Best Power Int'l, LLC

Project Title: EP3-3

Contract Number: Milestone Number: 6 Report Date: May 4th 2010

Principal Investigator: Mario Monesterio Contract Contact: Nathan Franzen

Phone: 952-697-5702 Phone: 952-697-5701

Congressional District: (Corporate office) Minnesota 3rd

Congressional District: (Project location) Minnesota 6th

FINAL REPORT

Executive Summary: Best Power Intl, LLC (BPI) has completed the construction of a 400kW solar electric (photovoltaic) energy generation facility. The facility is estimated to produce 575,000 kWh per year and 15,800 MWh over its 30-year lifespan. It is the first facility in the Midwest to utilize a motorized horizontal-axis tracking array. The PV modules sit on beams that rotate east to west on a horizontal axis throughout the day, following the path of the sun across the sky. This increases the efficiency of the array and produces approximately 15% more energy than a typical static array.

The project team has completed all of the Milestones. The system is fully operational and was commissioned on December 10th, 2009. It was awarded the *Commercial Renewable Energy Project of the Year* by the Minnesota Renewable Energy Society in February of 2010 and has been visited by more than 500 people from around the Midwest since completion.

Project funding provided by customers of Xcel Energy through a grant from the Renewable Development Fund.

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612-270-8864

Technical Progress:

The facility required various permits and approvals in order to proceed with construction. Below is a list of permits and agreements that were required to construct the facility.

Landuse Approvals/Permits:

- Zoning Code text change (to allow solar): Stearns County
- Rezoning to District that allowed solar: Stearns County
- Conditional Use Permit: Avon Township
- Site Permit: Stearns County
- NPDES (Stormwater): State of Minnesota
- State Building Permit (Electrical) State of Minnesota
- Decommission Plan: Avon Township

Legal Agreements:

- Interconnection Agreement: Xcel Energy
- Land & Solar Lease: Saint John's Abbey
- Construction Agreements: Mortenson, etc.
- Vendor Supply Agreements: Modules, Tracker, etc.

Project Timeline:

The project was completed ahead of schedule and within budget. Below is a summary of the project tasks and approximate timeline.

Task	2009
1. Site Acquisition	January - April
2. Sign Land Lease w/ Saint John's	May
3. Design Facility	June
4. Zoning/Permitting	June-August
5. Equipment Procurement	August-September
6. Site Work	September
7. Foundations	September-October
8. Tracker Assembly	October
9. Module Installation	November
10. Commissioning	December

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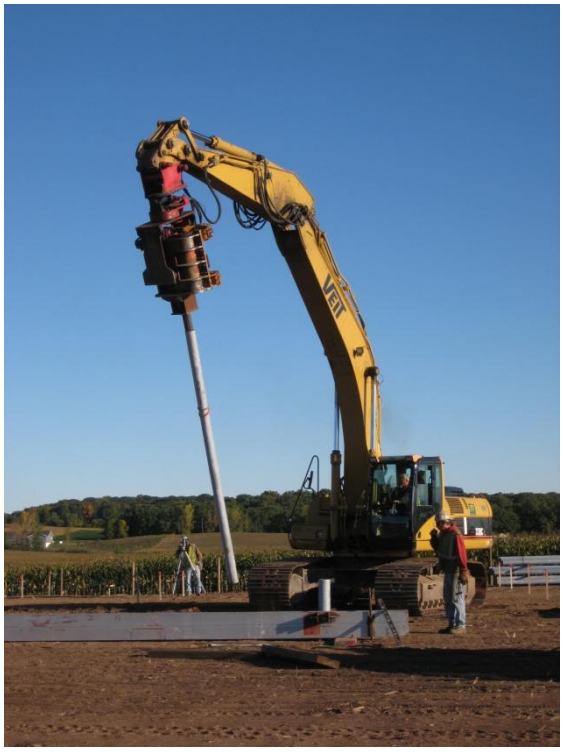
Installation of Tracker Foundations:

A total of 455 foundations were installed at the project site. Each foundation consisted of a 5" or 6" steel post driven 10' into the ground.



Installation of Tracker Frame:

The tracking mechanism was field assembled. This involved welding and cutting, as well as standard and nut and bolt construction of the torque tubes and motor assembly.

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Installation of Conduit and Wires:

The solar modules are wired in series strings of 13 then combined at combiner boxes (14 strings per box). The combiner box is wired to the inverter via a DC disconnect switch. A common trench is utilized through the middle of the array to collect the DC wiring from the strings to the combiners, and from the combiners to the inverter. All trenched wire is carried in PVC conduit.

Installation of Photovoltaic Modules:

1,820 modules were installed on the tracker frame. Each module is attached to the torque tube using clamps.

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***50% Modules Installed.**

Installation of Inverter & Transformer:

The central inverter station includes the inverter, transformers, disconnect switches, the CT cabinet with meter, a weather station, and monitoring hardware. From this location, BPI is able to remotely monitor the system performance, weather conditions and system faults.

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Commissioning:

Commissioning of the system involves calibrating the tracking mechanism and performing system checks on the inverter. The meter is then installed and tested by Xcel Energy. The final test is an anti-islanding test to verify that the system will not send power onto the grid during power outages (to protect line workers).

Completed System:

The facility was constructed in less than 10 weeks including rainfall delays in October.

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Project Benefits:

1. **The project has helped to familiarized Minnesotans with solar PV and educated the public on Minnesota's excellent solar resource. To date following publicity has occurred:**

    A. **Site Tours**: The project team and Saint John's University have provided over a dozen tours to interested parties including schools, industry groups and trades. This broad spectrum of visitors included general contractors, electricians, homebuilders as well as elementary, high school and college students and educators.

    B. **Earth Day**: In Celebration of Earth Day, Saint John's and the Project Team provided tours to the public. Over 300 people attended.

    C. **Media Coverage**: The project has been extensively covered in both print, radio and television coverage. Samples of the published articles are attached to this report.

    D. **Awards**: The project was awarded the *Commercial Renewable Energy Project of the Year* by the Minnesota Renewable Energy Society in February of 2010.

    E. **Educational Seminar**s: The Project Team and Saint John's Abbey & University are in the process of creating a PV focused curriculum to be integrated in the Universities offerings.

    F. **Live Website:** As part of the project, the project team has created a project website for the general public to view the "live" production and environmental conditions at the site. It also includes a project description and historic database. It can be found at:

    http://live.deckmonitoring.com/?id=saint_johns_solar_farm

2. **It provides a full-scale demonstration of utility solar power in Minnesota.**

    A. **Industry Groups:** Professionals from around the state and country have visited to site to review installation techniques, its design and overall constructability.

    B. **Project Investors:** It provides a physical local example of a successful solar project for project investors and lenders to reference.

    C. **Elected Officials & Government Staff:** The project team has provided in-depth tours for government officials that focus on how solar systems are permitted, constructed and operated.

3. **It has created a foundation of project management experience and knowledge regarding installations of this size.**

    A. **Contractors, engineers and integrators**: The project has provided a template for the commercial and utility scale photovoltaic market. The knowledge obtained

through this demonstration project has allowed project team members to expand their service offerings and their ability to deliver similar solar projects in Minnesota.

4. **It will generate renewable energy during peak periods and will serve as a test case to analyze the effects of solar energy generation on load management.**

    A. **Peak Load Reduction**: Data from this project will be used to examine the effects of solar energy on peak load reductions and to examine the usefulness of distributed generation.

    B. **Renewable Energy Production:** The facility will produce approximately 575MW hours of renewable energy and will count towards Xcel's Renewable Portfolio Standard. As of April 27th, 2010 the facility has produced over 185,000kWh.

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Project Lessons Learned:

1. **Site Control:** Acquiring raw land for a 20-year lease proved to more problematic than originally anticipated. Numerous organization were interested in the solar project, however many were hesitant to lock up a parcel for an extended period, requested early termination rights or required a lease payment that exceeded the financial parameters of the project. To overcome this challenge, rural sites were pursued to the increased availability of land.

2. **Financing:** Due to the condition of the financial markets, the ITC was not a viable option due to the lack of tax credit investors in the market. Without strong financial partners and over 30 years of experience in the renewable energy field, obtaining financing would not have been possible.

3. **Power Purchase Agreement:** BPI conducted a thorough review and analysis of the available power sale options. Upon review, it was determined that it would not be economically feasible to sell directly to St. John's since Standby Tariff Rider requirements did not provide sufficient savings to off-set the cost of solar adequately to make it a viable option. Also, since standard pricing does not exist outside of approved tariff rates for larger, commercial renewable energy projects including solar, it was necessary to negotiate a PPA and this can be a lengthy process (three to six months).

4. **Interconnection Agreement:** Due to the constraints of the selected site, the system was interconnected to the utility via the internal distribution system of the site host. This unique interconnection design did not fit the standard interconnection process and required additional review by the utility.

5. **Regulatory Lag:** In spite of strong support for the project by all involved, one should not underestimate the length of time it takes to secure the necessary approvals by the utility and the regulatory bodies with jurisdiction over PPAs (the MN Office of Energy Security and the MN Public Utilities Commission). After a PPA is negotiated and executed, the regulatory approval process can take an additional three to six months.

6. **Contractor Selection:** Identifying strong project partners with an interest in the industry were critical in maintaining project schedule and managing capital costs.

7. **Completion of Design and Engineering:** The design team involved key regulatory officials early in the preliminary design process. This allowed the design team to react to the recommendations of the key stakeholders before final design and product procurement was completed and resulted in a seamless review and approval process.

8. **Procurement of Photovoltaic Modules:** Selecting a product is a beginning of a 25+ year relationship and demands critical review of the product specification, warranty and overall company stability. While price is a critical component of module selection, output performance cannot be discounted in its overall effect to the success of a project over 25 years.

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9. **Obtain Permits and Licenses:** Commercial and utility solar projects are new to the region and do not necessarily fit within the current regulatory framework. As such, BPI identified key stakeholders early in the process to identify potential regulatory obstacles. This proactive approach resulted in a seamless permitting process that was completed in less than four months.

10. **Prepare On-Site Safety Plan:** The project team met with all stakeholders including university officials, campus security, neighbors and subcontractors to identity potential safety issues during construction of the facility. This resulted in a plan that provides a clear understanding of potential safety issues and an action plan during an emergency.

11. **Insurance Verification:** General liability coverage options for solar systems are extremely limited due to the fact that most solar systems to date have been added as additional insured property to an existing policy such as home owner's insurance. This is particularly true for commercial and utility scale project owners that do not own the underlying property upon which the system is installed.

12. **Site Preparation:** An integrated design that takes into account all aspects of a particular site can reduce costs and shorten the construction schedule. It also provides ancillary benefits such as reductions in erosion potential, soil compaction and minimized site disturbance.

13. **Module Delivery:** Utilizing American made products avoided complications with US Customs and oversea shipping complications. The delivery was made on time.

14. **Installation of Photovoltaic System:** Existing Conditions: Soil boring conducted during the due diligence period did not indicate the presence of any obstructions. However, large boulders were discovered during the site preparation and tracker foundation installation. This resulted in temporary delays until the installation crew worked through alternative installation methods.

15. **Budget Estimating:** Due to the relative newness of the solar industry amongst commercial contractors, a wide range of bids were received for each segment of the project during the preliminary bid process. To narrow the range, one-on-one pre-bid conferences were utilized to provide additional detail on installation methods and procedures. This approach resulted in an overall reduction in pricing and a better understanding of the task at hand by all parties involved.

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Appendix: News article, project sign, site plan & tracker power curve.

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MPR newsQ
Minnesota's Online News Source

St. John's Abbey gets Upper Midwest's largest solar farm

by Ambar Espinoza, Minnesota Public Radio
October 7, 2009

AUDIO
St. John's Abbey gets Upper Midwest's largest solar farm (feature audio)

Collegeville, Minn. — The largest experimental solar farm in the upper Midwest will sit on land that belongs to St. John's Abbey of Collegeville.

The solar farm will be four times bigger than Minnesota's current largest solar power system, and it will generate five times more energy. The groundbreaking took place Wednesday afternoon.

The solar farm, which will sit on four acres of farmland, will consist of 1,820 solar panels in 35 rows.

"Looks similar to a row of corn in some sense, that is, lined up in the field perpendicular north-south and faces the east-west in the morning," said Nathan Franzen, manager of Westwood Renewables, an Eden-Prairie based design and engineering consulting firm.

The company will maintain and operate the solar farm and is collaborating with St. John's Abbey and St. John's University on the project.

Mario Monesterio, principal of Westwood Renewables, said the solar panels have a tracking system, so they will follow the orientation of the sun throughout the day to generate maximum solar energy.

Presiding over groundbreaking

"So it follows the sun throughout the day, and at certain times of the day, you can almost imagine all of these solar panels being perpendicular or flat, parallel to the ground," he said. "So that would look like a large table."

The tracking system will increase the power output of the panels by about 15 percent, and produce enough energy for about 65 homes. That's a standard average for a solar facility this size.

The solar farm is designed to keep about 80 percent of the area in which it will sit untouched, with minimal impacts to the existing ground.

Franzen said if the panels didn't move, the facility would require hardly any maintenance.

The solar farm fits St. John's goal of practicing environmental stewardship. Two years ago, then-president Brother Deitrich Reinhart signed the American College and University Presidents' Climate Commitment. That directs St. John's University to work toward becoming carbon neutral; so the solar farm project is a step in that direction.

Brother Aaron Raverty, communications and development coordinator for St. John's Abbey, said Xcel Energy wanted a location in the upper Midwest with an educational environment for this solar farm. Raverty said that educational component is a key part of the project.

"It will be a facility to see if such a solar farm will really work here in an upper Midwest environment," he said, "and whether the students can use this facility as a way of furthering solar technology to see if it can be more effective in this area of the country."

Blessing the land

Raverty said the environmental studies program at St. John's University will likely develop a curriculum that will give students hands-on experience on solar technology, from how it operates to how it affects the environment.

During the summer, the solar facility will generate about 20 percent of the Abbey and university's electrical needs; and overall, it will provide 4 percent annually.

Franzen said most people don't think Minnesota is a good area for solar energy technology, but it actually is.

Solar farm

"The main reason for that is that solar works more efficiently in cooler temperatures," said Franzen. "So if you take this solar system and put it in New Mexico, on the same sunny day, it will actually produce more in Minnesota because of the cooler temperatures than it will on a hot day in New Mexico."

That's because electronics generally work better in cooler temperatures. Franzen and Monesterio said they hope the project will dispel myths about solar energy and prove that it's viable in the state.

A $2 million grant from Xcel Energy's Renewable Development Fund will help pay for the project, so the money will come from Xcel Energy customers. The remaining money will come from tax credits and equity investors, as well as from payments for the energy that's produced by the solar farm.

The solar facility will be fully operational by the beginning of December.

Broadcast Dates

All Things Considered, 10/07/2009, 5:20 p.m.

July 22, 2009

St. John's future solar farm to be largest in Minnesota

By Kirsti Marohn
kmarohn@stcloudtimes.com

COLLEGEVILLE — In a quest to make St. John's University more Earth friendly, university and abbey leaders are turning to the sun.

St. John's soon could become home to the largest solar farm in Minnesota and possibly in the Upper Midwest, providing as much as 20 percent of the campus's electricity on a cloudless day.

St. John's and the Order of St. Benedict are partnering with Westwood Renewables, an Eden Prairie-based company that received a $2 million grant from Xcel Energy for a renewable energy project.

They hope to install about 1,800 solar photovoltaic panels just northwest of the St. John's campus in Avon Township. The panels would produce up to 400 kilowatts an hour or about 575,000 kilowatt hours annually, roughly the same amount of energy that 65 homes consume in a year.

The project is part of St. John's goal to end its contribution to global warming. In 2007, it joined more than 300 colleges and universities nationwide signing a pledge to become "carbon neutral."

"It's a nice step forward," said Brother Benedict Leuthner, treasurer for OSB, which is spearheading the project. "It's surely not going to solve all our energy needs."

When nights and cloudy days are factored in, the solar farm would supply about 4 percent of St. John's electricity needs annually, Leuthner said.

The project's backers hope it will raise awareness of Minnesota's potential to produce electricity from the sun, one of the cleanest sources of renewable energy. The St. John's site would serve as a research and education tool for students and visitors who want to learn more about solar power.

"We wanted to find a partner that would both showcase the capacity of solar in Minnesota and provide an educational setting to do so," said Nathan Franzen, Westwood's general manager.

When people think of solar energy, they generally think of California and Arizona, Leuthner said.

However, Minnesota is at the same latitude as Germany, the world's leading producer of solar electricity. The long spring and fall days make up for the shorter days of winter, and the solar panels actually work more efficiently in cooler temperatures.

"We're a great candidate for it," said Doug Shoemaker, vice chairman of the Minnesota Renewable Energy Society. "We have the same potential here as Houston, Texas, and Jacksonville, Florida."

Fall construction

At 400 kilowatts, the St. John's project would easily surpass the largest solar farm in Minnesota, a 100-kilowatt system in northern Minneapolis.

The St. John's panels would be about 5 feet high and would move to track the sun across the sky, Franzen said. All of the power lines would be buried underground.

The project still needs local government approval. Stearns County agreed to rezone the property and to change its land-use zoning ordinance to allow a solar farm in the ecclesiastical/educational district. Avon Township would need to approve a conditional-use permit, Leuthner said.

If the project is approved, construction would begin in mid-September and would be completed in about six weeks.

St. John's plans to sign a 20-year lease agreement with Westwood for 4 acres for the solar panels and to buy electricity produced by them. Westwood also would agree to share data from the project and host workshops on solar energy.

Students are often enamored of solar because it's an "enticing technology" — renewable, quiet and clean, said Derek Larson, environmental studies professor at St. John's and the College of St. Benedict.

They don't always understand the limitations, including cost and the space needed for the panels, Larson said. The solar farm will provide data so students can do their own research and calculate what it would take to make it viable.

"From an educational standpoint, it's fabulous," he said.

A part of the project's mission will be demonstrating that a large-scale solar farm in Minnesota can succeed technically and economically.

"If we can put this in and make it work, other people will look at the numbers and say, 'OK, we can do this too,' " Larson said.

Changing attitudes

Solar hasn't caught on widely in Minnesota largely because it costs more to produce than other types of renewable energy such as wind.

Electricity in Minnesota comes mainly from coal-fired power plants and is inexpensive compared with other parts of the country, Larson said. In California, customers pay a higher rate for any electricity they consume above a base level. The state also offers incentives for homeowners who install solar panels.

"It becomes really economically smart," Larson said.

New federal tax credits and rebates from the state and utility companies should make solar energy more appealing for Minnesota homeowners, Shoemaker said.

"The cost of the system can be reduced significantly, which makes it a lot easier for people to try," he said.

Solar modules have evolved considerably since the unsightly contraptions of the 1970s. Today's sleeker rooftop panels are hardly noticeable, Larson said. There are even photovoltaic roof shingles available.

"You're not going to see these panels unless you're right there," he said. "It's not an intrusion like a wind turbine might be."

Additional Facts

About the panels

Photovoltaic solar modules consist of thin wafers made of silicon or other conductive material. When sunlight hits the wafers, a chemical reaction occurs, resulting in the release of electricity. Solar resources are available everywhere, although some areas receive less sunlight than others. The greatest solar resources are located in the Southwest, where sufficient solar energy falls on an area of 100 miles by 100 miles to provide all of the nation's electricity requirements.
— U.S. Environmental Protection Agency.

Wednesday, July 22, 2009 at 2:53:57 PM - by Danny Vo

Minnesota college eyes solar energy investment

A Minnesota college may soon become home to the state's largest solar energy array, according to a recent report.

The St. Cloud Times reports that St. Johns's College and the Order of St. Benedict will be working with Westwood Renewables to establish an 1,800-panel photovoltaic array that would generate up to 20 percent of the energy needs on campus on sunny days.

The newspaper adds that the array would produce about 575,000 kilowatt hours per year, sufficient to power about 65 homes, and that when factoring in nighttime hours and other conditions, the panels will meet about 4 percent of the total campus energy needs.

The Times also noted that Minnesota is at the same latitude as Germany, which is among the world's leaders in solar energy production.

In general, the solar industry stands to benefit from more high-profile projects in states that are commonly associated with cold weather because these will help demonstrate that photovoltaic technology can work well outside of sunny areas like California and the Southwest.

http://solar.coolerplanet.com/

Project Partners:

Saint John's Abbey

Saint John's University

Westwood Renewables

Mortenson construction

Westwood

Siliken renewable energy

Advanced Energy

Array Technologies

Hunt Electric Corporation

Veit Specialty Contracting & Waste Management

Project Owned and Operated By:

Best Power Int'l, LLC

Saint John's Solar Farm

Welcome to the Saint John's Solar Farm. This solar power plant was designed and constructed by Westwood Renewables, LLC and hosted by Saint John's Abbey and University. Project funding provided, in part, by customers of Xcel Energy through a grant from the Renewable Development Fund.

System Facts:

The solar farm uses 1,820 solar photovoltaic (PV) modules. Each module has 220 watts of peak power production, for a total of 400,400 watts of power. It is the first large scale PV system in the Midwest to utilize a tracking mechanism. The tracker increases the net annual efficiency of the system by 15% by capturing more sunlight in the morning and evening hours. The major components of the solar farm are made in America.

Power Production:

Approximately 575,000 kWh of electricity are produced at the solar farm each year. The electricity produced by this facility offsets about 4% of Saint John's annual electricity usage and up to 20% of its summer peak power demand. The renewable energy from the solar farm flows through the Saint John's system and onto the electrical grid, helping to meet Minnesota's renewable portfolio standard of 25% by 2025.

The solar farm will produce all the electricity to:

- Power 65 average homes for a year
- Power 2,983 22W compact fluorescent light bulbs for a year

The Environment:

The solar farm will offset 372 metric tons of carbon dioxide emissions each year. This equals the annual greenhouse gas emissions from:

- 163 metric tons of coal
- 61 passenger vehicles
- 38,300 gallons of gasoline

Midwest Solar Footprint

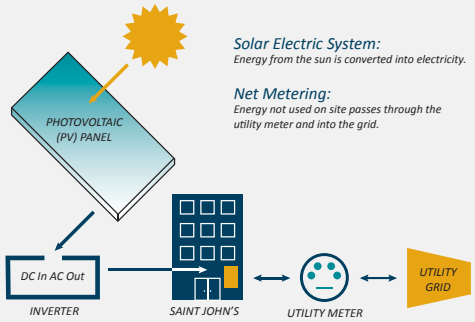
The Midwest solar resource is abundant. Minnesota has more sun hour days than Houston, Texas, and several areas of Florida. In fact, PV modules operate more efficiently in cooler weather, making Minnesota's long summer days and temperate seasons ideal for solar production.

kWh/kW/year around the world

BERLIN, GERMANY	785
ANCHORAGE, AK	827
PARIS, FRANCE	849
NEW YORK CITY, NY	1231
HOUSTON, TX	1269
MADRID, SPAIN	1336
MINNEAPOLIS, MN	1337
SAN FRANCISCO, CA	1503
PHOENIX, AZ	1681

Source: NREL

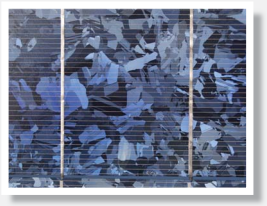
How PV Works:



Solar Electric System:
Energy from the sun is converted into electricity.

Net Metering:
Energy not used on site passes through the utility meter and into the grid.

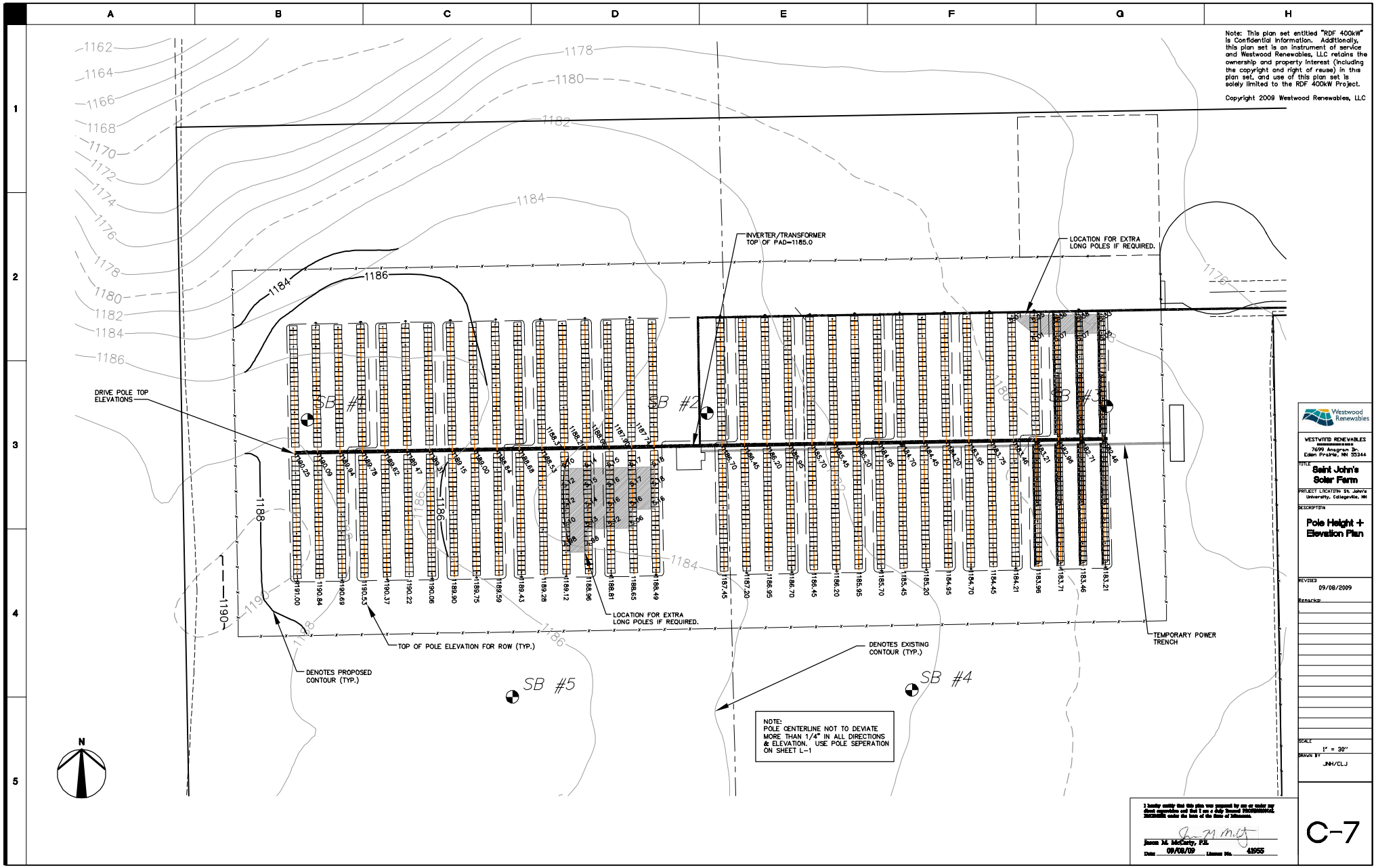
Photovoltaic (PV) solar modules collect the sun's energy, in the form of photons, and convert it to electricity. The word itself describes the process: "photo" meaning light, and "voltaic" meaning electricity.



PV modules are made of thin silicon wafers called "cells". The cells actually contain two layers of silicon pressed together: positive-type silicon and negative-type silicon. An electrical field (voltage) is produced from the opposite charges at the junction between the two layers. When light hits the cell, the electrons get excited and move in a current across the junction. This current (amperage), combined with the electrical field voltage, is electricity.

The electricity is fed into an inverter, where it is converted from direct current (DC) to alternating current (AC) electricity. The converted AC power can then be used by homes and businesses to run appliances, lights, computers, and any electrical load.

For more information, please contact Westwood Renewables
952-697-5700
www.westwoodrenewables.com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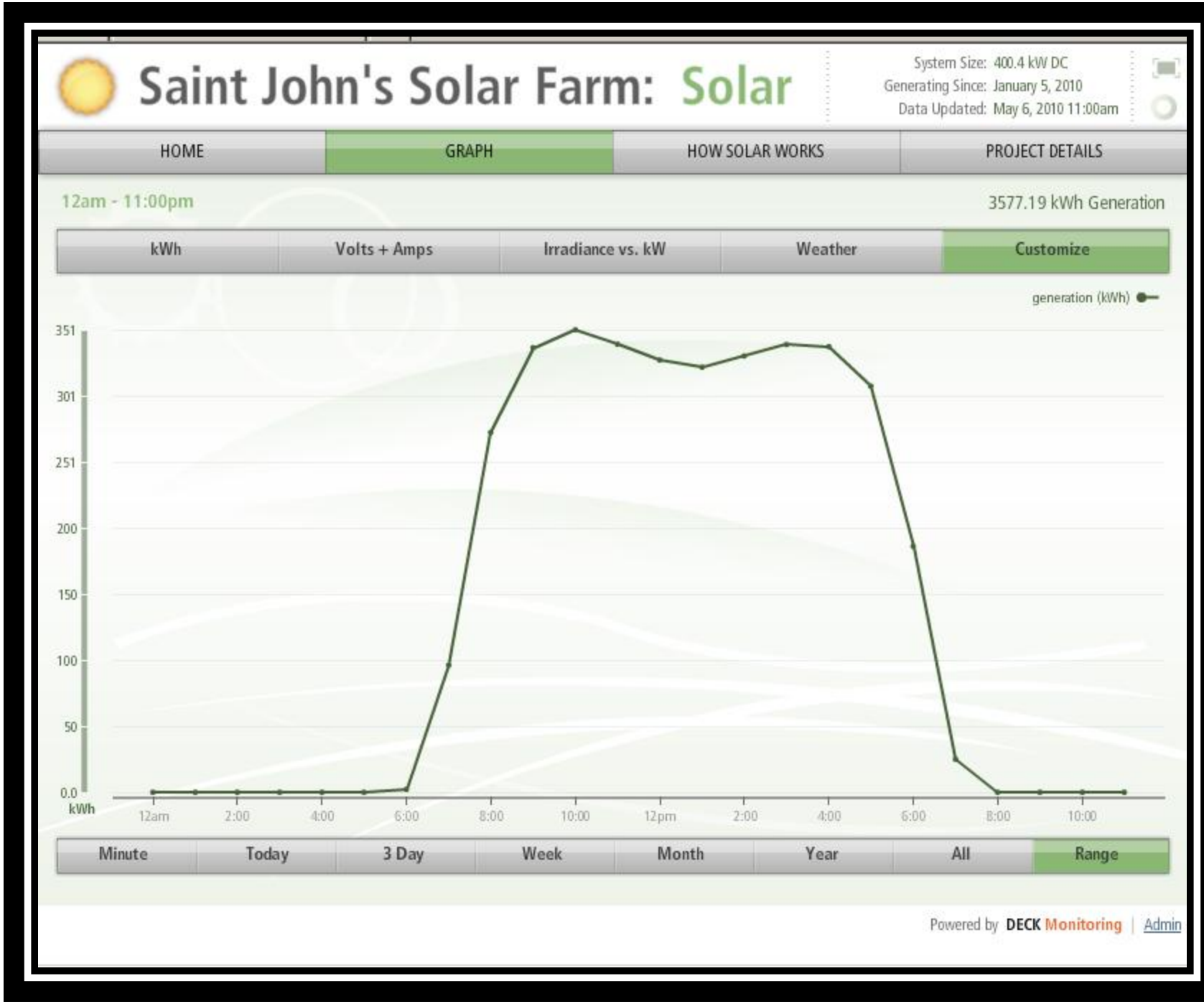
INVERTER/TRANSFORMER TOP OF PAD=1185.0
LOCATION FOR EXTRA LONG POLES IF REQUIRED.
DRIVE POLE TOP ELEVATIONS
SB #1
SB #2
SB #3
SB #4
SB #5
LOCATION FOR EXTRA LONG POLES IF REQUIRED.
TEMPORARY POWER TRENCH
TOP OF POLE ELEVATION FOR ROW (TYP.)
DENOTES PROPOSED CONTOUR (TYP.)
DENOTES EXISTING CONTOUR (TYP.)
NOTE:
POLE CENTERLINE NOT TO DEVIATE MORE THAN 1/4" IN ALL DIRECTIONS & ELEVATION. USE POLE SEPERATION ON SHEET L-1
N
Westwood Renewables
WESTWIND RENEWABLES
7699 Anagram Dr.
Eden Prairie, MN 55344
TITLE
Saint John's Solar Farm
PROJECT LOCATION St. John's University, Collegeville, MN
DESCRIPTION
Pole Height + Elevation Plan
REVISED
09/08/2009
Remarks:
SCALE
1" = 30'
DRAWN BY
JNH/CLJ
Jason M. McCarty, P.E.
Date: 09/08/09 License No. 41955
C-7
20091015AYF03.dwg


Saint John's Solar Farm: Solar
System Size: 400.4 kW DC
Generating Since: January 5, 2010
Data Updated: May 6, 2010 11:00am
HOME
GRAPH
HOW SOLAR WORKS
PROJECT DETAILS
12am - 11:00pm
3577.19 kWh Generation
kWh
Volts + Amps
Irradiance vs. kW
Weather
Customize
generation (kWh)
351
301
251
200
150
100
50
0.0
kWh
12am
2:00
4:00
6:00
8:00
10:00
12pm
2:00
4:00
6:00
8:00
10:00
Minute
Today
3 Day
Week
Month
Year
All
Range
Powered by DECK Monitoring | Admin