

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

Solar in Action



Ann Arbor, Michigan

Includes case studies on:

- Advocating for State-Level Policy and Legislation
- Developing Visible, Monitored Demonstration Projects
- Developing a Solar Plan to be Adopted by the City Council
- Using a Solar Feasibility Study as a Training Opportunity
- Cost-Conscious Solar Mapping
- Working with the Historic District Commission



The “Nature House” at the Leslie Science Center in Ann Arbor, Michigan, which is an environmental learning center for schoolchildren, features solar hot-water panels and two PV systems among other solar technologies.

Photo from The City of Ann Arbor, NREL/PIX 09690

Cover photos from Ann Arbor Area CVB

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.

Ann Arbor’s Starting Point

Ann Arbor was designated by the U.S. Department of Energy (DOE) as a Solar America City on June 20, 2007. Prior to that, Ann Arbor had a modest number of installations by many standards and a number of challenges. However, the city was gaining momentum from municipal installations and supportive political leadership.

At the time of the award, Ann Arbor had:

- Approximately 86 kilowatts (kW) of photovoltaic (PV) and 19 solar water heating (SWH) installations
- Highly visible public installations with strong educational content available in multiple locations, including on the well-known Leslie Science Center
- Specific goals for renewable energy and solar endorsed by the mayor
- A state government actively promoting renewable energy and solar manufacturing
- A dedicated city energy programs manager staff position
- A limited net metering program that was not a strong incentive—less than 15% of known installed solar systems were enrolled.

While Michigan is not known for its sunshine, Ann Arbor receives 25% more sunlight than Germany, a world leader in solar energy utilization. Ann Arbor believed that its well-educated population could be brought to understand the benefits and value of solar in Michigan.

Building Partnerships and Setting Goals

Ann Arbor entered the Solar America Cities partnership with a limited number of existing monitored installations that proved solar could work in Michigan and visionary political leadership willing to set lofty goals for renewable energy. The city set a goal to install 5,000 solar systems and obtain 20% of the city’s energy from renewable sources by 2015. To achieve these goals, the Ann Arbor Solar America Cities partnership identified the following activities:

- Develop an Ann Arbor Solar Plan to identify and remove barriers to increased solar energy use
- Improve city regulations and building codes to help streamline the installation of solar systems

- Train installers and city staff to properly assess sites for solar feasibility including accounting for code and permitting issues
- Increase the number of large-scale solar installations on city buildings, including highly visible public demonstration and educational installations
- Establish new partnerships with local organizations designed to educate the Ann Arbor community.

The Ann Arbor Solar America Cities partnership is an extensive collaboration among nearly two dozen organizations. Major partners include:

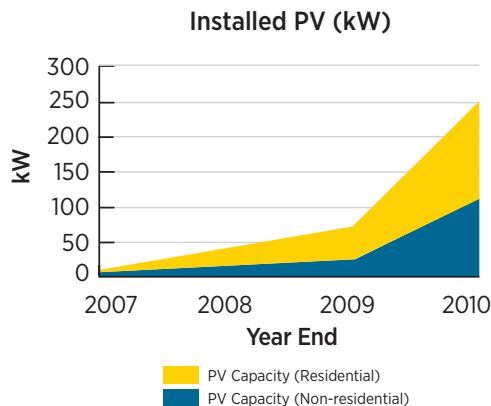
- City of Ann Arbor Energy Office
- Clean Energy Coalition
- Great Lakes Renewable Energy Association
- Ann Arbor Hands-On Museum.

Other program partners included:

- The University of Michigan's Memorial Phoenix Energy Institute
- Ann Arbor Downtown Development Authority
- Washtenaw County
- DTE Energy
- State of Michigan Bureau of Energy Systems
- United Solar Ovonics.

Installed Capacity

Ann Arbor



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

Accomplishments and Highlights

Ann Arbor focused its efforts on planning and changing policy and attitudes toward solar in the city. Highlights of Ann Arbor's accomplishments include:

- Developed a formal Solar Plan accepted by the city council that identified key steps and activities to be taken by city, local, and regional partners to increase the prevalence of solar in Ann Arbor



Ann Arbor promotes solar in the community through highly-visible installations on city-owned facilities, such as this 10-kW PV system at the Farmers' Market.

Photo from The City of Ann Arbor, NREL/PIX 18348



The Fuller Pool Sun Dragon helps to draw attention to one of Ann Arbor's solar pool heating systems.

Photo from The City of Ann Arbor, NREL/PIX 18350

- Installed a new 10-kW PV system at the Farmers' Market and assessed feasibility at other city facilities, which led to American Recovery and Reinvestment Act funding for additional systems, including PV and solar water heating.
- Developed a solar map at relatively low cost
- Leveraged city solar installations into training opportunities for local installers
- Succeeded in getting approval for a commercial and a residential solar project to go forward on historic buildings and spurred the creation of a solar subcommittee of the Historic District Committee
- Installed multiple systems in locations visible to the public with associated performance monitoring.

Case Studies: Successes and Challenges

Advocating for State-level Policy and Legislation

The City of Ann Arbor has been a leader in advocating for various changes in state-level policy and legislative changes, most recently for enacting legislation to enable cities to develop Property Assessed Clean Energy (PACE) financing programs.

As part of its aggressive policy agenda, the city identified a need for additional incentives and financing mechanisms to allow its residents to install solar technologies. Many of the

most attractive means required changes to state policy or law, including the need for legislation that would allow PACE.

With Michigan a bit behind other states in implementing PACE, the city connected with staff at the Great Lakes Environmental Law Center (GLELC), which worked with the city and its partners to craft PACE-enabling legislation for Michigan. The advantage of not being the first state to implement PACE was that GLELC was able to take best practices from other states' legislation to craft a strong, flexible framework for Michigan.

City staff then worked with state-elected officials to get the legislation out of committee and passed by the Michigan House of Representatives before it stalled out in the Senate due to opposition from bankers.

In the process, city staff learned several important lessons in relation to advocating for state-level policy change.

Several challenges were encountered:

- The pace of political decision-making
- The time associated with advocating for policy, for example, preparing to testify at committee hearings in person, especially if representing one of only a few entities that are actively preparing to make use of the proposed policy
- The wide variation in support and opposition to new policies from one state to the next. The absence of opposition from a group in one state does not guarantee the absence of opposition in another
- The importance of maintaining vision for a program despite federal-level issues.

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A balance of optimism and realism is needed in advocating for policy change. While PACE currently faces regulatory uncertainty at the federal level, the city remains hopeful that a path forward will be identified that will renew efforts in the Michigan legislature.

Developing Visible, Monitored Demonstration Projects

Ann Arbor has undertaken a handful of carefully calculated demonstration projects to raise public awareness of solar technologies and educate the public on the technology, value, and benefits of solar energy. An important element in raising

public awareness is the ongoing monitoring and data collection that happens at each site.

The Leslie Science and Nature Center is an environmental education center in Ann Arbor. The Center's Nature House hosts a solar hot water system and two 2.5-kW PV systems featuring different technologies—cadmium telluride and amorphous silicon. Both PV systems feed data to the same PowerDash data logging system, which allows for several interesting uses.

One great feature of having data available is that it allows for educational opportunities, such as comparing solar insolation and electricity generation as the seasons change. Another interesting use of the data logged at Leslie is the ability to make side-by-side comparisons of the two technologies. Finally, it allows for investigation of noteworthy events.

An interesting example of these benefits occurred when, in the middle of winter, one set of PV panels was covered with snow but the other was available to generate electricity due to melting. Analyzing the data from the two systems, city staff were able to determine how many such “snow adhesion” events occurred over the last winter (two), how long they lasted (about 4 days each), and how much power the covered system generated on those days (not much).

Ann Arbor also collects data from a 10-kW amorphous silicon installation at its farmers' market via SMA's Sunny Webbox and Sunny Portal system. The two data collection systems both make data available online, but in different formats. Using multiple data collection systems presents a challenge in that comparing production between systems requires manual data analysis. City staff would like to be able to see side-by-side solar data from all local solar systems, but different data loggers cannot typically be integrated into one data collection system without a custom engineering solution.

Two types of PV systems at Ann Arbor's Leslie Science Center enable snow adhesion comparisons.

Photo from The City of Ann Arbor/NREL PIX 18352



Fire Station #1 in downtown Ann Arbor became the first fire station in Michigan to use solar hot water in 2007.

Photo from The City of Ann Arbor, NREL/PIX 18349

Developing a Solar Plan to be Adopted by the City Council

Ann Arbor developed a Solar Plan for adoption by the city council that outlines the steps the city, local, and regional energy partners will take to increase the amount of solar installed in Ann Arbor.

Solar Plan development began by conducting local market research to identify local benefits of and barriers to adopting solar technology. This was followed by an extensive literature review of more than 120 documents. Best practices were identified for each topic area and compared to local resources and practices. The plan includes eight recommendations for the city:

1. Commit to a solar plan implementation process
2. Design municipal solar financial incentives
3. Simplify solar permitting
4. Advocate for state-level policy changes
5. Integrate solar into city infrastructure and culture
6. Introduce solar access laws and robust building energy efficiency
7. Create a solar outreach campaign
8. Support solar workforce development and green jobs.

These recommendations are intended to be used by officials to reduce any barriers to solar energy growth, help craft solar-friendly incentives, and introduce progressive solar policies.

The plan was endorsed by the Ann Arbor Energy Commission in July 2010. Implementation of the plan began shortly afterward.

Using a Solar Feasibility Study as a Training Opportunity

As part of Ann Arbor's Solar America Cities project, city Energy Office and field operations staff visited five municipal buildings to evaluate the SWH and PV potential of each facility. The staff was accompanied by representatives from its technical assistance team, including representatives from Sandia National Laboratories and the engineering consulting firm CH2M HILL. The evaluation criteria included available roof area, roof age and condition, shading factors, electrical interconnection access, conduit routing, facility energy consumption, electrical meter location, potential inverter and disconnect mounting locations, structural roof issues, and potential solar thermal applications.

The feasibility study and associated report serve as a framework for evaluating and reporting on the solar potential of other facilities in the City of Ann Arbor. Washtenaw County and the Ann Arbor Downtown Development Authority plan to conduct solar feasibility studies at more city facilities.

During the site evaluations, the experts trained a representative from Recycle Ann Arbor, a local nonprofit charged with promoting green building practices in Ann Arbor. The representative was trained to conduct scoping visits to other potential sites in the city, independent of the experts. Recycle Ann Arbor has included solar feasibility studies in some of the 100 home energy audits that it conducted with funding from the Michigan Public Service Commission.

Recycle Ann Arbor leveraged the training in two ways. First, in discussions around potential "time of sale" home energy audit and disclosure requirements, Recycle Ann Arbor staff proposed a solar feasibility component, which ultimately could lead to a required solar feasibility study for every Ann Arbor home that is put up for sale. Second, Recycle Ann Arbor staff members became a part of Energy Works Michigan, which performs solar feasibility studies for schools across the state as part of a program funded by Michigan Public Service Commission.

Cost-Conscious Solar Mapping

Ann Arbor was able to develop a solar map of its own showing the solar potential of single-family houses at a fraction of the costs of solar maps being deployed in other cities. A group of university students working with the EnHouse (a program of Recycle Ann Arbor dedicated to furthering the causes of green building, energy efficiency, and renewable energy) used aerial photographs to analyze the solar potential of single-family houses in Ann Arbor. Their study concluded that 86% of the 22,000 Ann Arbor rooftops would be feasible sites for solar hot water installations.

By utilizing student resources—funded largely by the University of Michigan—the city was able to undertake a project that could cost hundreds of thousands of dollars for a fraction of that cost. The key ingredients were having both "leaf on" and "leaf off" aerial photographs; a team of engineering students to model the solar potential of different roof orientations, pitches, and shading; and the students' time to (virtually) walk through the city evaluating houses. While the aerial analysis is not a substitute for an on-site evaluation, it has been a valuable tool for raising public awareness.

Working with the Historic District Commission

Ann Arbor, in conjunction with XSeed Energy (a program of the Michigan Clean Energy Coalition) is working to develop community-funded solar installations. That program's first installation is being developed for the historic Michigan Theater in downtown Ann Arbor. The project was selected based on the support of the theater and the unique technical and political challenges associated with the project.

Ann Arbor had not previously considered solar panels on historic structures, so the team hoped to use this project to begin breaking down that barrier. City energy staff and members of the XSeed Energy board presented the project for approval to the Ann Arbor Historic District Commission.

After lengthy discussions, the theater proposal and an unrelated residential installation were both unanimously approved by the commission. An important part of the rationale for approving the installations was that they are reversible and could be removed in the future without any permanent impact to the structure. While these approvals do not guarantee approval for every solar project that comes before the commission, they establish important precedents for when the commission does allow solar installations.

The commission also decided to form a committee to study solar. This committee will help make sure the commission is up-to-date on the types of solar panels available (different PV and solar water heating technologies), best practices for mounting systems, and other relevant issues. This will allow the commission to continue to review solar installations intelligently and balance aesthetic and historic preservation needs with sustainability objectives. These guidelines should lower the barriers for future applicants—especially residential applicants—in winning approval for solar, thereby opening up a large percentage of Ann Arbor rooftops for solar installations.

The most significant challenge faced during this process was the lack of information the commission had about the benefits and the types of solar PV technologies available. Once the team had sufficiently presented these details to the commission, the commission was very understanding and supportive.

Top Takeaways

- Partnerships have been—and will continue to be—essential to success in promoting solar energy in Ann Arbor. The various strengths that different organizations bring to the table create a well-rounded working group for tasks from planning to implementation.
- In particular, working with the University of Michigan has been extremely valuable in terms of providing technical resources and people power that the city would not otherwise be able to afford.
- Perceptions are essential in discussing solar feasibility. The Solar America Cities project has led many of Ann Arbor's authorities to realize that Michigan does, in fact, have a good solar resource, and there is still an opportunity to help others understand that solar is not just a "Southwest thing."

Next Steps

Working with the recommendations from the Ann Arbor Solar Plan, the city will focus its efforts on education and outreach

opportunities to finance and/or provide incentives to private sector solar installations. Specific initiatives include:

- Community supported solar—Ann Arbor is working with the nonprofit Clean Energy Coalition to support visible installations at local businesses and nonprofits with community financial support.
- Community outreach—With Recovery Act funds, the city is hiring a community energy coordinator, who will be responsible in part for helping residents "go solar."
- Property Assessed Clean Energy—Ann Arbor will continue to work toward implementing a local PACE program with state-enabling legislation.

Additional Resources

- Ann Arbor Solar Plan: www.a2gov.org/government/publicservices/systems_planning/energy/solarcities/Pages/default.aspx
- Ann Arbor Farmers Market PV Data: <http://sunnyportal.com/Templates/PublicPageOverview.aspx?plant=9553699c-6e19-418c-b505-a0c33ddd83db&splang=en-US>
- Leslie Nature House PV Data: <http://web1.powerdash.com/das-prod/tabs.php?site=leslie>
- How to Go Solar in Ann Arbor: www.a2gov.org/government/publicservices/systems_planning/energy/solarcities/Documents/How%20to%20Go%20Solar%20Guide.pdf
- Site Assessment of City Facilities: www.a2gov.org/government/publicservices/systems_planning/energy/solarcities/Documents/AnnArbor_SolarSiteAssessments.pdf
- Recycle Ann Arbor: www.recycleannarbor.org/?module=Home
- XSeed Energy: www.xseedenergy.org

For more city information, contact:

Andrew Brix, Energy Programs Manager, Ann Arbor's Energy Office Email: energy@a2gov.org Telephone: 734-794-6430

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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