U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Challenges and Successes on the Path toward a Solar-Powered Community

Solar in Action

Madison, Wisconsin

Includes case studies on:

- Allowing Solar Energy Systems in Historic Districts
- Helping Prospective Solar Owners Make Purchase Decisions
- Developing Online Mapping Tools for Customers and Installers
- Developing Structural Engineering Guidelines to Facilitate Photovoltaics Permitting

SOLAR AMERICA CITIES

Part of the Solar America Communities program

October 2011

The Demetral Landfill is home to one of the first city-owned, pole-mounted PV arrays. *Photo from The City of Madison, NREL/PIX 18357*

Cover photos from iStock/10294146, View of City of Madison.

About the U.S. Department of Energy's Solar America Communities program:

The U.S. Department of Energy (DOE) designated 13 Solar America Cities in 2007 and an additional 12 cities in 2008 to develop comprehensive approaches to urban solar energy use that can serve as a model for cities around the nation. DOE recognized that cities, as centers of population and electricity loads, have an important role to play in accelerating solar energy adoption. As a result of widespread success in the 25 Solar America Cities, DOE expanded the program in 2010 by launching a national outreach effort, the Solar America Communities Outreach Partnership. As the Solar America Cities program evolved to include this new outreach effort, the program was renamed Solar America Communities to reflect DOE's commitment to supporting solar initiatives in all types of local jurisdictions, including cities and counties. Visit Solar America Communities online at www.solaramericacommunities.energy.gov.

Madison's Starting Point

Madison was designated by the U.S. Department of Energy (DOE) on June 20, 2007, as a Solar America City. Madison has been an excellent place to showcase solar energy in Wisconsin, even prior to receiving assistance through the Solar America Cities partnership.

Unanimously adopted by the city council in 2005, the mayor's Energy Task Force report, *Building a Green Capital City: A Blueprint for Madison's Sustainable Design and Energy Future*, adopted the goal of "Making Madison a green capital city, a national leader in energy efficiency and renewable energy that also supports the city's economic vitality."

At the time of the award, Madison had:

- Participated in the Clean Air Coalition, working to lower ozone and particulate matter (PM 2.5) emissions
- Created the Sustainable Design and Energy Committee, a standing city committee to oversee implementation of the Green Capital City Blueprint, which called for Madison to become the nation's leader in energy efficiency and renewable energy
- Partnered with its utility, Madison Gas & Electric, to install visible on-site solar systems
- Installed 100 solar systems producing 16,558 therms for heating water and 8,073 kilowatt-hours (kWh) of electricity annually
- Adopted requirements that each new city building and major retrofit become certified in the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) program
- Planned to meet 20% of city government electricity use with renewable energy by 2010.

In early 2007, a report from Focus on Energy, the state's rebate program administrator, reported that 17% of Wisconsin's solar electric capacity is located in Madison, though only 4% of the state's population lives there, demonstrating that Madison is a leader in solar energy development.

Building Partnerships and Setting Goals

The City of Madison set out to coordinate and galvanize substantial local and state resources with a motivated population to showcase how a U.S. city in the Midwest can dramatically increase the use of solar energy. Under the Solar America Cities grant, the city launched a solar initiative called MadiSUN, which established the following high-level objectives:

1. For individuals, businesses, and city staff to be made aware of solar energy options

2. For solar to be considered a "normal" energy system when evaluating options

3. For solar projects to be made easy to implement

4. For residents and businesses to embrace solar energy because it saves money, is a locally available resource, creates jobs, and improves the quality of city life

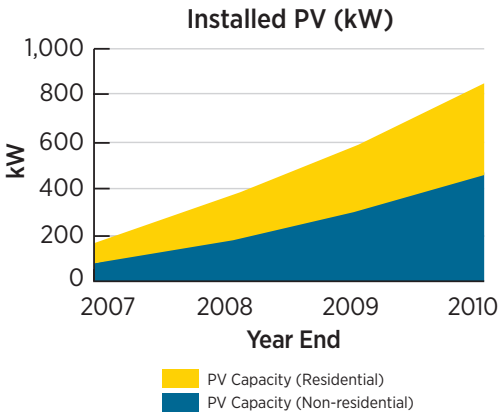
5. To double solar utilization in the city within 2 years to 250 kW of photovoltaics (PV) and install 200 solar hot water systems by 2010.

The MadiSUN solar team partnered with the following organizations:

- Focus on Energy
- University of Wisconsin-Extension
- Madison Gas & Electric Co.
- Madison Area Technical College
- Sustain Dane, a Dane County nonprofit organization promoting community sustainability
- Environmental Action Team (EnAct), an action-oriented book club to help people live a greener life and build community
- Midwest Renewable Energy Association (MREA).

Installed Capacity

Madison



Installed PV capacity increase from December 31, 2007, to December 31, 2010

Madison promotes solar in the community through highly visible installations on city-owned buildings such as this branch of the Madison City Library. *Photo from The City of Madison, NREL/PIX 18354*

One of the first city-owned PV tracking systems is on the East Police Parking Lot. Tracking systems are built to move throughout the day to follow the sun's path, increasing electricity production. *Photo from The City of Madison, NREL/PIX 18355*

Accomplishments and Highlights

Building on local experience with previous solar installations and the city's commitment to enhance the sustainability of its operations and facilities (using a framework called The Natural Step), MadiSUN worked with Sandia National Laboratories, the National Renewable Energy Laboratory (NREL), and other organizations to achieve its goals through a variety of activities. These include:

- Strategic planning, marketing, information sharing, and education
- Technical and policy training for city staff and other community solar professionals using both in-state resources and assistance provided by the DOE technical assistance team
- Review and modification of the city's procedures and policies, using The Natural Step framework to ensure that the policies and procedures support solar system installations in the city
- Publicity of MadiSUN through its partner grassroots organizations.

Madison made installing solar easier with improved zoning, a customer assistance program, and online tools.

Madison focused on growing its installed base by making the process of installing solar easier through improved zoning, prospective solar owner agent (PSOA) services, and the development of an online tool to help customers do a pre-assessment of their property for solar. Madison took the following steps as part of this effort:

- Contracted an independent PSOA to assist residents interested in solar installation
- Developed a solar map to help residents evaluate the appropriateness of their own property for roof or pole-mounted solar systems and to see existing solar installations in the city
- By supporting training workshops, added at least one North American Board of Certified Energy Practitioners (NABCEP)-certified solar hot water installer and one NABCEP-certified PV installer to bring the total in the area to four certified PV installers and three certified solar water heating installers
- Teamed up with Madison Area Technical College and University of Wisconsin Solar Lab to operate a solar thermal panel testing facility to Solar Rating and Certification Corporation standards
- Amended its ordinances to clear the way for solar to be installed on historic structures.

Case Studies: Successes and Challenges

Allowing Solar Energy Systems in Historic Districts

Madison formerly prohibited solar installations in some historic districts on the grounds that a "solar apparatus is not compatible with the historic character of the district." In other districts, solar could be denied based solely on aesthetics. These provisions actually were illegal based on state statutes. The city amended the legislation to allow solar installations in historic districts. It also created a permitting process for solar installations in these districts and on landmark properties that allowed for an easy staff-level permit as opposed to a more cumbersome committee approval process.

This solar hot water system at a Madison fire station provides a reliable hot water source for firefighters. *Photo from The City of Madison, NREL/PIX 18353*

Helping Prospective Solar Owners Make Decisions

One of the first and most important steps taken by Madison was to hire a PSOA to provide unbiased coordinating services to interested building owners. The PSOA has simplified the solar energy installation process by being the connection agent to a wide array of technical, financial, and policy information. The PSOA has helped increase solar installations in Madison by:

- Reducing delays or "no go" decisions from prospective system owners who are exasperated by barriers
- Providing the MadiSUN team feedback on what the installation barriers are and how they can be overcome
- Spreading the PSOA model across Wisconsin through the MREA, Focus on Energy Renewable Energy program, and other partners.

Through the Solar America Cities grant, the City of Madison contracted with a MREA-certified consultant to guide Madison's home and business owners through the process of "going solar."

The objective of the PSOA program is to increase the knowledge, understanding, and confidence about purchasing a solar system by offering a free site assessment to Madison residents and businesses. The PSOA consultant works directly for the city, lending credibility to the program and giving the consultant direct access to city departments to work through any procedural or permitting issues.

The PSOA performs remote site surveys using aerial photography and Google Streetview. If the property receives a favorable rating regarding the solar resource, the PSOA discusses general installed-cost figures and arranges on-site assessments.

After an assessment, the PSOA prepares a financial analysis using a third-party template from Focus on Energy, an independent organization that promotes renewable energy and energy efficiency projects in Wisconsin. The PSOA offers an independent analysis of the specific customer site, but does not design the solar system or make

The Larry D. Nelson Engineering Service Building received the first (and smallest) city-owned PV system, at 4.2 kW in size. *Photo from The City of Madison, NREL/PIX 18356*

recommendations about specific installation companies. The PSOA assists residents, nonprofit organizations, and businesses in gathering and understanding quotes from certified contractors.

Developing Online Mapping Tools for Customers and Installers

Anticipating an increasing demand for solar, the city developed a set of online tools to assist its residents in evaluating the fitness of their specific property for solar and the financial implications associated with solar installation. The tools provide an analysis showing the number of hours of sunlight any surface receives each year to help residents determine the best locations for solar. It also helps residents estimate the size of system their roof could accommodate, and the approximate costs, savings, and incentives associated with the system.

This site went live in the last quarter of 2010. The city believes that the availability of an online tool with these features will bring people to consider solar who might not otherwise have considered it. The city also believes that this map will help the PSOA focus its time on residents who are most serious about installing solar by helping them do an individual pre-screening of their own property.

Developing Structural Engineering Guidelines to Facilitate PV Permitting

The City of Madison has a significant portion of its building stock that is older construction. When paired with the potential for significant snow loading, it is especially important to be attentive to the additional stresses a solar installation may place on a structure.

With Sandia National Laboratories leading the technical work, the city and Sandia sought to develop guidance that would help installers identify situations where a structural engineer would be required. Sandia also worked with the city to help standardize the structural evaluation and permitting process for PV systems while simultaneously making the process more streamlined and less expensive.

The project was substantially more complex than expected, encountering a wide variety in the local building stock and some difficulty making the preliminary evaluation process as simple as was desired.

Ultimately, the project has streamlined the permitting process for solar on existing buildings. It also led to a set of training materials targeted at installers presented for the first time in late March 2011.

> Madison developed a simpler structural evaluation and permitting process for solar installations.

Top Takeaways

- By installing solar on city facilities, a city can demonstrate leadership and show its businesses and residents the viability of solar in Wisconsin.
- There are many citizens and businesses that potentially want to invest in solar technology—they just need to be made aware of their specific options and advantages.
    - Citizens need to be aware of the facts about solar and to understand its advantages and options through a network of freely available information. Required information includes:
        - Individual advice on the solar options for a specific property. Madison provided this through a PSOA.
        - Online tools that allows anyone with Internet access to perform a rough assessment of his or her property. People also will be creative and use new technology in more ways than originally intended. These tools not only help prospective solar owners, but also installers and solar assessors.
- Structural considerations currently are not part of many solar installer training courses, which often causes problems in obtaining a permit. The MadiSUN team is developing structural training for solar installers that also will simplify the permit process.

Next Steps

In 2009, the City of Madison applied for and received a DOE Solar America Cities Special Projects grant to focus on innovative programs and policies that can be replicated across the nation. As part of this funding, Madison will focus on the following activities:

- Community-financed solar
- Bulk purchasing of solar installations
- Founding of a solar business center
- Marketing solar to businesses.

Additional Resources

- A clearinghouse for all things solar in Madison, WI: www.cityofmadison.com/Sustainability/City/madiSUN/

View of City of Madison. *Photo from iStock/10294146*

For more city information, contact:
Jeanne Hoffman, Facilities and Sustainability Manager, Engineering Division Email: solar@cityofmadison.com Telephone: 608-266-4091

For more information on going solar in your community, visit *Solar Powering Your Community: A Guide for Local Governments* at http://solaramericacommunities.energy.gov/resources/guide_for_local_governments/

For more information on individual cities' solar activities, visit www.solaramericacommunities.energy.gov/solaramericacities/action_areas/

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Clockwise from top left: *Photovoltaic system in Philadelphia Center City district (photo from Mercury Solar Solutions); rooftop solar electric system at sunset (photo from SunPower, NREL/PIX 15279); Premier Homes development with building-integrated PV roofing, near Sacramento (photo from Premier Homes, NREL/PIX 15610); PV on Calvin L. Rampton Salt Palace Convention Center in Salt Lake City (photo from Utah Clean Energy); PV on the Denver Museum of Nature and Science (photo from Denver Museum of Nature & Science); and solar parking structure system at the Cal Expo in Sacramento, California (photo from Kyocera Solar, NREL/PIX 09435)*

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