



A 34 KW system, the largest in Minnesota and the surrounding five states, was installed at the Green Institute, a Minneapolis nonprofit.



Randy and Kris Olson show off their 1 KW solar-electric shingle system in Elk River, Minnesota.

Courtesy Kris Olson

A Tale of Two States

Small Solar Rebates—Steady Success

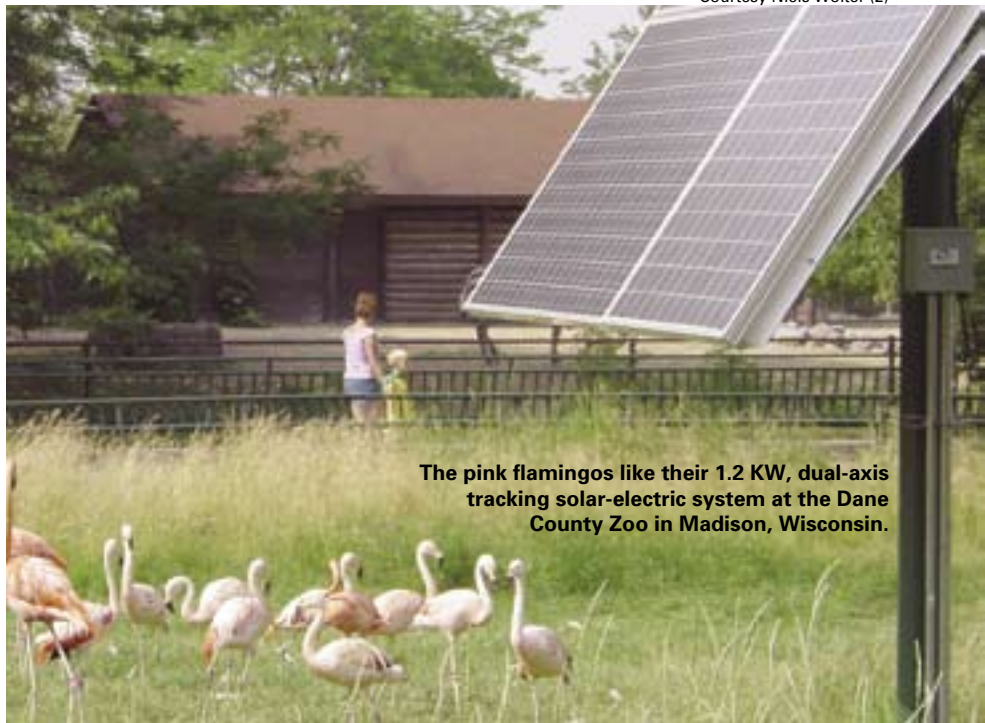
With as good or even better solar resources than parts of Florida or Texas, Minnesota and Wisconsin have become movers and shakers in the Midwest's solar-electricity markets. In this region known for its pragmatic attitudes and reliance on tradition, there is a decidedly progressive movement toward residential renewable energy.

Mike Taylor, Minnesota Department of Commerce & Niels Wolter, MSB Energy Associates Inc.

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Courtesy Niels Wolter (2)

Madison Christian Community Church in Madison, Wisconsin, invested in a 2.7 KW system co-funded by Focus on Energy.



The pink flamingos like their 1.2 KW, dual-axis tracking solar-electric system at the Dane County Zoo in Madison, Wisconsin.



The 3.06 KW solar-electric system on their Minneapolis, Minnesota, home makes this modern *American Gothic* couple much happier than the ones in Grant Wood's painting.

In fact, both states have more solar-electric capacity per capita than either Florida or Texas. In the past three years, the amount of grid-connected solar electricity in Minnesota has more than doubled—from 186 kilowatts (KW) to 421 KW—largely because of Minnesota's PV (photovoltaic; solar-electric) rebate program. Similarly, Wisconsin's PV rebate program has co-funded about 200 KW of PV installations, increasing the state's PV-produced electricity capacity to about 460 KW. And this is despite small budgets and smaller-than-average incentives—typically a 20 percent to 25 percent rebate.

Program Particulars

The Minnesota Solar Electric Rebate program pays US\$2,000 per installed KW (the sum total of the DC ratings of the solar-electric panels in the system) for systems ranging in size from 0.5 to 10 KW of grid-connected solar electricity. Larger systems are eligible for the rebate on a case-by-case basis. Only new equipment qualifies, and a site assessment, performed by the applicant or their solar-electric dealer, is required.

To qualify for Minnesota's rebate, a site needs to meet an estimated annual production of 960 kilowatt-hours

Gordon Carlson of Duluth, Minnesota, received the standard state rebate of US\$5,340 for his 2.67 KW PV system, and an additional US\$4,000 from his electric utility, Minnesota Power.



Courtesy Helen Carlson

(AC energy) per KW installed. (For comparison's sake, an unshaded, nontracking, 1 KW system in Minneapolis produces an estimated 1,100 KWH per year.) Typically, the solar-electric installer submits a Solar Pathfinder diagram, photographs, and a copy of the rebate program spreadsheet used to calculate the system's estimated performance. Applicants not using solar dealers can opt to provide just photographs with their applications. However, if site shading is evident in the photos, the rebate program requires a Solar Pathfinder diagram and spreadsheet assessment.

The Wisconsin program uses the U.S. Department of Energy's PVWatts calculator, along with information (panel capacity, orientation, shading, and percent snow cover) supplied by the prospective system owner to estimate the system's anticipated production. The PVWatts production estimate is reduced by 20 percent to account

for system losses (inverter and wire losses, and panel temperature correction).

Both programs allow homeowners to install their own systems, provided they meet applicable local building codes and pass the electric utility's anti-islanding test (which determines that the system can be successfully shut down in the event of a grid failure). However, Wisconsin incentive amounts are tiered to reflect various parameters, awarding:

- US\$1 per KWH for self-installed systems
- US\$1.50 per KWH for professionally installed systems
- US\$2 per KWH for North American Board of Certified Energy Practitioners (NABCEP) installed systems
- US\$3 per KWH for NABCEP-installed systems on new Wisconsin Energy Star Homes or new commercial buildings

The incentive is a one-time payment based on the yearly electricity production estimate made at the time of application.

Owners of this home in Waukesha, Wisconsin, installed a 4.32 KW solar-electric system.



Courtesy Jon & Janell Wilcox

PV Rebate Program Comparison

Demographics	Minnesota	Wisconsin
Population (2003 census)	5,059,000	5,472,000
Households (2003 census)	1,895,000	2,085,000

Grid-Connected PV

Pre- or non-rebate (KW)	186	260
Rebate program (KW)	235	200
Total KW	421	460

Program Specifics

Participating households (to date)	79	100
Rebate amount per KW (US\$)	\$2,000	\$1,200–\$3,600*
Eligible system types	On-Grid	On- / Off-Grid
Spent to date (US\$)	\$497,000	\$870,000
Total budget (US\$)	\$1,150,000	Annually Renewed
Program end date	Dec. 31, '07	Annually Renewed

*Approx. per KW; actual rebate is US\$1–\$3 per KWH, dependent upon installation variables

Funding

Minnesota's PV program funding comes from Xcel Energy's Renewable Development Fund (RDF), a mandated funding source that was part of a legislative compromise to allow additional nuclear waste storage at the Prairie Island nuclear power plant in Red Wing, Minnesota. (Most of Minnesota's utility-scale wind energy development was also the result of the compromise.) Xcel Energy issued a competitive request for proposals to spend the RDF, and the solar-electric rebate program was one of many chosen for funding. The Minnesota Department of Commerce State Energy Office administers the program, and Xcel Energy funds it through periodic payments to the state.

Focus on Energy administers Wisconsin's rebates. The state's electricity and natural gas utility ratepayers fund the program through a "systems benefit charge," a small fee that appears on their bills. The state collects this fee from the utilities and disperses it through Focus on Energy's energy efficiency and renewable energy projects. As a result of this funding centralization, they are able to provide enhanced coordination of their solar programs, which include training, workshops, and other industry and consumer educational efforts. Since the program's inception, the number of PV installers in Wisconsin has more than doubled. Several installers are NABCEP-certified, and several more are in the process of being certified. The program also supports renewable energy education in primary and

secondary schools with its K–12 Energy Education Program (KEEP) and at Wisconsin's technical colleges. However, the program's centralization has also made it subject to significant funding cuts during recent Wisconsin state budget downturns.

Minnesota's simple dollar-per-KW approach provides for an easily marketed message and low administrative costs, but does not provide funding for training, workshops, or other industry or consumer educational programs. Although Minnesota isn't able to offer a more comprehensive program, its funding is somewhat insulated from potential cuts because of the legal contract that exists between Xcel Energy and the State, making it a more difficult target for budget cuts.

Although Minnesota's rebate program lacks the breadth of Wisconsin's, it has sparked many

unanticipated changes in the state. Minnesota Power, a northeastern Minnesota utility, now offers a companion rebate program for their customers, and another cooperative utility, Great River Energy, is developing one for its members. Community solar-electric projects are emerging on schools, nonprofits, and businesses, where local citizens actually help plan and fundraise for PV systems in their neighborhoods. Three solar home tours take place in various parts of the state. Solar Saver Homes, a building developer, constructed and sold eight energy efficient town homes that have integrated solar-electric shingles. A Million Solar Roofs Initiative was started in Minnesota, and

The Dodge Nature Center in West St. Paul, Minnesota, features a 1.0 KW system on a single-axis tracker.





Courtesy Anderson family

Tom Anderson from Cloquet, Minnesota, stands in front of his 2.53 KW solar-electric system on a sunny winter day.

various organizations are slowly awakening to solar energy opportunities in the state.

Incentive Levels

Both Wisconsin and Minnesota's programs are limited to relatively small budgets. This translates into either a small number of systems that receive larger incentives or more systems with less funding for each. By starting small, both states independently concluded that the market would grow in a more moderate fashion and attract the passionate installer and system owner. Interestingly, if Minnesota had offered a US\$4,000 per KW rebate, the funding would have been used by the end of 2005. As a result, fewer individual photovoltaic projects would have ultimately been installed, and no additional funding to continue the program would be available now.

Getting Tied In

Connecting PV systems to the grid in Minnesota is a mixed bag that is improving. Net metering, which allows system owners to offset their electrical usage with their electrical production, has been available since 1984, but the rules have not been revised in many years. While strong in spirit, the interface with recently adopted distributed generation interconnection standards is not clear and in some cases conflicting.

However, Minnesota Power, which was the first to offer a companion rebate program, has stepped up its leadership on training solar dealers, code officials, and its internal engineers to streamline interconnection in their service territory. Other utilities may follow this model of cooperation. In addition, system owners continue to press interconnection issues with their local utilities. And those who have made it through the interconnection grind are making it easier for those who follow.

In Wisconsin, utility-tied systems are no longer an issue. A collaboration of interested parties (electric utilities, renewable energy groups, regulators, and the public) developed uniform, statewide technical standards, forms, and processes for interconnection, and presented them to the Public Service Commission of Wisconsin and the Legislature in 2002. Today, these standards are law.

Wisconsin's Renewable Energy Program helped the state develop a simple, uniform interconnection application and requirements. And We Energies, the largest regional utility in Wisconsin, recently agreed to buy solar-electric generated energy at a rate much higher than the retail rate, for use in their green pricing program.

Program Results

The response to both programs has been very similar over roughly the same time period—about 200 KW of new capacity has been installed in each state. Together, this represents more than US\$3 million in solar investments.

Initially, both states were challenged with few PV installers and needed to grow their installer base. Today, both states maintain lists of solar energy installers for consumers to reference. There is no licensure requirement to be listed in either state, but there is a designation if an installer is NABCEP certified.

In Minnesota, 89 percent of the funds have gone directly to rebates. The average system size is 2.5 KW, and 78 percent of these systems are installed at residential locations, with an average cost of US\$8,177 per KW for a dealer-installed system. A 34 KW system, the largest in Minnesota and the surrounding five states, was installed at the Green Institute, a Minneapolis nonprofit.

The biggest underestimation of the Minnesota program was that the progress of solar installations was slower than proposed in the funding application. Originally slated as a four-year program, after three years, the solar rebate program is only about halfway toward the goal of 500 KW of installed PV.

Program Statistics

	MN	WI
Avg. system size (KW)	2.5	1.9
Avg. on-grid system cost (US\$/KW)	\$8,177	\$9,230
% Residential	78%	75%
% Dealer installed	80%	68%
Largest system funded (KW STC)	34	12

In Wisconsin, the influx of applications for solar-electric incentives is highly variable. A seasonal cycle exists, with applications peaking in the June–July time frame. Applications also increase whenever funding is threatened, or when incentive levels are poised to decline. Other factors thought to influence application rates include local and world issues and events, and the state’s economy.

Lessons Learned

More than 400 KW of new photovoltaic systems have been added in three years using only about a 25 percent rebate between the two states. This bears witness to the progressive nature of Midwesterners who have committed to PV, despite the common misperceptions of the lack of solar resources in this region.

Although each program’s measure of success is to get more PV installed, the programs are also helping to build grassroots and organizational support for solar energy and the solar industry. These rebate programs are moving the Midwest solar-electric market forward, providing consumers with an incentive to say “yes.” The respective programs also provide the PV industry with a predictable, long-term market. And, as more people become aware of the rebate programs, the goals of a self-sustaining industry will become attainable.

Minnesota’s program is set to expire at the end of 2007; Wisconsin’s is dependent on annual funding availability. The key will be the transition away from the incentives—will the market dry up or will the low incentive levels help the industry in the long run? Time will tell.

Access

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PVWatts Calculator • <http://rredc.nrel.gov/solar/calculators/PVWATTS/> • Performance calculator for grid-connected PV systems

