

# SCHOOL SISTERS OF NOTRE DAME SOLAR PARK

RDF BOARD PRESENTATION OCTOBER, 2015  
EP4-5 RDF GRANT CONTRACT

*Partial project funding by customers of Xcel Energy through a grant from the Renewable Development Fund.*



# PROJECT SCOPE

The School Sisters of Notre Dame Solar Park is a 850kWDC PV ground mounted static solar array in Mankato, MN and was commissioned on September 30<sup>th</sup>, 2015. It demonstrated the use of higher voltage technology and how it lowers the cost of PV solar projects. It also shows the effects of aligning the array West of South.

**At the time of commissioning, it was:**

- the 3<sup>rd</sup> largest solar project in the State of Minnesota
- the 2<sup>nd</sup> largest ground mounted solar facility in the State of Minnesota
- the largest solar project in Mankato
- The largest 1,000 volt project in the State of Minnesota



# PROJECT OBJECTIVES

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- Demonstrate reductions in system costs by shifting from a 600 VDC platform to a 1,000 VDC platform;
- By shifting the array 10-degrees West of South, experience increased energy production during higher value time periods (between 1:00 pm to 7:00 pm);
- Provide a process for local electrical inspectors to understand the 1,000 VDC system requirements for future solar projects;
- Increase the penetration of solar energy in the Mankato area;
- Provide an increased knowledge of solar in the Mankato area.



# WHAT WE DID

- We demonstrated that the project's installed cost is less when using a 1,000 Vdc platform compared to a 600 Vdc platform.
- By building this facility just prior to the ramping up of solar energy in Minnesota with Community solar, we provided timing critical benefits and learned from experiences to better help Xcel Energy and solar developers roll out new projects and bring down the cost of solar energy into the future.
- Increased the knowledge of solar energy in the Mankato area by making two presentations about the solar project to the Region Nine Renewable Energy task force in Mankato as well as an on-site "thank you" event.
- We worked hand in hand with state inspectors to increase the knowledge of 1000 Volt design and installation of solar facilities.
- We show the effects of rotating the solar system to the West by 10-degrees



# WHAT WE FOUND

- By increasing the voltage design from the standard 600 Volts to 1000 Volts we lowered the cost of this project by 1.8% or \$32,000.
- Possible savings are as high as 4%

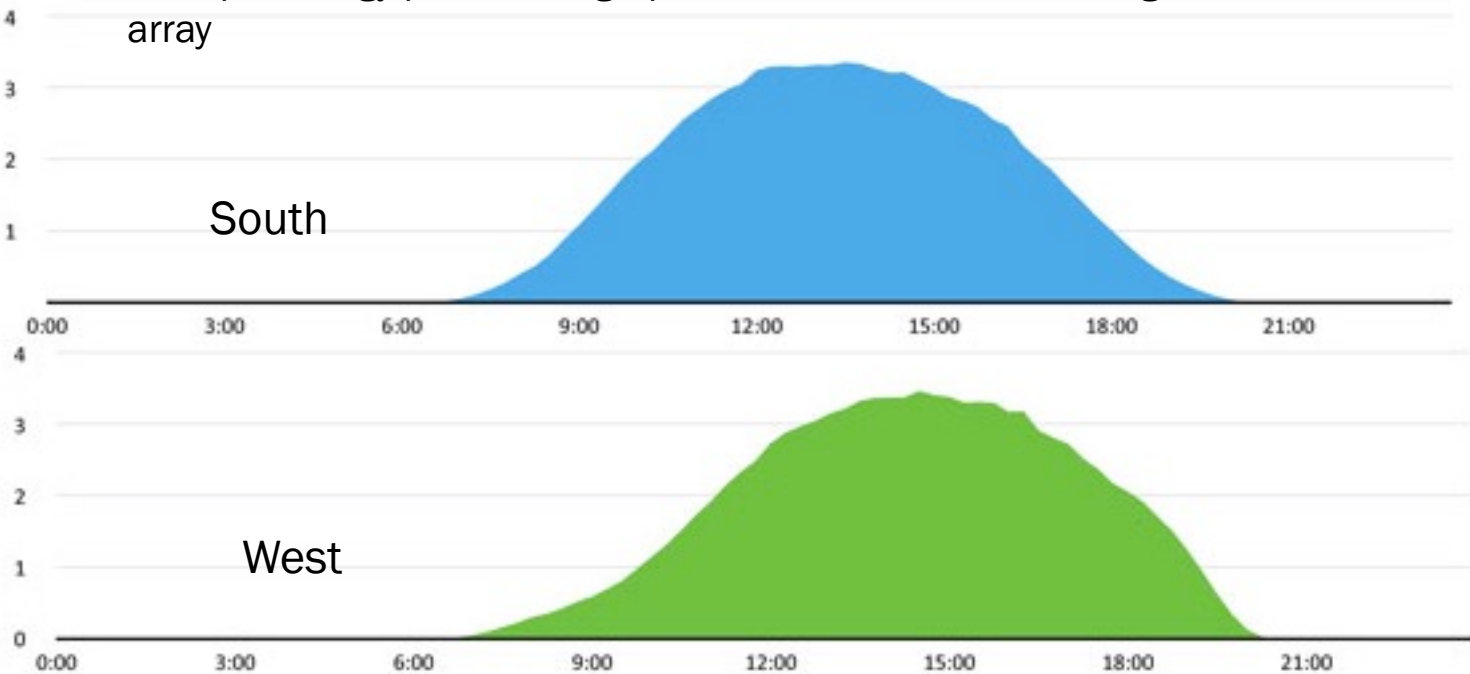
Table 1 – Cost Comparison

Item	600 V	1,000 V	Difference	Value
Modules per string	11	16	7 (31%)	N/A
Watts per string (305 W Panels)	3,355	4,880	1,525 (31%)	N/A
Parallel connections	253	174	-79 strings (31%)	N/A
Combiner box	32	29	-3 (9%)	\$1,200
24kW Inverter	32	29	-3 (9%)	\$12,705
AC Shutoff	32	29	-3 (9%)	\$990
Conduit/AC Wiring, Etc.	NA	NA	NA	\$10,000
12/10 AWG DC wire (panel to combiner)	37,670 ft.	21,710 ft.	- 15960 (42%)	\$3,990
Est. labor (Hours)	80	0	-80	\$6,000
Fencing	\$9,000	\$12,000	\$3,000 (25%)	-\$3,000
<b>Total</b>				<b>\$31,885</b>
			1.8% of Total Cost	<b>\$0.038/Watt</b>

# WHAT WE FOUND - CONT.

According to PVWatts models, by shifting the array 10 degrees to the West we moved the peak power 40 minutes later in the day providing approximately 4% more energy during peak use times while reducing the total annual energy production by just 0.4%.

Example energy production graph on a south and West facing array




# PROJECT BENEFITS

## Immediate benefits realized at completion of the project

- Taxable Income will be generated based on fees paid to contractors and suppliers in the amount of approximately \$1,600,000.
- This project provided one of the lowest grant dollars per kilowatt of PV solar installed compared to other PV projects awarded during this RDF cycle.
- Local construction jobs were created. Approximately 12-full-time people worked on the project site for 8 weeks. Approximately 6-full-time people worked on the project site for an overlapping 8 weeks.
- The purchase of over \$800,000 (50%) of materials and services to install the facility were obtained from Minnesota suppliers and contractors providing economic stimulus to the Minnesota economy.
- Lessons learned by the Developer, Xcel Energy, Contractors, and the agencies involved can be utilized to lower the cost of solar energy in the future. The project has provided local electrical inspectors experience with electrical code issues on solar projects and specifically working with a 1,000 Vdc platform.

# PROJECT BENEFITS - CONTINUED

## Immediate benefits realized at completion of the project

- Press coverage in print, radio, and television helps to educate people in the Mankato area about solar energy.
  - Two local presentations to the District 9 Renewable Energy Task Force and a project “thank you” event have brought increased knowledge about solar energy to the local Mankato area.
  - The practical knowledge relating to solar development and construction obtained through this demonstration project has allowed the project team to expand their service offerings and their ability to deliver similar solar projects in Minnesota. By adding this knowledge, better decisions about design and construction of future facilities will lower the cost of future solar projects.
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# PROJECT BENEFITS - CONTINUED

## Benefits realized over time

- Taxable income of approximately \$2,170,000 will be generated based on the grant amount and electricity generated during the first 15 years.
- During the 15 years of production, the facility will produce approximately 15,470 MWh's of renewable energy, all of which will count towards Xcel Energy's RPS.
- The facility produces more energy during afternoon periods due to shifting the array. Electrical energy is more valuable later in the day so it will provide long-term value to ratepayers.
- The facility will be available for educational opportunities that will be administered by The School Sisters of Notre Dame. This will increase the knowledge of solar energy in the region.



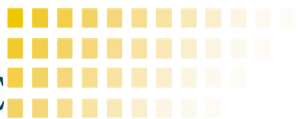
# ENVIRONMENTAL BENEFITS

The project will produce the following annual environmental benefits during its first year while producing 1,182 MWh of energy:

- The equivalent of 1,245,828 pounds of carbon dioxide (CO<sub>2</sub>) not released
  - The equivalent of 1,891 pounds of sulfur dioxide (SO<sub>x</sub>) not released
  - The equivalent of 1,537 pounds of Nitrogen oxides (NO<sub>x</sub>) not released
  - The equivalent of 0.019 pounds of Mercury not released
  - Approximately 874,456 pounds of coal not used
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- Enough energy to drive a Tesla 4,137,000 miles! Or power 275 Electric Cars

Source: Xcel Energy 2014 Corporate Responsibility Report upper Midwest Xcel owned facility comparison





# QUESTIONS