

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

Solar in Action



Minneapolis and Saint Paul, Minnesota

Includes case studies on:

- District Energy Saint Paul Solar Thermal Project
- State Policy Stakeholder Workgroup
- Solar-Friendly Zoning
- Solar Permitting Processes Improvements in Minneapolis and Saint Paul



The Minneapolis skyline is the perfect backdrop to the 600-kW solar electric system installation on the Minneapolis Convention Center. *Photo from Meet Minneapolis, NREL/PIX 18700*

Cover photos from iStock/7892720, Central Avenue Bridge, Minneapolis

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.

Minneapolis' and Saint Paul's Starting Point

At the start of their engagement in the Solar America Cities program in 2008, the Twin Cities of Minneapolis and Saint Paul were already well known in the Midwest for their environmental leadership. Both cities are founding members of the Cities for Climate Protection Campaign (run by ICLEI—Local Governments for Sustainability), and have committed themselves to a variety of climate protection agreements and carbon dioxide (CO₂) reduction plans.

The Twin Cities also benefit from the statewide Next Generation Energy Initiative, legislation that enacted what some considered at that time the nation's most aggressive renewable energy standard.

While the cities' records were strong with respect to environmental action, solar had been a nascent technology in the region. When the cities' partnership with the Solar America Cities program began, the entire state had only 1 megawatt (MW) of solar capacity. Some solar-specific accomplishments prior to engaging in the Solar America Cities program included:

- The City of Minneapolis installed solar systems on four city buildings, including a fire station and two public works facilities. The 3rd Police Precinct building used a passive solar heat exchanger to pre-heat air before it enters the building's ventilation system.
- The Science House Experiment Center on the Mississippi River in downtown Saint Paul is a regional attraction. The zero-energy-consumption Science House features a solar-powered classroom and an 8.4 kilowatt (kW) photovoltaic (PV) laminate on standing-seam steel roof, and it includes passive solar design.
- The City of Minneapolis assisted a neighborhood bulk purchase program for solar thermal (solar hot water) in 2006 by waiving permit fees. The 17 residential solar thermal systems installed under the program each save about 120 therms of natural gas annually.
- The cities partnered with Xcel Energy (the local electric utility), the Metropolitan Council, and other stakeholders to create the Energy Innovation Corridor along the proposed Central Corridor light-rail line connecting the two downtowns. The Energy Innovation Corridor will feature building and transportation energy efficiency and renewable energy initiatives to accompany the redevelopment along the rail line.

- The ongoing Xcel Energy Renewable Development Fund committed \$6.2 million to support nearly 3 MW of new solar projects in Minnesota in 2007.
- “Solar Minnesota,” the Minnesota Million Solar Roofs program was formed and received two Million Solar Roof grants to begin to fund specific solar initiatives, including working on local government incentive models and a community solar guidebook.

Building Partnerships and Setting Goals

In proposing the Twin Cities for the Solar America Cities program, program leaders developed the following focused objectives for the cities and identified key partners who could collectively help achieve the program’s objectives:

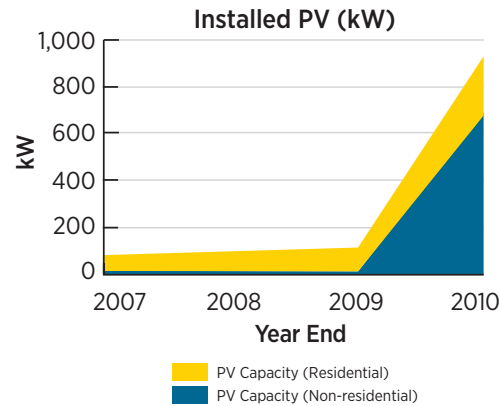
- Build a solar infrastructure leading to a quintupling of market penetration of solar capacity in the Twin Cities by 2010.
- Develop a long-term strategic plan for the sustainable large-scale deployment of solar technologies in the Twin Cities by 2015.
- Demonstrate leadership in renewable energy by expanding the use of solar technologies in public buildings.

Key Twin Cities Solar America Cities partners included:

- Minnesota Office of Energy Security
- Minnesota Renewable Energy Society
- Xcel Energy

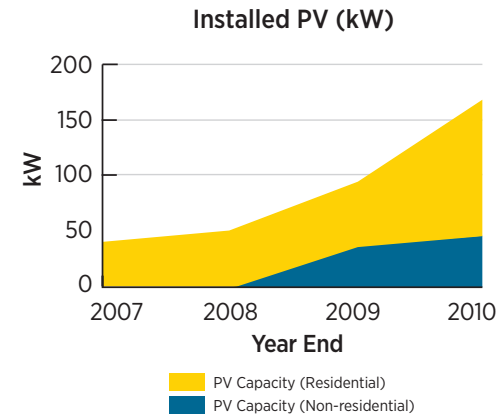
Installed Capacity

Minneapolis



Installed Capacity

Saint Paul



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



Local installers inspect PV panels that are part of the District Energy Saint Paul Solar Thermal project. Photo from District Energy, NREL/PIX 18697



A rooftop solar array system is displayed on a Minneapolis business. *Photo from Meet Minneapolis, NREL/PIX 18698*

- District Energy Saint Paul, (a heating and cooling provider for downtown Saint Paul)
- International Brotherhood of Electrical Workers.

The team identified the following key activities to meet the cities' solar goals:

- Implement change in policies and standards relevant to solar deployment
- Develop financing mechanisms for solar projects
- Elevate public awareness and interest in solar technologies
- Identify ways to integrate solar technologies into city infrastructure
- Provide education and training for solar installers.

Accomplishments and Highlights

- Completed a 600-kW PV installation on the Minneapolis Convention Center, producing 750,000 kW per year and offsetting 539 metric tons of carbon dioxide emissions—as of this writing, this is the largest solar electricity array in the Upper Midwest
- Completed a utility-scale (1-MW equivalent) solar thermal installation by District Energy Saint Paul, the only solar hot water project in the United States integrated with a district energy system
- Convened and facilitated discussions among major solar energy stakeholders to transform state policy and programs

A 600-kW PV installation on the Minneapolis Convention Center is the largest solar array in the Upper Midwest.

to restart the Minnesota Solar Electric Rebate Program and Minnesota Solar Hot Water Rebate Program, create new solar-focused programs, leverage significant private investment in solar energy, and develop a self-sustaining solar industry

- Worked with land use and solar energy advocates to create a solar energy ordinance in Minneapolis, proactively addressing potential conflicts between zoning regulation, solar installations, and solar access
- Completed more than 3 MW of PV installations statewide since involvement in the Solar America Cities program
- Minneapolis recorded a nearly eight-fold increase in solar PV permits issued in 2010 compared with 2007
- Conducted several well-attended trainings for installers and permit officials on electrical, structural, and permitting issues
- Successfully worked with Xcel Energy to launch its Solar Rewards rebate program for PV systems under 40 kW in capacity

- Completed a pilot solar leasing initiative with funding from the Renewable Development Fund (a Minnesota public benefits fund) that resulted in 25 residential and commercial installations totaling 280 kW
- Developed a Solar Ready building guideline and model construction specification tailored to Saint Paul and Minneapolis construction.

Case Studies: Successes and Challenges

District Energy Saint Paul Solar Thermal Project

The Twin Cities Solar America Cities team worked with District Energy Saint Paul to acquire a \$1 million Solar America Cities Special Projects grant. The grant leveraged more than \$1.2 million in matching funds from District Energy Saint Paul to create a unique solar thermal installation (1.2-MW equivalent, the largest in the Midwest) on the Saint Paul RiverCentre in downtown Saint Paul. District Energy Saint Paul owns and operates the system and uses the energy produced for domestic hot water and space heating within the RiverCentre. When excess energy is

produced, it is contributed to the district heating system and benefits nearby buildings, reducing the non-renewable energy demand for space and water heating in surrounding buildings. The primary district system is already more than 50% renewable, served by a biomass-fueled combined heat and power plant.

Challenges. The project faced challenges being the first large-scale solar thermal installation for a commercial/industrial application. The non-profit utility had not adopted large-scale solar because of the intense capital and small customer base that would be tapped to recoup the investment through utility rates. From a technical perspective, most domestically manufactured collectors were not equipped with the temperature range, efficiency, and overall performance needed for an industrial application; additional time was needed to find a qualified vendor. The project also was slowed by structural challenges to retrofit the building for such a major installation on a tight project schedule.

Good Practices Developed. The District Energy Saint Paul installation demonstrates the viability of both a large-scale application of solar technology and innovative financial tools, which helped lower the payback term and overall project economics. It also demonstrates the opportunity to integrate solar thermal systems as either supply-side inputs to the district energy system or as demand-side investment for district energy customers or buildings. The integration can serve multiple goals, including fuel supply diversity, reducing carbon footprints, and positioning the district energy system to capture future solar investment opportunities.

An important market transformation message is that buildings with common ownership and the ability to link energy systems could use this innovative application of solar thermal energy. These may include hospitals, industrial parks, and business and academic campuses—the system need not be limited to areas that have extensive existing district energy networks.

State Policy Stakeholder Workgroup

To expand the use of solar technologies statewide, the Twin Cities Solar America Cities team convened a state policy workgroup comprising industry, utility, business, policy, and regulatory stakeholders. Key public, private, and nonprofit stakeholders were invited to participate, including those stakeholders who might be vocal in opposing a solar agenda at the legislature. The stated goal was clear: to identify a state-level policy agenda that would promote the adoption of solar statewide. The workgroup's task was to determine what policy tools to use to accomplish this goal.



Residential areas also are adopting solar power. Here, a rooftop installation is displayed on a home. *Photo from Applied Energy Innovations, NREL/PIX 18699*

The group held strategic planning meetings over several months leading up to the state legislative session and established a set of principles to guide the process. Decision makers were at the table during these strategic planning meetings.

The single most important outcome of this successful effort was creation of a new framework for ongoing programmatic support by the utilities and state agencies. The Twin Cities Solar America Cities team coordinated ongoing stakeholder discussions that included the state's largest electric utility, environmental and energy efficiency organizations, and solar advocacy groups to create an agreed-upon solar policy legislative agenda that was adopted by the workgroup. This forum allowed all stakeholders to inform policy affecting solar adoption, embrace the final outcome, and provide critical support at the legislature to get the solar agenda passed.

Partnering with the local utilities on this broader policy effort laid the groundwork for District Energy Saint Paul's partnership on the Solar America Cities special project grant opportunity, resulting in the largest solar thermal system in the Upper Midwest. The utility provided significant private capital as a match. Similarly, Xcel Energy expanded support for solar technology adoption in its Energy Innovation Corridor—a high-visibility light-rail corridor connecting Minneapolis and Saint Paul.

Challenges. While all stakeholders had an interest in promoting solar, building consensus on how to do so took time and compromise. Also, timing was critical to promote a unified solar development strategy in time for the legislative session.

Solar-Friendly Zoning

Minneapolis and Saint Paul engaged in dialogue with installers, manufacturers, and land use planners on how development regulations should be changed to allow solar investment while protecting community character and property values. The Twin Cities Solar America Cities program worked with other cities across the nation to assess options for zoning and development code modifications regarding solar energy. Minneapolis and Saint Paul already recognized solar energy systems as allowed accessory uses (a secondary activity incidental to the primary use of the property) in all zoning districts. The cities now have developed new regulations that distinguish solar energy from other accessory uses and clarify where accessory use regulation is inappropriate or needs additional consideration. The Minneapolis ordinance gives explicit consideration to solar access for existing solar systems when considering rezoning or conditional use applications on adjacent properties. It also creates a “solar carveout” within lot coverage standards for pole- or ground-mounted systems, and exempts building-integrated solar systems from accessory use or solar system standards.

Challenges. As solar energy systems have become more common, local development regulations sometimes present substantial barriers to retrofitting existing buildings. For instance, solar systems are not defined in zoning ordinance and are frequently considered to be “accessory uses” or “rooftop equipment” and therefore subject to screening requirements—which can render a solar system useless. In some cities, because solar systems are not specifically named in the ordinance, zoning staff assumes that solar systems are not allowed. Moreover, homeowners and businesses installing solar systems are concerned about how the long-term viability of their investments could be affected by new buildings or changes in land use on adjacent properties that could reduce their solar access.

Lessons Learned. The nature of zoning is that solar installations are subject to its provisions even though solar energy systems are not mentioned in the regulation. Incorporating explicit provisions for solar installations avoids varying interpretations and recognizes the difference between

solar accessory uses and other accessory uses (such as garages, sheds, rooftop equipment, etc.). But adding solar to a zoning ordinance gives the impression of a new regulation, particularly when done proactively rather than after installations have been denied a permit. Minneapolis and Saint Paul needed to repeatedly engage solar installers and advocates and provide multiple scenarios to demonstrate that the solar zoning was actually clarifying regulation and enabling better protection of homeowners’ interest in solar energy.

Solar Permitting Processes Improvements in Minneapolis and Saint Paul

Saint Paul and Minneapolis collaborated with local and state building officials, solar installers, and national organizations to create a solar permitting guidance document for use in both cities to ensure consistent permitting requirements for solar electric systems. Solar installers have a clear set of requirements to demonstrate compliance with building and electric codes and can obtain a permit with a single visit for qualifying systems. The guidance document allows for residential solar installations meeting certain performance and design standards to avoid having a structural study or engineer stamp. The document also sets a clear path for systems that require a structural study so that a permit can still be acquired in one visit. Upon further review by the Minneapolis Regulatory Services Department, small solar PV permit fees were reduced by hundreds of dollars based on a revised valuation calculation that excludes the cost of solar equipment.

Challenges. Getting all parties to the point that they were comfortable with the guidelines took many meetings and many iterations of a relatively brief document. The perceived risks associated with the concept of “streamlining” regulation slowed the process. Coordinating between the two cities posed several challenges because each city had its own distinct approval processes and permitting authority.

Good Practices Developed. Taking the time to let stakeholders arrive at their own conclusions about the validity of the model permitting process made for smooth adoption of the guidelines. The permit process in Minneapolis and Saint Paul is now a straightforward process for most solar PV

The Twin Cities worked with other cities across the nation to assess options for solar zoning development code modifications.

projects. The Twin Cities also have added a pro-solar marketing campaign to the permit process. An installer following the permitting guidelines can walk into the permit office in either city with documentation and leave an hour later with the building permit, in addition to a “Solar Works! in Minnesota” yard sign and window cling.

Top Takeaways

- Market transformation efforts may take much longer than anticipated—especially if the industry is still nascent. Building capacity in an industry takes time.
- Building relationships across stakeholder groups is a slow process but critical to moving forward on any initiative. Efforts to change policies or processes require the allocation of resources to engage stakeholders.
- To be effective and sustainable, market transformation requires action at state and local levels.
- Installing solar in the winter is not impossible, but it may pose some challenges depending on conditions.

Next Steps

- As of early 2011, Minneapolis and Saint Paul were in the process of bidding and installing an additional \$3 million of solar projects in the Energy Innovation Corridor. The projects are funded primarily through state legislation that emerged from the state policy workgroup in 2009. Installations range from small systems less than 10 kW to installations exceeding 100 kW, and will all be located within the light-rail corridor on public buildings.
- Minneapolis and Saint Paul continue to refine zoning ordinances, taking Minneapolis’s language to Saint Paul for adaptation into that city’s code. The Twin Cities will also

consider additional elements, including addressing solar in historic districts, understanding how to adapt zoning incentives to apply them to solar, and considering “solar-ready” construction requirements.

- Both cities are preparing to enhance the recently adopted permitting guidelines with structural recommendations for solar thermal systems. Thermal systems are heavier, more likely to be non-flush-mounted to an existing roof, and consequently more likely to bear additional costs associated with structural engineering and roof modifications.
- Minnesota has a dearth of large-scale solar installations. Solar stakeholders are working to change state policy and regulatory standards that are barriers to large-scale installations. Most stakeholders recognize that changes are needed in the state’s nearly 30-year-old net metering policies, and possibly other elements of the interconnection process for large solar projects. The discussion that started with the Twin Cities Solar America Cities state policy workgroup has been picked up by other organizations, including an effort to create a solar set-aside in utility resources.

Additional Resources

- Convention Center Solar Array Information: www.minneapolisconventioncenter.com/about/sustainability.asp
- District Energy Saint Paul Solar Thermal Project: www.districtenergy.com/solutions/solar.html
- Minneapolis Solar Resources: www.ci.minneapolis.mn.us/sustainability/solar.asp
- Saint Paul Solar Resources: www.stpaul.gov/index.aspx?NID=3479

For more city information, contact:

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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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