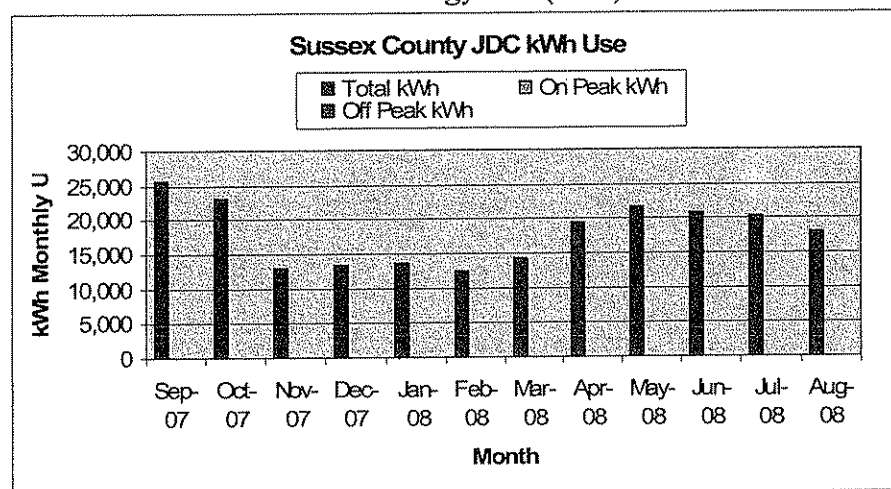
## Study Details

The Sussex County Homestead Nursing Home and Juvenile Detention Center facilities located at 129 and 134 Morris Turnpike, Frankford, New Jersey has significant amount of land area/square footage that can accommodate the installation of solar arrays. Based on the energy profile of the facilities, the available real estate, and the most cost effective layouts, we recommend the installation of a 750 kW of ground mounted solar system that can be installed on the site. Currently, the facility has a projected average energy cost of \$0.157/kWh. Both of facility's current operation is indicated in a weather and schedule sensitive electric usage pattern represented in the graphs below:

Sussex County JDC  
Electric Demand Profile (kW)

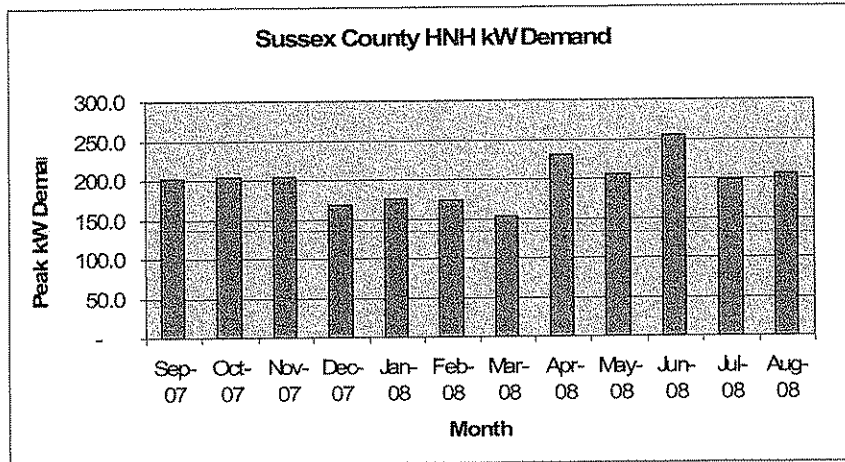


Sussex County JDC  
Electric Energy Use (kWh)

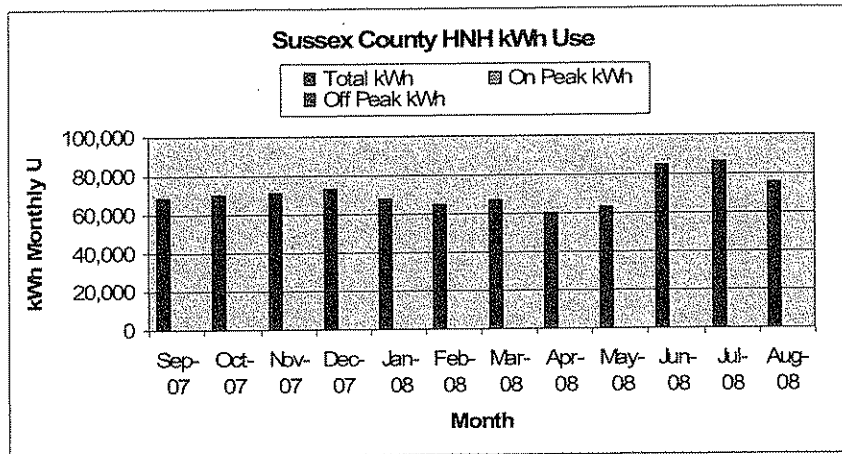




### Sussex County Homestead Nursing Home Electric Demand Profile (kW)



### Sussex County Homestead Nursing Home Electric Energy Use (kWh)



Due to the unique nature of the site's electric usage and associated electrical requirements characterized by the facility types on site, a 750 kW system would serve the site by providing approximately 70% to 75% of the facilities overall electric load throughout the course of the year, depending on the monthly demand level.



Evaluating a system this size utilizing solar production software which accounts for weather patterns in Sussex County New Jersey, produces the following energy performance:

Station Identification	
Cell ID:	267369
State:	NJ
Latitude:	41.3° N
Longitude:	74.7° W
PV System Specifications	
DC Rating:	750 kW
DC to AC Derate Factor:	0.770
AC Rating:	577.5 kW
Array Type:	Fixed Tilt
Array Tilt:	41.3°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.5 ¢/kWh

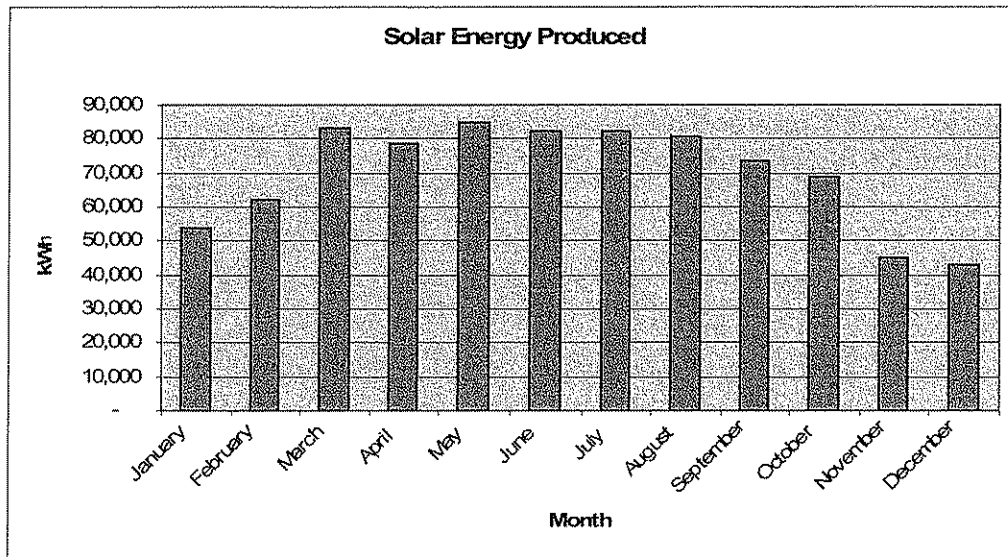
Results			
Month	Solar Radiation (kWh/m <sup>2</sup> /day)	AC Energy (kWh)	Energy Value (\$)
1	2.90	53805	\$8,339.78
2	3.77	62153	\$9,633.64
3	4.69	83483	\$12,939.79
4	4.72	78720	\$12,201.60
5	5.14	84863	\$13,153.69
6	5.26	82065	\$12,720.08
7	5.23	82410	\$12,773.55
8	5.05	80565	\$12,487.58
9	4.64	73493	\$11,391.34
10	4.04	68535	\$10,622.93
11	2.73	44963	\$6,969.19
12	2.41	42758	\$6,627.41
Year	4.22	837,810	\$129,860.55





When running this data through a financial model, following annual system financial performance based on an avoided electric cost of \$0.157/kWh and a SREC value of \$0.55/kWh results:

Month	PV Watts Solar Energy Projection (kWh)	Energy Savings Value at kWh rate shown below (\$)	SREC Value at kWh rate shown below (\$)	Total Solar Energy Value (\$)
1	53805	\$8,339.78	\$26,902.50	\$35,242.28
2	62153	\$9,633.64	\$31,076.25	\$40,709.89
3	83483	\$12,939.79	\$41,741.25	\$54,681.04
4	78720	\$12,201.60	\$39,360.00	\$51,561.60
5	84863	\$13,153.69	\$42,431.25	\$55,584.94
6	82065	\$12,720.08	\$41,032.50	\$53,752.58
7	82410	\$12,773.55	\$41,205.00	\$53,978.55
8	80565	\$12,487.58	\$40,282.50	\$52,770.08
9	73493	\$11,391.34	\$36,746.25	\$48,137.59
10	68535	\$10,622.93	\$34,267.50	\$44,890.43
11	44963	\$6,969.19	\$22,481.25	\$29,450.44
12	42758	\$6,627.41	\$21,378.75	\$28,006.16
<b>Year</b>	<b>837810</b>	<b>\$129,860.55</b>	<b>\$418,905.00</b>	<b>\$548,765.55</b>





## Financial Analysis

The projected 15 year financial performance of a purchased system including the Federal Tax Credit, is as follows:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total
<b>Program Savings</b>																
Annual Energy Savings	\$ 124,851	\$ 153,655	\$ 144,457	\$ 149,875	\$ 149,875	\$ 151,816	\$ 157,235	\$ 164,365	\$ 170,288	\$ 177,723	\$ 184,822	\$ 192,225	\$ 199,944	\$ 207,941	\$ 216,221	\$ 224,829
Residential Energy Credit Value	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836	\$ 49,836
Net Solar Program Financial Benefit	\$ 184,787	\$ 203,491	\$ 194,293	\$ 199,711	\$ 207,651	\$ 211,652	\$ 217,071	\$ 224,201	\$ 230,124	\$ 237,659	\$ 244,658	\$ 251,061	\$ 257,780	\$ 264,777	\$ 272,057	\$ 279,665
Federal Investment Tax Credit	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total Program Savings</b>	<b>\$ 184,787</b>	<b>\$ 203,491</b>	<b>\$ 194,293</b>	<b>\$ 199,711</b>	<b>\$ 207,651</b>	<b>\$ 211,652</b>	<b>\$ 217,071</b>	<b>\$ 224,201</b>	<b>\$ 230,124</b>	<b>\$ 237,659</b>	<b>\$ 244,658</b>	<b>\$ 251,061</b>	<b>\$ 257,780</b>	<b>\$ 264,777</b>	<b>\$ 272,057</b>	<b>\$ 279,665</b>
<b>Program Costs</b>																
Project Cost	\$ 570,000															\$ 570,000
Financed Amount	\$ 570,000															\$ 570,000
Interest Rate	4.0%															
Finance Term	15 Years															
Annual Debt Payment	(\$12,894)															(\$12,894)
<b>Financial Summary</b>																
Annual Net Benefit	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)	\$ (5,107)
Levelized Lifetime Cost	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total Program Costs</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>	<b>\$ (5,107)</b>
<b>Annual Cash Flow</b>	<b>\$ 179,680</b>	<b>\$ 198,384</b>	<b>\$ 189,186</b>	<b>\$ 194,604</b>	<b>\$ 202,544</b>	<b>\$ 206,545</b>	<b>\$ 211,964</b>	<b>\$ 219,094</b>	<b>\$ 225,017</b>	<b>\$ 232,552</b>	<b>\$ 239,551</b>	<b>\$ 245,954</b>	<b>\$ 252,673</b>	<b>\$ 259,670</b>	<b>\$ 266,950</b>	<b>\$ 274,568</b>
<b>Net Present Value of Cash Flow - 15 Year</b>	<b>\$749,340</b>															
<b>IRR Cash Flow</b>	<b>\$ (5,700,000)</b>	<b>\$ 548,766</b>	<b>\$ 553,862</b>	<b>\$ 558,958</b>	<b>\$ 564,054</b>	<b>\$ 569,150</b>	<b>\$ 574,246</b>	<b>\$ 579,342</b>	<b>\$ 584,438</b>	<b>\$ 589,534</b>	<b>\$ 594,630</b>	<b>\$ 599,726</b>	<b>\$ 604,822</b>	<b>\$ 609,918</b>	<b>\$ 615,014</b>	<b>\$ 620,110</b>
<b>IRR on Total Capital</b>	<b>5.91%</b>															
<b>Total Cash Flow over 15 Year</b>	<b>\$2,016,610</b>															

As seen above, this system will create \$ 548,766 in first year value and result in an internal rate of return of 5.91%.



## Photovoltaic System Details

Photovoltaic Power Generation (PV Power) has been gaining favor throughout the State through the combination of social awareness and economic benefit. Solar Power is no longer considered a fringe installation for the environmentally sensitive, but a mainstream technology for all developers to weigh as an option to offset peak utility power.

The energy generated by a PV system is actually more valuable than the average cost for energy that is used in the economics. The maximum energy generated from the system occurs simultaneously with peak energy market pricing (mid-day, high use, extremely sunny periods). With the deregulated market for energy in New Jersey, the hourly pricing that customers can pay for energy will make users of solar power more economically savvy by lowering peak demand load and offsetting the highest cost electricity.

Climate and configuration have significant bearing on the overall performance of a photovoltaic system. For optimum results, systems should be installed at a congruent attitude, favoring a southern exposure to maximize system efficacy. Fortunately, the proposed site is conducive for such a photovoltaic installation. For this reason we have chosen an optimum area within the site boundary for the potential system location.

Based on the production calculations for this system and the average cost of energy for the the two facilities located on site, we have determined that the system will offset \$129,860 in annual electricity costs in year 1. In addition to this financial benefit, there is an added cash stream generated through the sale of solar renewable energy certificates (SREC). SREC's, also known as "green tags", represent the environmental attribute associated with producing non-polluting energy. These are marketable rights linked to PV system production. New Jersey has minimum portfolio standards for all electric generation marketers who supply power in the State, and these standards set a requirement for all generators to have a portion of their supply sources come from renewable power, with a corresponding sub-requirement for solar power. If these generators fail to have renewable energy plants operating, it can result in suspension of the supplier's license, financial penalties, disallowance of recovery of costs in rates, and/or prohibition on accepting new customers. The financial penalties are \$0.71 kW. In lieu of building and owning renewable generating facilities, these generators can circumvent the penalty by obtaining the "right of production" through purchasing SREC's from a private renewable generating system owner, such as the one proposed for the County facilities.

While the value of these SREC's have a ceiling value of \$0.71 kW (established by the renewable portfolio standard), current markets for these credits are placing the value around \$0.55-\$0.65/kWh. Using the \$.50 figure to establish an additional cash stream for the County, an additional \$418,905 can be reaped annually from the installation of a PV system. By adding the electrical cost savings and the SREC benefit together, the County can expect to save approximately \$548,766 annually through the thoughtful utilization of a ground mounted PV system. If purchased outright, this system would result in a simple payback of approximately 10 years.



## Operations and Maintenance Impact

A beneficial feature of photovoltaic power generation is the benign nature of the system operation. With virtually no moving parts, the impact of the system on the ongoing operations and maintenance costs for the County are small. The panels are very robust and extremely durable so breakage should not be a factor. The only mechanism that would be considered a regular maintenance item are the inverters. This is the equipment that converts the DC power generated from the panels to AC power that is utilized in the buildings.

Our economics have included the costs for replacing the inverters in year 11. Inverters have a 10 year warranty and an estimated useful life of 20 years. Any other minor maintenance activities should be in the capabilities of the on site staff.

A final maintenance item will be an annual inspection of the system to ensure all electrical connections are in tact and that the panels are clear of dirt and debris. Buildup of any kind of dirt or debris on the panels should be rare as they sit on a slight angle and are rinsed off naturally by rainwater. Maintenance Services Agreements are available for such an installation and can be figured into the annual financial performance.

The system will deliver approximately 837,810 kWh on average each year. Over the life of the system, the value of the output is considered fixed due to the only "fuel" input being the free sunshine. Touted as the most "green" of all energy technologies, this solar plant would result in the reduction of approximately 800 metric tons of CO<sub>2</sub> on an annual basis.

As described above, we have incorporated a ground mount into the conceptual design. This would allow the solar system to provide its energy production while not utilizing the surface area on the roof which only has a limited useful life remaining.

We have provided significant details regarding the layout and distribution requirements associated with the ground mounted installation in the Sketch Attached at the end of this report. There are a multitude of products available on the marketplace, and after evaluating many products and styles, we have selected a system utilizing panels manufactured by Suntech for use in this study. We assess this product to be representative and one that is appropriate for photovoltaic production with the practical attributes salient to the installation for Sussex County. Our utilization is not an endorsement of the product; we merely use the system as a realistic example of what equipment is commercially available at a fair and reasonable cost. If you have any questions regarding the system type or selection, please feel free to contact us at any time for clarification.

We have provided our detailed layout and solar production information for incorporation into the Attachments section to provide Sussex County with the best visual interpretation of the proposed systems.



## **Next Steps**

Upon your review of ENERActive's report and recommendations, we will meet with you to discuss the various options for moving ahead with development of the project.

Should Sussex County wish to purchase the system outright, this transition could commence immediately into development and installation complete with final system engineering and configuration.

Alternatively, should the County wish to pursue a third party PPA to avoid the upfront capital expense and market volatility and still benefit from a fixed energy rate moving forward, ENERActive is available to prepare the appropriate procurement documents and facilitate this development.

Regardless of the arrangement for moving forward, a phase of detailed engineering is recommended to allow for final system sizing, pricing confirmation, and an economic performance reflecting the final system design.

We thank you for the opportunity to work together and look forward to helping support you in moving ahead.



**SKETCH SK-1**  
**750 kW System Overall Layout**

Below is our conceptual layout for the proposed photovoltaic systems to be located at the Sussex County Morris Turnpike location. This layout is preliminary and could change based on final detailed engineering and analysis.

