Improving the Educational Role of Municipal Solar Installations

A Resilient Communities Project–GreenStep Cities Guide

Resilient Communities Project
University of Minnesota
Driven to Discover℠

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Solar Array Installation in Chaska, Minnesota

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Original Student Report: https://conservancy.umn.edu/handle/11299/184904

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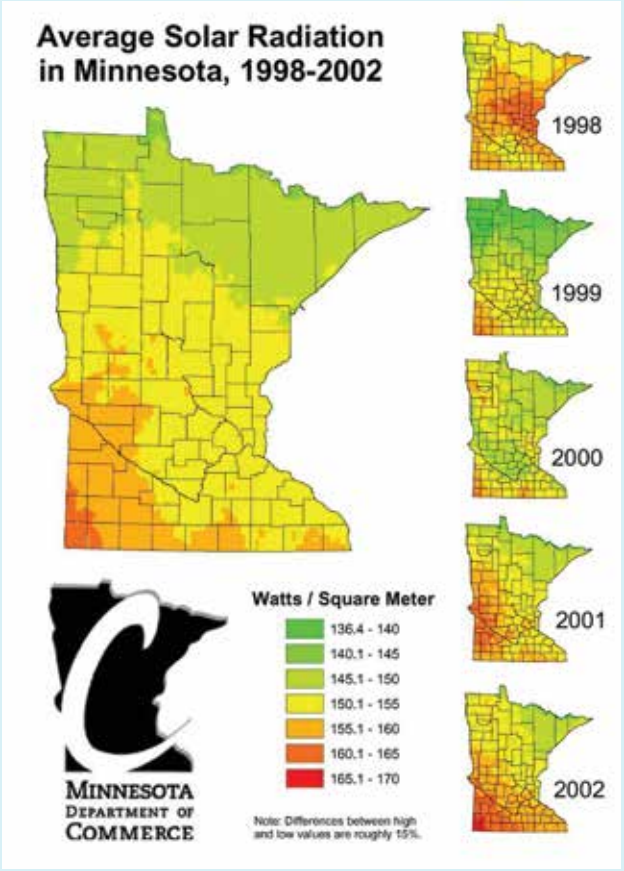
INTRODUCTION

Despite being known for its harsh winters and climatological extremes, Minnesota has an excellent solar resource with a relatively consistent availability of sunshine throughout the year.[1] Investment in solar energy has been increasing dramatically over the past few years and the Minnesota Department of Commerce (DOC) projects that the state's solar capacity will continue to increase.[2] This rapid rate of investment in solar energy has been attributed to favorable solar policy[3] as well as the rapidly falling costs of solar photovoltaics (PV).[4] The boom in Minnesota's solar market has also spurred local job growth[5] and between 2013 and 2015 the number of Minnesotans employed in the solar industry doubled.[6]

Due to attractive pricing, policy incentives, and the opportunity to create and support local jobs, many cities throughout Minnesota have already begun incorporating solar PV installations onto local buildings.[7] In addition, as more cities in Minnesota adopt sustainability goals and focus on reducing municipal carbon emissions, solar PV systems are increasingly seen as a means of sustainably meeting municipal energy needs.

While solar systems have been lauded for their ability to provide a safe, resilient, zero-emission source of locally produced energy, solar panels also have the potential to offer a valuable educational opportunity for local residents. Community members are often curious about solar and see the city as a reliable source of information.



Source: Minnesota DOC Solar Ready Buildings Guide: http://mn.gov/commerce-stat/pdfs/solar-ready-building.pdf.

Figure 1: Average Solar Radiation in Minnesota.

By providing opportunities for community members to learn about local solar installations it is possible to:

1. Catalyze conversations about solar energy opportunities in the community.
2. Promote a greater understanding of renewable energy technologies and how they operate.
3. Advertise the city's efforts to become more sustainable.
4. Normalize the use of renewable energy technologies in the community.

This tool is meant to serve as a guide for communities interested in increasing the educational value of municipal solar installations. All solar projects must account for economic and technical factors (including site assessment and efficiency considerations as well as system components, sizing, costs, and installation) to ensure that panels are financially feasible and able to produce electricity. However, the considerations below focus primarily upon factors that increase the educational value of solar installations.[8] For guides that focus upon assessing the technical and economic feasibility of solar see:

- Clean Energy Resource Teams (CERTS)' *Solar Electricity for the Home, Farm and Business Factsheet Series* which is designed to help interested parties determine if an electric solar system is the right choice for them.
  http://www.cleanenergyresourceteams.org/e3a
- The National Association of Regional Council's *Solar for the Environment Toolkit* and *Regional Solar Development Handbook*
  http://narc.org/wp-content/uploads/Solar_Environment_Toolkit.pdf
  http://narc.org/solarops/
- Natural Renewable Energy Laboratory's *Consumers Guide: Get Your Power from the Sun*
  http://www.nrel.gov/docs/fy04osti/35297.pdf

In addition, for information about funding sources see:

- Minnesota Department of Commerce Solar Energy Resources
  https://mn.gov/commerce/consumers/your-home/energy-info/solar/
- Minnesota Clean Energy Authority's Minnesota Rebates and Incentives Summary
  http://www.cleanenergyauthority.com/solar-rebates-and-incentives/minnesota/

The following sections provide an overview of factors to consider when optimizing the educational capacity of solar installations as well as examples from cities in Minnesota.

Key Considerations for Improving Educational Capacity of Solar

Factors such as location selection, type of solar array and methods of engaging community members are especially important to consider when optimizing the educational value of solar installations.

TYPE OF MOUNT

Solar panels can be placed on a variety of surfaces including roofs, over parking lots, and on the ground. However, ground-mounted solar arrays (see Figure 2) are often more visible and provide more opportunities for close inspection compared to roof arrays.

LOCATION

Location is a very important factor to consider when maximizing the educational value of solar panels. The ideal location for an educational solar array would have a high solar yield (be unshaded) as well as excellent visibility and close proximity to populated areas frequented by a variety of community members. In addition, by selecting locations that are highly visible to community members, the solar panel will help young and old come to see the use of renewable energy resources as applicable in their daily lives. When identifying potential locations consider proximity to the following:

Source: NAVFAC

Figure 2: Tour of ground-mounted solar panel.

Educational institutions
Locations with access to large diverse groups of students can provide far-reaching educational opportunities and allow the panels to be incorporated into classes.

Major roadways
Panels that are visible from the road would allow the installations to be viewed by many motorists daily.

Residential areas
Locations near residential areas could provide exposure to local community members and help to normalize the existence of solar panels in the local community.

Gathering spaces
Locations near athletic fields and other community gathering places such as libraries, community centers, nature centers, etc. provide exposure to community residents when they attend events or activities. Siting panels at highly frequented gathering spaces can ensure that panels are exposed to a large and diverse cross section of the community.

Figure 3: Minnesota Solar App (http://solar.maps.umn.edu/app).

As mentioned above, in addition to a location's visibility, a solar site must also have sufficient exposure to sunlight. A solar panel can only effectively produce energy if its location has sufficient exposure to the sun. The University of Minnesota has recently completed a database of solar irradiance data for the state of Minnesota through the Minnesota Solar Suitability Analysis. This database can be used to determine the optimal location based upon solar resource availability.[10]

Source: Audubon Society

Figure 4: Sign explaining conversion to solar energy.

Engaging Community Members

Communities, schools, museums and other institutions have already developed a variety of methods of engaging community members around solar and other forms of renewable energy. Some examples of engagement opportunities include:

TED TALKS

Ted Talks are typically short videos featuring expert speakers on a variety of topics such as science, technology, global issues, etc. The videos are aimed at spreading new ideas. For example, Edina City Councilman Kevin Staunton recently released a Ted Talk focusing on the city's new Community Solar Garden entitled *Community Solar Gardens: How cities can lead the way to cleaner energy*.

INTERPRETIVE SIGNS

Another means of engaging community is through interpretive signs or brochures. Signs are a great way to convey a specific message about the city's solar panels.

COMMUNITY MEETINGS

Cities in Minnesota have also organized specific meetings for residents to introduce them to solar energy projects and answer questions. The face-to-face format at these meetings allows residents to voice questions and concerns directly to city staff.

Photo Credit: Lauren Blank, MMPA.

Figure 4: New solar installation at a high school in Olivia, MN.

SOLAR IN THE CLASSROOM

Incorporating solar panels into school campuses gives educational institutions an exciting opportunity to incorporate hands-on solar energy lesson plans into curricula. Hands-on displays and activities allow students to gain a deeper understanding of solar energy. Using actual data from solar installations on or near campus, a lesson plan can showcase both economic and environmental impacts of solar or the differences in energy production that occur on a daily, monthly, or annual basis. There are several excellent resources for schools interested in incorporating solar into the classroom including:

- Minnesota Renewable Energy Society's *Renewable Energy and Schools*. This step-by-step guide for schools focuses upon evaluating, acquiring, installing, promoting, and using renewable energy systems in Minnesotan schools. http://www.cleanenergyresourceteams.org/sites/default/files/publication_files/RenewableEnergy_SchoolsGuide_MRES.pdf
- Community Power Network's Solar Curriculum, Activities, Events and Resources. This resource provides a list of resources for schools interested in Solar Energy. http://www.communitypowernetwork.com/node/1100
- The National Renewable Energy Laboratory's Solar Energy Science Project examples http://www.nrel.gov/education/pdfs/educational_resources/high_school/solar_projects_hs.pdf

SOLAR ENERGY TOURS

Another option would be to offer tours of solar facilities to both students and adults. Tours can either feature stand-alone solar features or the panels can be

Figure 6: Students on a tour of MMPA's Faribault Energy Park.

Source: MMPA

Source: Jim Girardi.

Figure 5: Portable Solar.

incorporated into existing public facility tours to show how renewables are being integrated into existing community infrastructure. For example, through the Energy Education Program, MMPA provides interactive tours of the Power Agency's Faribault Energy Park to 2,500 Minnesotan 4th grade students.[12] While visiting the facility, students are able to view the on-site control room, steam turbine, wind turbine, and solar array. The tours allow students to learn first-hand about how energy is generated, transmitted, and used.[13]

BROCHURES/FACT SHEETS

Some cities have produced informational fact sheets and brochures about solar installations. For example, the city of Maplewood created the Maplewood City Hall and Community Center Solar Panel Demonstration Project Information Sheet.

NEWS ARTICLES

Articles featuring the city's efforts to invest in solar help to introduce the topic to residents, generate conversation about renewable energy, and can reach a wide audience. Refer to the following examples of recently published articles:

- Danfelt, Virginia. (2012). "Solar Panels Installed at Gunflint Hills Golf Course." *Cook County News Herald*.
- Educational Solar Arrays Energized in MMPA Communities. (2016). Minnesota Municipal Power Agency (MMPA).
- McCleary, Jay. (2013). "Saving future tax dollars with alternative energy projects." *Public Works Magazine*.

SOLAR ENERGY WEBSITES

Cities can put up pages on their websites about their solar energy efforts. These websites can detail the benefits of solar, the energy produced by solar sites, and/or information for citizens interested in solar. Refer to the following examples of city solar pages:

- Community Solar Gardens. City of Edina Website. http://edinamn.gov/index.php?section=solar-gardens
- Renewable Energy. City of Maplewood Website. http://www.ci.maplewood.mn.us/1006/Energy
- Solar Power. City of Woodbury Website. http://www.ci.woodbury.mn.us/environment/sustainability/solar-power

ENERGY PRODUCTION TRACKING

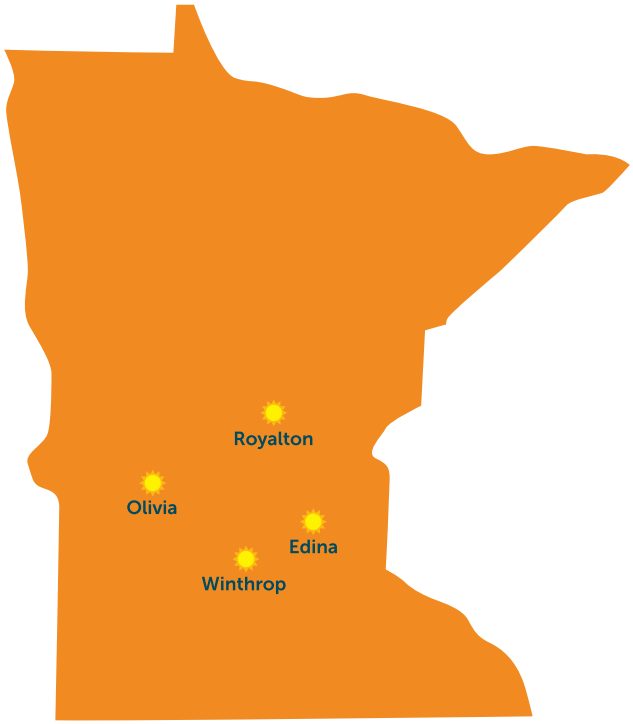
Many cities also provide live streams of the solar production which community members can use to track solar information. For example Poolesville, MD publishes information on energy generated and carbon emissions prevented by solar panels[14] at the city's Waste Water Treatment Plant on its website.[15] Some examples of city webpages in Minnesota include:

- Solar-log - Edina solar energy production tracker. http://home.solarlog-web.net/953.html#952
- E-Gauge - City of Mountain Iron solar energy production tracker. http://egauge3204.egaug.es/
- Maplewood Nature Center energy tracking. https://enlighten.enphaseenergy.com/pv/public_systems/qdQg23522/overview

SOLAR TEST BEDS

A solar test bed is a small (10-40kW) transportable solar array. The small PV system can be mounted on a trailer and located in a central location were students or residents can observe and/or use to charge their electronics such as cell phones and laptops. The panel can also be taken off site to help facilitate educational activities at schools or community events.[16]

The examples discussed above provide students and community residents with the ability to learn about solar energy in a variety of ways.



Examples in Minnesota

WINTHROP, MINNESOTA

The city recently installed a small solar panel, funded by MMPA's Hometown Solar Grant program, at the local high school. The panels will be used to offset some of the school's energy use and to serve as an educational resource. To provide maximum visibility, the panel is on a ground mounted system and is installed directly in front of the school off a major state highway. The panel can be seen from the highway and it is at a focal point in front of the school. The location was also convenient because it was not currently being used for other school activities. The school has a list of ideas of how the panels can be incorporated into high school and middle school classes. For example, science teachers plan to have their students track electricity production by month, day, and temperature in order to see how the panels perform throughout the day and under different conditions. They may also experiment with angle of incidence to see how energy production is affected. Having panels at the school is also catalyzing more conversation about solar in Winthrop. As solar becomes more visible in the community, more residents are encouraged to consider investing in solar technology.

EDINA, MINNESOTA

The city of Edina has engaged in several solar-related initiatives. In 2011 Edina received a grant from the American Recovery and Reinvestment Act (AARA) to install a 24KW photovoltaic system on City Hall. Edina is also currently purchasing electricity that is guaranteed to come from solar in an effort to support the renewable sector. The city is also leasing space for a Community Solar Garden. In order to reach out to residents about the Community Solar Garden and other sustainability efforts, Edina has developed a page on the city website featuring solar efforts,[17] has partnered with Minnesota Interfaith Power and Light[18] for community solar outreach, and has also published a Ted-Talk featuring a city councilman.[19] Edina sees the important of educating residents about solar energy projects because there is a growing curiosity. People are interested in solar and are coming to the city to asking about it.

OLIVIA, MINNESOTA

MMPA approached Olivia about the Hometown Solar Grant program and worked with local community members to identify a potential location. Originally, Olivia was considering several sites including the high school, the public library, and the local waste water treatment plant (which already offers tours of facilities). Ultimately, the city decided to site the solar panel at the high school on the ground at the edge of the running track (see Figure 5). The panel was installed over the summer and it is expected that high school teachers will incorporate the panels into classes. However, this project has also impacted the entire community. It catalyzed a larger conversation within the city about solar. The city is now considering installing additional solar panels at the waste water treatment plant. In addition, the town's new hospital and clinic have started talking about putting solar on their roofs and other underdeveloped areas on campus. As solar panels are dropping in price, solar is increasingly seen as a financially viable option and more community residents are becoming interested in solar.

ROYALTON, MINNESOTA

The city of Royalton received a Local Government Renewable Energy Grant from the Office of Energy Security to install solar on City Hall. Initially, to engage residents the city put information during a bi-monthly newsletter. The city also held community meetings about the potential economic savings from the project. The city is interested in engaging local schools about solar, as well as the local chapter of Youth Energy Summit.[20] The city has found that having student groups talk about solar panels with community residents and other students is very effective. Royalton has also participated with YES students in a local Green Fair.

MINNESOTA MUNICIPAL POWER AGENCY (MMPA) HOMETOWN SOLAR GRANT PROGRAM

The MMPA serves 12 communities[21] located throughout Minnesota. With its Hometown Solar Grant Program MMPA subsidizes small solar arrays in local community-owned buildings (such as community centers, city offices, or libraries) and schools. The solar arrays are intended to be educational assets for students and community residents. The goal of this program is to educate future leaders in Minnesota about the benefits of renewable energy. The solar grant program is an extension of MMPA's Energy Education Program.

With the educational solar installations, community members will have the ability to learn about the unique benefits of solar power and about how sunlight is converted into electricity. MMPA's goal is to install one educational solar asset in each of the communities that it serves. There is an application process for the Hometown Solar Grant Program. The application form requests that communities provide general site information, as well as the following:

- A description of why the facility would be a good candidate for the Hometown Solar Grant.
- A plan view of proposed site.
- 2-3 Proposed solar installation locations on the property.
- Proposed point of interconnection.
- A list of required permits and approvals for the proposed solar installation.
- A letter of support from property owner (i.e. school district/board, county, city, etc.).

This information allows MMPA to review and evaluate the proposal by giving decision-makers a better understanding of the feasibility of installing the solar array at the proposed locations.[22]

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