



Solar Energy Financing **GUIDE**



Empowering **Wisconsin** Local Governments



Solar installation at Coleman Elementary School, Coleman, WI

- Municipal, Tribal & School
- Residential & Commercial
- Microgrids
- Government Actions

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Front cover photo courtesy of Coleman Elementary School.



INTRODUCTION

There is a shift toward clean, reliable and affordable electricity in the United States, and local governments and tribal nations have an opportunity to position their communities well in the growing renewable energy economy. Local governments are installing solar systems on their own buildings and land and are working with partners to help promote solar installation by their residents and businesses. **Solar energy is broadly available now as a result of dramatically falling prices of solar equipment and innovative financing approaches and partnership models.**

Solar panels convert sunlight into energy and generate no air or carbon pollution, solid waste, or water use (solar panel manufacturing does have environmental impacts like all other energy generating equipment; however, the manufacturing energy cost versus the energy production payback for solar modules is generally 2 years. NREL Report No. NREL/FS-520-24619). Since solar is a technology and not a fuel, solar prices continue to fall with efficiency improvements and are at par with or approaching the price of coal today across the country.

Solar energy supports:

- ✦ **Energy independence** by reducing dependence on imported fossil fuel energy.
- ✦ **Local energy resilience** by providing electricity close to where it is used and at peak cooling times when the grid is strained and power is most expensive.
- ✦ **The local economy** by providing good paying jobs for local installers and construction crews.
- ✦ **Job growth** by providing new jobs and training opportunities for workforce development.
- ✦ **Reduced electricity bills.**

Wisconsin has an ample solar resource with 20 percent more sunlight than Germany, a world leader in solar installations. As a state that is reliant on imported fossil fuels for 65 percent of its energy, **Wisconsin is sending \$13-15 billion out of state each year.** By increasing solar as a local energy resource, Wisconsin will keep more

money at home where it can provide local jobs. It will attract businesses and residents who prefer to locate where they have clean energy options as well. School



districts are installing solar as an educational tool for students, to keep costs down for local taxpayers and to improve the environment.

Many Wisconsin municipalities and tribal nations have a history of supporting clean energy with more than 140 local governments having passed **Energy Independent Community** resolutions beginning in 2008. These communities have adopted the goal of generating 25 percent of their energy for local government operations (buildings, infrastructure and fleet) from renewable sources locally by 2025. This includes implementing energy efficiency measures because energy efficient buildings enhance the effectiveness of photovoltaic generation. Many of the Energy Independent Communities steadfastly continue to pursue that goal. There are a myriad of other local governments working on energy efficiency and renewable energy efforts as well. They are supported by many organizations that provide funding, technical assistance, education and networking in the energy arena.

Given these factors and more, local governments in Wisconsin are investing in solar energy and working with partners to create robust local solar markets.

Local governments, businesses, utilities, and nonprofit organizations have implemented a variety of financing approaches to support solar system installations and solar purchase. Those that can be used in Wisconsin are dictated by the laws of this regulated utility state. Even within those constraints, communities have applied innovative financing and brokered novel arrangements to encourage investment in solar. Recognizing that there are multiple paths to finance solar development and that the best options will be crafted to address local market factors, this guide provides a range of financing options using Wisconsin case studies to help communities identify those best suited locally.

The *Solar Energy Financing Guide* is a resource designed to fuel local governments and stakeholders with ideas and approaches for financing solar systems. The Guide explores financing models for solar energy used successfully by Wisconsin municipalities, tribes and school districts for their own installations and for their residents and businesses. It provides case studies that demonstrate how the various financing approaches have been applied in Wisconsin; lists and maps detailing Wisconsin solar projects; useful tools and additional resources; and recommended actions municipalities can take to facilitate solar development.

Financing approaches covered include:

- ✦ Direct Buy
- ✦ Public-Private Partnership
- ✦ Third-Party Financing
- ✦ Solar Group Buy
- ✦ Solar Garden
- ✦ Solar Cooperative
- ✦ PACE Financing
- ✦ Green Power Purchase
- ✦ Microgrid

Wisconsin local governments are investing in solar energy and working with partners to create robust local solar markets.

↑ JOBS
25% U.S. solar industry employment increased by more than 73,000 jobs in 2016, a 25% increase
(Scientific American)

.5 MILLION
 Half a million solar panels were installed each day around the world in 2015
(International Energy Agency)

↓ COST
70% Cost of solar systems (hardware) dropped more than 70% in 3 years
(Lawrence Berkeley National Laboratory)

Wisconsin receives 20% more sunlight than Germany
(National Renewable Energy Laboratory [NREL], U.S. Department of Energy)

125 PER MINUTE
 The U.S. added 125 solar panels every minute in 2016
(Solar Energy Industries Association)

USA SOLAR
 Since 2010, the solar industry has created nearly 115,000 new American jobs
(Solar Energy Industries Association)

5.34 MW
 Municipalities and school districts own at least 5.34 MW or 10% of Wisconsin's 52.8 MW of solar electric generation
(NREL, The Open PV Project, May 2015 plus 2016 installations)

Wisconsin has nearly 25,000 clean energy jobs
(Clean Jobs Midwest)

300,000
 The U.S. solar industry employs over 300,000 workers at more than 8,000 companies across every state (as of 2015)
(The Solar Foundation)

RESOLVE
140 Wisconsin municipalities adopted Energy Independent Community resolutions
(Energy On Wisconsin)



FINANCING MUNICIPAL, TRIBAL AND SCHOOL SOLAR PROJECTS

Direct Buy

Municipal governments can directly fund and own their solar systems and have them installed on city buildings, structures and land. The municipality puts out a request for proposal (RFP) for the project with basic elements including: design, permitting, interconnection, equipment, installation, commissioning and timeline.



Over 125 Owned Solar Systems

Before issuing the solar RFP, the municipality has work to do to: identify potential sites and projects, collect data to inform the choice of project and consult with its local utility about system size and connection options.

The RFP should specify:

- ✦ That professional contractors must have a valid Wisconsin license or credential. One such credential is North American Board of Certified Energy Practitioners (**NABCEP certification**) for photovoltaic (PV) and solar heating installation.
- ✦ That the system meet requirements for Wisconsin Focus On Energy incentives. Including performance expectations about the amount of energy the system will generate is a preferred approach to specifying types of equipment. Also specify that the photovoltaic panels and inverters are listed on the Go Solar California **prequalified equipment list**, that warranty information is provided and that the systems meet national, state and local electrical and building codes.

Some municipalities that have a goal of growing local solar jobs include in their RFPs a requirement that products and labor are locally sourced. This broadens their evaluation criteria from simply lowest price and project completion time.

With direct purchase, the municipality funds the solar system and can offset the cost with Focus on Energy incentive money, utility funding, federal grants and

other funding sources. Brown and Dane counties, Oneida Tribe, City of Madison and Lakeland Union High School are among nearly 50 jurisdictions that own their own solar systems. More than 125 of their solar electric and solar thermal projects are listed in Appendices 1 and 2.



Ground-mounted solar array owned by the Oneida Nation of Wisconsin in Brown County

Direct Buy Case Study



Brown County Sheriff's Office pole-mounted PV system

BROWN COUNTY

Brown County installed a 22.5 kilowatt (kW) PV pole-mounted array at its sheriff's office in 2011, which generated 65 MWh of electricity and saved \$7,200 in energy costs during its first 2 years of operation. The system cost of \$153,500 was **fully funded** through a federal grant, a Focus on Energy incentive and a grant from Wisconsin Public Service.

Direct Buy Case Studies

VILLAGE OF FOX CROSSING

The Village of Fox Crossing, formerly the Town of Menasha, is an Energy Independent Community in the Fox Valley with over 18,600 residents. The community installed a 28 kW ground-mounted solar system in 2010. The Village leveraged funding from Focus on Energy and We Energies to reach a 15-year return on investment. While the cost of solar is far lower today, the municipality's detailed process toward making the project succeed is instructional for any municipality. View their process in a [presentation](#) from the 2011 WAPA/WI-ASLA Conference.

DANE COUNTY

Dane County invests in solar electric generation along with the conversion of landfill gas to usable biofuel as part of its Energy Independent Community commitment. Its [2017 budget](#) includes \$2.4 million in new solar development, more than tripling the county government's entire solar energy production portfolio. It funds new solar systems for Dane County's Job Center and Alliant Energy Center. Together, the County will own and operate 770 kilowatts (kW) of solar generation and avoid 777 tons of carbon dioxide (CO₂) emissions per year. This will **save over \$2.1 million** in direct energy costs over the next 20 years. Existing solar arrays produce electricity at the Dane County Regional Airport maintenance facility and its East District Campus.

MADISON

The City of Madison was designated a Solar America City in 2007 by the U.S. Department of Energy and has been investing in energy efficiency and solar power since then, including incorporating policies and procedures to facilitate energy independence. The city made it standard practice that all fire stations have solar hot water heating. Together, systems installed on 11 existing fire stations save over 3,400 therms of natural gas and 18 tons of CO₂ each year. Monetary payback varies with the relative cost of natural gas.

Madison's [Fire Station 12](#) was designed and constructed using the LEED green building rating system (Platinum certified) to optimize performance. It has geothermal heating and cooling systems, solar hot water heating and enhanced energy efficiency.

Among Madison's many [renewable energy projects](#), the 2.1 kW solar shade canopy at the Goodman Community Pool serves several purposes. It generates 2,600 kWh per year of electricity that runs the freezer at the concession stand while shading children from the sun. Its high visibility educates the community while affirming the city branding as a Solar City.



City of Madison

Fire Station 6 solar hot water system and the Solar Shade Canopy at Goodman Community Pool

LAKELAND UNION HIGH SCHOOL

Lakeland Union High School (LUHS), located in Minocqua (Oneida County) with 700 students, installed a 280 kW solar electric system on its field house roof, making it the largest school solar system in Wisconsin. It was paid for under Act 32 legislation that allows school districts to levy additional property taxes to pay for energy efficiency projects that exceed state revenue limits without going to referendum. The solar project is one of more than 20 energy saving projects LUHS, which operates year round, is undertaking at a cost of \$14.6 million.



Field house roof solar array

The PV system cost approximately \$631,000 and became operational in December 2016. It was installed by SunPeak with Schneider Electric as the energy service company (ESCO) for the overall project. The electricity generated will directly offset school electricity use (rather than flow into the grid given the small remuneration the school district would get from WPS for the electricity). The solar array should offset 20 percent of the school's electricity use annually.

The first year savings on electricity will range from \$15,400- \$18,000 with a guaranteed cost savings by Schneider Electric of at least \$291,400 over 15 years. In 30 years, cost savings on the solar alone should net the school district \$264,600. Prior to the big installation, LUHS had 30 solar thermal panels to help heat the school pool as well as 10 PV panels as an educational tool. Classes will incorporate solar energy education as part of career training.

For more case studies detailing energy efficiency and renewable energy projects, financing and costs, view “Power Through Partnerships,” a short UW-Extension video of Brown County and the Oneida Tribe working toward energy independence.

Public-Private Partnership

A public-private partnership (P3) is an agreement between a public entity and a private company that attracts private sector investment in a public infrastructure project. This can be for a single project or a bundle of small to medium-sized projects. P3s provide long-term financial benefit to the private partner in exchange. One of the main forms of P3s is the power purchase agreement.

P3s incentivize the use of solar due to lower upfront costs of installation. They require the municipality to consult with attorneys and negotiate with solar developers.

THIRD-PARTY FINANCING

One form of P3 is third-party financing. Municipalities and schools can work with a third-party private business (third-party owner [TPO]) to finance solar projects on their property and avoid the initial costs of purchase

and installation. Typically the local government hires a consultant that identifies investors and developers and helps put the project financing together. The solar developer owns, operates, maintains and repairs the solar system located on municipal property.

There are two main forms of third-party financing:

1. Through a **solar power purchase agreement** (sPPA), the municipality buys electricity from the TPO over a fixed period of time, usually at a lower rate than what they would pay to the utility because the TPO passes along some of the tax benefit savings.
2. Another option is for the municipality to enter into a solar lease that is a service contract to pay for the use of the solar system rather than for the electricity it produces.

Businesses are motivated to enter into these agreements to take advantage of the 30-percent federal **Renewable Energy Investment Tax Credits**.

Actual cost differences between a direct solar buy and a third-party financing arrangement are exemplified in Appendix 3, which summarizes a study for the City of Fitchburg for a 100 kW solar array for a fire station roof.

A third-party financing bid should include:

- ✦ The PPA price for electricity.
- ✦ A fixed rate or a rate at which the price increases over the life of the contract.
- ✦ Production guarantees.
- ✦ Ownership of solar renewable energy credits (SRECs) (see glossary).
- ✦ Buy-out options, should the municipality seek to purchase the system after a specified number of years at a depreciated value.
- ✦ Operations, maintenance and repairs.
- ✦ Performance monitoring.
- ✦ Revenue from land/roof leasing.

Partnership Case Study



Half Moon Ventures' 1 MW solar park in Jefferson, WI

JEFFERSON SOLAR PARK: A BUSINESS MODEL

The City of Jefferson contracted with Half Moon Ventures in 2013 to develop a 1MW, 3,600-panel solar park and sell the electricity to an electric provider. Half Moon Ventures owns the project over its lifetime and pre-paid the city \$123,000 for a 20-year lease. The power is sold to WPPI Energy and distributed by Jefferson Utilities, the city-owned municipal utility. The project is expected to generate 1.57 million kWh annually, and provide 4-5 percent of the city's electricity needs.

WISCONSIN STATE POLICY ON THIRD-PARTY FINANCING OF SOLAR PROJECTS

Wisconsin’s interconnection rule (PSC 119) sets forth the terms and procedures for connecting customer-sited electric generation equipment to the utility grid. It does not address the issue of third-party ownership of renewable energy systems (i.e. what constitutes ownership for any

entity whether primary, second party or third party). Wisconsin’s Public Service Commission has not made a formal ruling on the legality of third-party financing and whether the third-party owner should be regulated as public utilities.

As a result, there are third-party solar projects in Wisconsin as exemplified in the two case studies below, but

Partnership – Third-Party Financing Case Studies

CITY OF MONONA

The City of Monona, at very little upfront cost, installed 156 kW of solar PV arrays on roofs of four municipal buildings in 2014. These solar systems generate approximately 30 percent of the buildings’ electricity use and are estimated to save the city \$75,000 in utility bills during the first 6 years of co-ownership. This puts the city halfway to its Energy Independent Community goal by producing renewable energy locally and eliminating 187 tons of CO₂ emissions a year.

The systems are interconnected by local utility Madison Gas & Electric (MGE). MGE monitors the energy use and electricity output of those buildings every 15 minutes and shows the balance of electricity generated over electricity consumed on the city’s monthly bill. Monona worked with **Legacy Solar Co-op’s Solar Connections**, a Madison-based company, to put the project together. The city entered into a solar service partnership agreement and leased its roofs to Falcon Energy Systems (FES) for 6 years. FES, out of



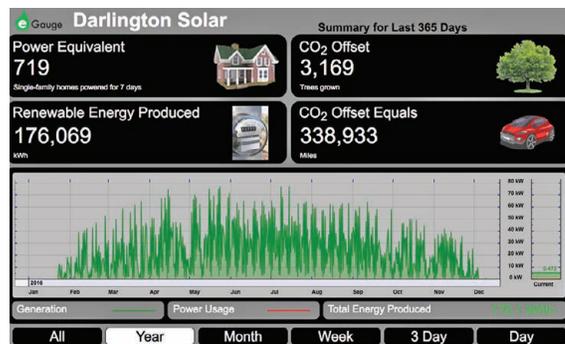
Monona hosts 156 kW of solar across four municipal rooftops in a third-party financing arrangement

Denver, CO, is the investor and receives the federal tax credit. Monona buys solar renewable energy credits (SRECs) from Falcon rather than electricity at a cost less than MGE’s current electricity rate. After 6 years, Monona can buy the system at a depreciated cost.

DARLINGTON SCHOOLS

Darlington Community School District installed the largest solar energy system of any Wisconsin K-12 school district in 2016. Energizing the elementary and middle school buildings, the 156 kW rooftop solar PV system generates 20-30 percent of the electricity used by each. The school district used innovative financing with co-ownership, where a solar developer installed and operates the system for the first 15 years, limiting the district’s upfront costs.

The superintendent and school board of Darlington Community Schools conceived of and initiated the solar project. Hoffman Planning Design & Construction and Madison Solar Consulting worked with the school district to put the financing and project together. Law firm Boardman and Clark drafted the third-party contract. Green Minded Partners were the investors and Current Electric the solar installer. The head of facilities for the school district was a key player as well. Darlington School District’s goals were to provide hands-on education to students and the community, promote clean energy and greenhouse gas reductions and the wise use of natural, financial and social capital. A kiosk that shows real-time energy production and savings (above right) is at each school and linked on its [website](#).



Real-time energy kiosk



Solar ribbon cutting ceremony at Darlington School

they are not nearly as common as in the 20 states that clearly support these agreements and have realized strong solar market growth as a result.



Solar power at Barkhausen Waterfowl Preserve, Brown County

AN ANALYSIS by the Environmental Law & Policy Center in 2015, following a 2014 Iowa Supreme Court case that protected third-party solar generation there, shows that third-party owners of distributed generation systems that provide electricity to a limited class of customers (rather than to the general public) are not “public utilities” as defined by Wisconsin law. Therefore, they should not be subject to being regulated as a utility.

Partnership – Third-Party Financing Case Studies

MOLE LAKE CHIPPEWA TRIBE

The U.S. Department of Energy awarded the Mole Lake Tribe of Lake Superior Chippewa in Forest County a \$1 million matching grant for the installation of 600 kW of solar PV on all 17 of the Tribe’s commercial buildings. The buildings include the casino lodge (106kW), the elderly center (60kW) the wastewater treatment facility (45.5kW) and the cultural building (11.9kW) (see Appendix 1 for all buildings). Most of the solar systems are larger than the 20kW net metering cap of the Tribe’s utility, WPS. Those will be set up behind the meter to provide electricity directly to that facility. The smaller installations will feed into the grid and receive the net metering rate credited against the Tribe’s bills.

The project leverages private funds to help finance the solar systems. The private investor will leverage the federal solar energy investment tax credit as 99-percent owner but will provide those funds to the Sokaogon Chippewa community.

The Tribe formed the Sokaogon Solar Authority, LLC by working with Godfrey and Kahn law firm. The LLC then entered into an energy service agreement with the Tribe.

The Tribe negotiated a design-build agreement between the installer and its LLC that has a capped price, includes a 6-year warranty on parts, labor, insurance, roof analysis and indemnities. The installer obtains the interconnection approval. An important component of the contract with the installer for the Tribe is that it provides training and installation experience to Sokaogon Chippewa Housing Authority employees.

This project incorporates training and job opportunities for tribal members and substantial cost savings on electricity. In addition, the solar systems provide clean, emissions-free energy to help safeguard treaty fishing waters and sacred wild rice beds while moving the Tribe toward energy independence.

FOREST COUNTY POTAWATOMI COMMUNITY

The Forest County Potawatomi community installed 15 solar projects totaling 923 kW in 2016. Fourteen solar systems are on tribal buildings in Crandon. Almost half of the 923 kW is on the Milwaukee casino (see Appendix 1). The Tribe received a grant from U.S. Department of Energy that covered 50 percent of the cost and partnered with a private entity that was able to take advantage of the federal solar tax credit to fund the rest of the project. Based on this structure, before the project started, it was estimated that the tribe would have its investment paid

back in approximately 5 years. Early data show that the payback will be faster.



A 447.6 kW solar array on the Bingo Casino Event Center in Milwaukee



A 62.3 kW solar system on the tribe’s Forest County recreation center



FINANCING RESIDENTIAL & COMMERCIAL SOLAR

Solar Group Purchasing

Solar group purchasing is an approach that encourages solar installations through aggregating interested community members into a purchasing pool to obtain a reduced rate for solar systems and installation. This can reduce upfront costs (hard and soft costs) as much as 20 percent. In 2016, the average residential solar PV installation costs were \$3.50 per watt. They are predicted to drop as low as \$2.50 per watt in 2017.



Over 1,000 kW Generation

Group purchasing simplifies the solar purchase process by relieving homeowners and businesses of much of the research and work. Prospective purchasers are assisted with where to start, what to budget and whom to hire and are connected with incentives and financing solutions. They go through the process with other home and business owners in their community, which helps provide an impetus to act.

Local government can organize a solar group purchasing program or hire a third party to run it. It entails arranging for the education, coordination and bundling of solar electric orders of community members within a specified

timeframe and a competitive bidding process to get a bulk price from one or more providers on the solar equipment and installation.

Wisconsin municipalities bidding out solar group purchases have chosen to award contracts either to a single installer or to multiple installers. Table 1 shows the program partners structure, subscriber participation and distributed energy generation resulting from Wisconsin solar group buy programs.

THE CITIES of Milwaukee and Madison offer a Solar Energy Loan Program with Summit Credit Union and Focus on Energy to finance 100 percent of the cost of a solar system with a 15-year loan.

Further cost savings are available to governments, schools, businesses and homeowners through Focus on Energy. This Wisconsin public benefits program provides renewable energy incentives of 12 percent of the installed cost, up to \$2,000 in incentives on residential solar installations and up to \$4,000 for businesses. Additionally, businesses are eligible for the 30-percent Federal Investment Tax Credit for solar in 2017.



Dan Bucks at his home on Milwaukee’s East Side, a participant in Milwaukee Shines Solar Group Buy, a partnership between the City of Milwaukee and MREA



Milwaukee Shines Solar Group Buy “Solar Power Hour” information session at the Urban Ecology Center in Milwaukee

MREA (both photos)

Overall, more than 1,000 kW of distributed solar has resulted from solar group purchasing in Wisconsin (Table 1). The City of Milwaukee, working with The Midwest Renewable Energy Association, has conducted solar group buys in a variety of neighborhoods since

2013 as part of its Solar America City and SunShot program. Milwaukee’s solar group buy program is responsible for more than half the participants and installed solar generation in Wisconsin.

TABLE 1: Solar Group Buy Programs in Wisconsin

Program	Administrator	Co-Sponsor	Utility	Generation (kW)	Subscribers
<u>Milwaukee Shines</u>	City of Milwaukee	Midwest Renewable Energy Association	WE Energies	496	146
<u>Solar Chippewa Valley</u>	Chippewa Valley Affordable Solar*	Midwest Renewable Energy Association		185	31
<u>MadiSUN</u>	City of Madison	RENEW Wisconsin	Madison Gas & Electric	165	38
<u>SOLARacine</u>	Greening Greater Racine*	Current Electric and SunVest	We Energies	104	19
<u>Portage County Solar Group Buy</u>	North Wind Renewable Energy*		WPS	96	15
Total				1,046	249

*Solar Chippewa Valley, SOLARacine and Portage County Solar Group Buy are not administered by a local government

Solar Group Buy Program Case Studies

SOLAR GROUP BUY PROGRAMS 2016

In the second half of 2016, there were four active solar group buy programs in Wisconsin: Milwaukee Shines, MadiSUN, Solar Chippewa Valley and SOLARacine. Together, more than 120 households subscribed to install more than 488 kW of solar photovoltaics.



Residential solar system

PORTAGE COUNTY SOLAR GROUP BUY

The Portage County Solar Group Buy program in 2014 reported that it saved the system owner approximately \$1,000 in electric bills in the first year, plus it eliminates five tons of coal burning and nine tons of CO₂ emissions annually. It was not administered by a local government but by North Wind Renewable Energy (Table 1).

MOLE LAKE CHIPPEWA TRIBE APPLIES GRANT TO GROUP BUY

The tribal government of the Mole Lake Band of Lake Superior Chippewa was awarded a grant from the U.S. Department of Housing and Urban Development (HUD) to fund residential solar systems. The \$900,000 project will cover installation of ~270 kW of solar on roofs of approximately 50 houses in 2017. Current Electric is installing the systems as a sub-contractor of Sunvest Solar.

The Tribe’s goal is to reduce household electric costs by more than half. A net metering agreement with its utility, Wisconsin Public Service Corporation, will pay owners for the electricity they produce up to 20kW. Households could save even more than half their electric costs if they reduce their energy use by doing simple things like unplugging items not in use and turning off lights when they leave a room.

Community Solar Gardens

Community solar, also called solar gardens and shared solar, are large centralized solar arrays often owned, built and maintained by a utility in which individuals and businesses can buy shares. This allows broad access to solar power investments by anyone with a utility bill: those who don't own property, who live in a condo, who have inadequate solar access* or are unable or unwilling to make the major investment on their own property.

*Approximately 50 percent of residential and commercial electric customers cannot host PV systems (based on LiDAR data).

Investors normally receive a lower cost per watt due to the size of the community solar garden and reduction in the soft costs (development, labor, financing, legal, permitting, etc.). Participants pay an upfront price for their percentage of the system and installation then receive

Colorado passed the country's first Community Solar Gardens Act in 2010. The law has been replicated in 12 states.

utility bill credits (through virtual net metering) if they are grid connected, or some other form of compensation for electricity generated from their share of the solar system. Vernon Electric Cooperative posts monthly savings to solar garden investors per panel (see image below). MGE subscribers pay a locked-in rate for 25 years.

Community solar garden programs vary in the cost per share (from \$350-\$1,350 across WI) and the number of shares a participant can buy whether capped at half their electricity use or 100 percent. More community solar programs are coming on line as utilities respond to increasing customer demand for clean energy choices.

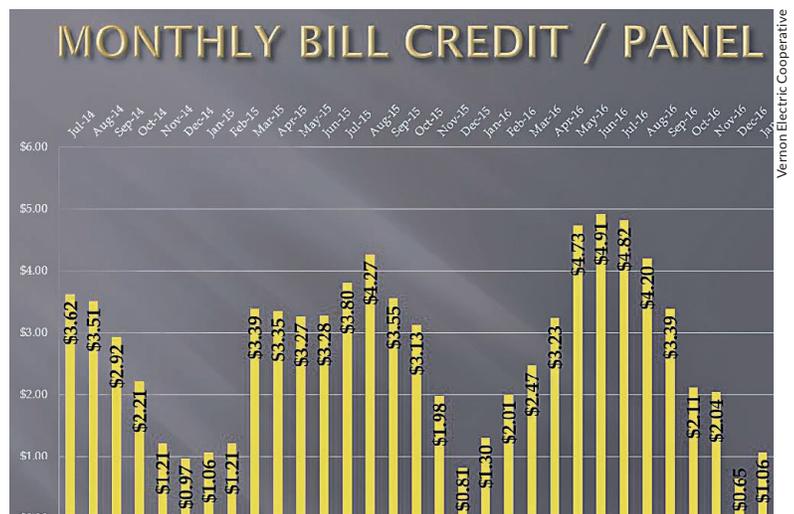
RATE STRUCTURE impacts the financial viability of distributed energy systems. La Farge Municipal Utility customers and those of other municipal utilities have been working to make the financials pencil out for a large community solar array. However, they are challenged with the substantial monthly fixed system costs the utility must pay its power suppliers.

System costs typically include long-term payments on capital additions of power plants and transmission. These costs must be subtracted from what the utility can afford to pay for locally produced solar power. In La Farge, this is lowering the economic value of the proposed solar facility effectively by one-third.

Utilities in many states have argued for increasing fixed charges to recover system costs as energy use flattens. Given that higher fixed charges are almost always accompanied by lower energy rates, studies show that this rate design weakens the price signals that reward customer investments in energy efficiency and self-generation. Electricity customers and advocates maintain that designing rates primarily around recovering past infrastructure investments hampers a utility's ability to respond to changes in load requirements and technological advances in a cost-effective manner.

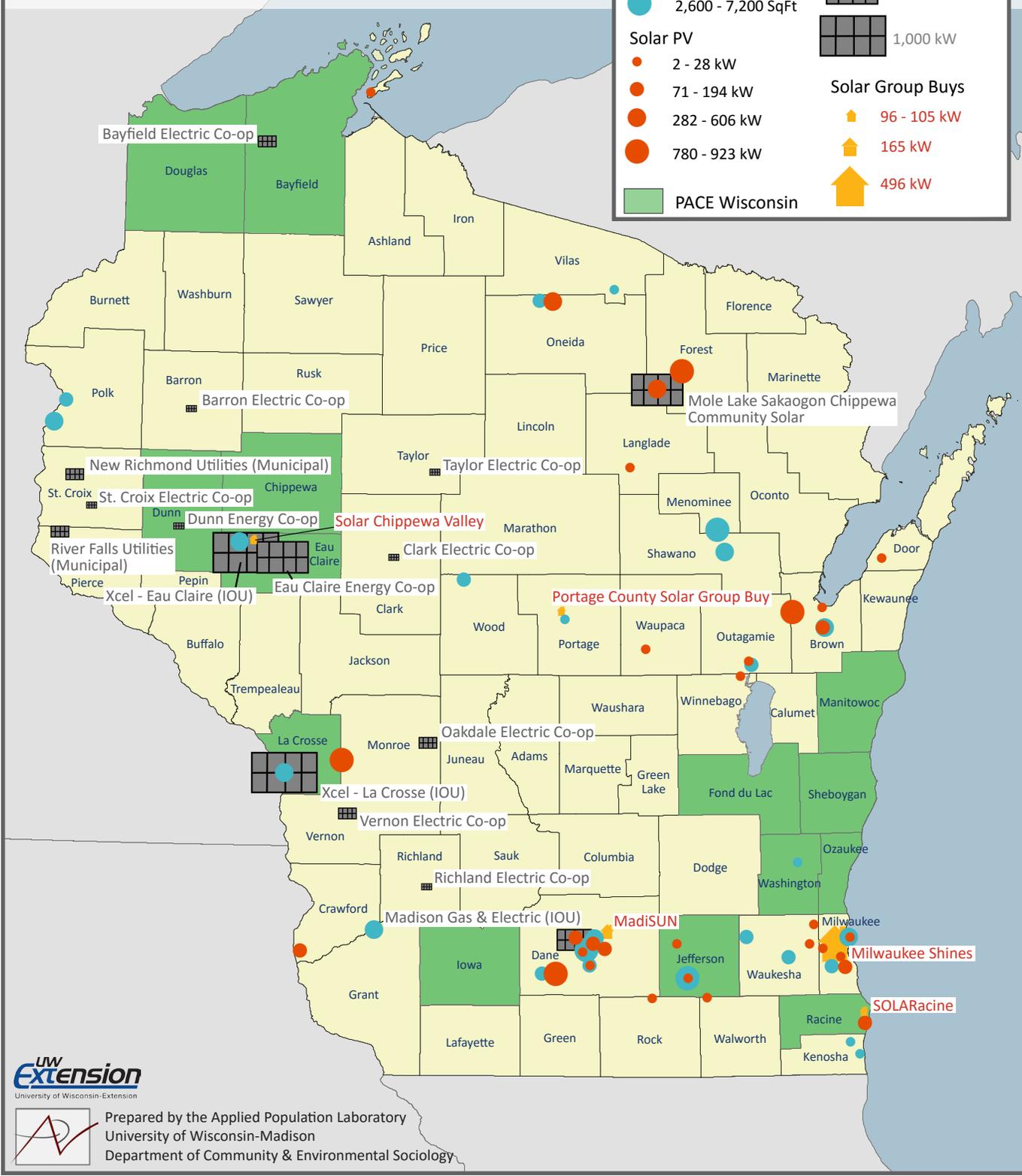
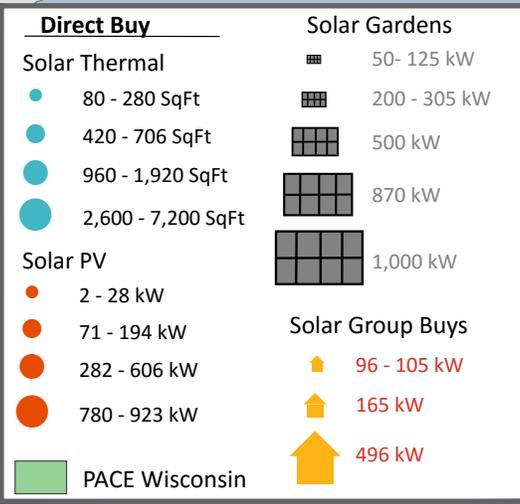
Possible income tax credits for resident-sited solar and solar garden subscribers

A recent change in the Internal Revenue Code Section 25D allows taxpayers to claim tax credits not only for residential solar installations on their property, but also for off-site solar gardens they have invested in **if the utility or developer hasn't claimed the tax credit.** Electric cooperatives that are nonprofit entities cannot claim the tax credit; therefore, their residential customers may be eligible. An [IRS Q&A publication \(pdf\)](#) provides official information.



Vernon Electric Cooperative's website posting of monthly savings to solar garden investors per panel.

The State of Wisconsin Solar: Local Governments, Tribes and Schools



Prepared by the Applied Population Laboratory
University of Wisconsin-Madison
Department of Community & Environmental Sociology

Including solar gardens, there are several variations of community solar programs in Wisconsin (illustrated in the case studies). The majority of programs are through electric cooperatives with a few through municipal utilities and investor-owned utilities (IOUs) (as shown on the map and in Table 2). Wisconsin's first Community Solar Farm was built by **Vernon Electric Cooperative** in 2014. New Richmond and River Falls have the only solar gardens by municipal utilities. **MGE's Shared Solar** located on the roof of the City of Middleton Municipal Operations



Vernon Community Solar Farm

Center and **Xcel's Solar*Connect Community Gardens** in La Crosse and Eau Claire (see case studies below) are the two community solar projects by investor-owned utilities.



Barron Electric Cooperative ribbon cutting for their "Community Rays" solar garden in 2015. More than 80 co-op members subscribed to the 100MW solar system.



Community Solar Case Studies

ST. CROIX SOLAR GARDEN

St. Croix Electric Cooperative, part of Dairyland Power, built a 103 kW community solar garden called **Sunflower 1** in 2014. One hundred-twenty co-op member subscribers paid for up to five, 500-watt production unit(s) and collect credits on their monthly electric bills from the



solar garden's output. The solar PV array produced 125,000 kWh of electricity in its first year. It is estimated to prevent 123 tons of CO₂ emissions annually and more than 3,000 tons over the course of 25 years.

SOLAR*CONNECT COMMUNITY SERVES EAU CLAIRE AND LA CROSSE

The City of Eau Claire, an Energy Independent Community, will have a 1 megawatt (MW) community solar garden by working with their utility Xcel Energy. It is sited on a reused part of an abandoned 26-acre city-owned landfill located next to Xcel's headquarters and close to area educational opportunities. The City of Eau Claire is leasing the land to the developer.

The Eau Claire garden and another 1 MW community solar garden by Xcel in La Crosse (also an Energy Independent Community), are called Solar*Connect Community.

The City of Eau Claire subscribed for 116 kW of solar electricity to fully offset the electric use at its public swimming pool. Eau Claire County, Stanley Boyd School



Solar Connect groundbreaking

District, Chippewa Valley Technical College, Village of North Hudson, Menominee School District and Fort McCoy are other public subscribers.

In addition to local government use, more than 20 businesses and 80 homeowners are subscribers. In La Crosse, Gundersen Health, Mayo and Marshfield Clinics have subscribed.

TABLE 2: Wisconsin Solar Gardens

Program	Utility	County	Municipality	System Size (kW)
<u>Community Rays</u>	Barron Electric Co-op	Barron	Barron	101
<u>BEC's Solar Garden</u>	Bayfield Electric Co-op	Bayfield	Iron River	300
<u>Clark Electric Solar Garden</u>	Clark Electric Co-op	Clark	Greenwood	53
<u>Dunn Energy Community Solar</u>	Dunn Energy Co-op	Dunn	Menomonie	100
<u>MemberSolar</u>	Eau Claire Energy Co-op	Eau Claire	Fall Creek	870
<u>SharedSolar</u>	Madison Gas & Electric	Dane	Middleton	500
<u>Community Solar Garden</u>	New Richmond Utilities (Muni)	St. Croix	New Richmond (C)	254
<u>SunnyOak Community Solar Garden</u>	Oakdale Electric Co-op	Monroe	Oakdale	200
<u>Transition Energy</u>	Richland Electric Co-op	Richland	Richland Center	125
<u>River Falls Community Solar</u>	River Falls Utilities (Muni)	Pierce/St. Croix	River Falls (C)	254
<u>Sunflower 1</u>	St. Croix Electric Co-op	St. Croix	Hammond	110
<u>Bright Horizons</u>	Taylor Electric Co-op	Taylor	Medford	96
<u>Community Solar Farm</u>	Vernon Electric Co-op	Vernon	Westby	305
<u>Solar*Connect Community</u>	Xcel - Eau Claire	Eau Claire	Eau Claire	1,000
	Xcel - La Crosse	La Crosse	La Crosse	1000
<u>Mole Lake Sokaogon Chippewa Community Solar</u>	WPS	Forest	Mole Lake Tribe	878

Legacy Solar Cooperative Model

Another financing model is the **Legacy Solar Co-op** approach. Legacy Solar projects are solar energy installations built on community institutions like schools, libraries, food co-ops and houses of worship. This tax financing model also doubles as a community solar garden approach, but instead of a bill credit for participating, members of the co-op buy “Slice-of-Sun” subscription bonds and receive their “virtual net-metering” payback in the form of annual principal and interest payments from the co-op. Note that the municipality does not offer these bonds; they are available through Legacy Solar Co-op.

The co-op takes the bond receipts and makes a single secured loan to a solar project that is co-owned by the host site and a third-party business (tax financing party) that is set up specifically for that project. Municipal buildings can serve as host sites. The tax financing party provides all installation and maintenance for the solar array for the first six years. In exchange, the municipality

buys Solar Renewable Energy Certificates (SRECs) from the project so the local government can claim the environmental benefits of the project and demonstrate progress toward their 25 x '25 Energy Independence goal and other sustainability goals.

The municipality reaps the energy bill savings. Just as with third-party ownership, the business can transfer ownership of its portion to the municipality at any time. Usually, this occurs after 6 years to maximize municipal savings through the efficient use of the tax benefits of the solar equipment. Once ownership has been transferred, the municipality keeps all of the energy bill savings generated from the project going forward.

LEGACY SOLAR CO-OP BONDHOLDERS provide funding toward their institutions' own solar installation that continues beyond that project, becoming part of a revolving loan fund supporting other Wisconsin solar projects.

PACE Financing

Property Assessed Clean Energy (PACE) financing is a local economic development tool used by municipalities to help fund the upfront costs of energy efficiency, renewable energy and water conservation upgrades by property owners without taxpayer assistance. PACE programs use a property tax repayment method that is long-term, allowing the payment to be transferred with the property even when it is sold.

PACE enables businesses to make costly equipment upgrades with no upfront cost and often allows businesses to realize monthly savings in energy costs beyond the cost of paying back the loan. PACE programs stimulate investments, increase property values, improve local building stock and create local jobs.

PACE Wisconsin is a unified statewide program that allows counties and municipalities to work with private lenders to provide financing to property owners with qualified projects. A PACE Commission, administered by a third party – Wisconsin Energy Conservation Corporation (WECC) Energy Finance Solutions – provides little to no cost or risk to municipalities.

Municipalities join the PACE Commission, participate

in its governance, and agree to support the statewide PACE program. The PACE administrator is responsible for handling day-to-day PACE financing application reviews and approvals, as well as payment collections on behalf of the PACE Commission.

The program is providing financing for commercial projects initially. It may expand to residential projects at a later time.

FOURTEEN WISCONSIN COUNTIES passed PACE resolutions beginning in 2016 to become part of Wisconsin PACE (see Page 13 map) and are able to offer financing for energy efficiency, renewable energy and water conservation:

BAYFIELD	JEFFERSON
CHIPPEWA	LA CROSSE
DOUGLAS	MANITOWOC
DUNN	OZAUKEE
EAU CLAIRE	RACINE
FOND DU LAC	SHEBOYGAN
IOWA	WASHINGTON

In addition, the City of Milwaukee has an established [Milwaukee Commercial PACE Financing program](#).

Green Power Purchase

Purchasing renewable energy certificates (RECs) from solar, wind and geothermal providers is a legitimate way for local governments, individuals, businesses and organizations to offset their fossil fuel energy use with clean renewable energy. There are many companies that provide clean energy RECs in the marketplace nationwide. Look for **green-e certified** programs; they are third-party verified by the nonprofit Center for Resource Solutions.

Ethos Green Power in Viroqua, WI, is a local certified option that purchases renewable energy from small and medium generators mostly in Wisconsin. Customers continue to pay their bill to their utility as usual and buy RECs from

Ethos for green power. A short video on the [Ethos home page](#) shows how buying green power works.

Some Wisconsin utilities provide **green pricing programs** that enable customers to offset some or all of their electric use with green power. Wisconsin utilities with green-e certified pricing programs are Alliant's Second Nature™, We Energies Energy for Tomorrow and Stoughton Utilities' Renewable Energy Program. Wisconsin Public Service has two programs: NatureWise and SolarWise for Schools. Madison Gas & Electric's program is Green-Power Tomorrow. Touchstone Energy Cooperatives has an Evergreen program that includes energy from landfill gas and livestock manure along with solar and wind in the mix of "green power."

WISCONSIN UTILITIES RANK FOR GREEN POWER PROGRAMS: Xcel and We Energies were among the top 10 utilities nationwide for green power program participants in 2015. MGE and Stoughton Utilities were in the top 10 for both green power participation rate and sales rate.

(Top 10 Utility Green Power Programs, NREL, 2015)



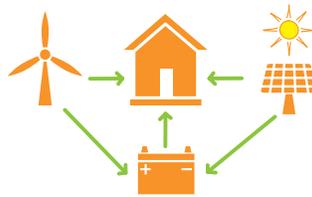
MICROGRIDS

Flexible Power Sources & Connectivity

Microgrids are local grids containing energy sources and loads that are capable of operating with or without the utility grid. Microgrids typically utilize a variety of local renewable sources such as solar PV, solar thermal, wind and geothermal and have an energy storage system.

Microgrids are more efficient than the larger grid because they use local energy locally, avoiding losses from transmission and distribution. By operating independently from and cooperatively with the utility grid, microgrids improve energy resilience when the grid is down.

Traditionally, microgrids were used in remote areas, but more recently communities have become interested in microgrids as a system to safeguard energy delivery in potential severe climate disaster situations. Utilities are interested in microgrids' potential to aggregate and integrate distributed energy resources into their larger



systems. Microgrids can be funded as third-party, in an integrated utility model or as an unbundled hybrid of third-party and integrated utility models.

The Madeline Island Microgrid is the first Wisconsin municipal planned microgrid under development. UW-Madison's Wisconsin Energy Institute has a **micro-grid facility** for research.

In Milwaukee, Century City Microgrid is being developed through a partnership between General Capital Group, the City of Milwaukee, UW-Milwaukee, Mid-West Energy Research Consortium (M-WERC), We Energies and the Electric Power Research Institute (EPRI). The City of Milwaukee is supportive of the development of the first industrial-scale microgrid in the country so that the city can become a national center for expertise in microgrid technology. Century City Microgrid represents an economic development thrust to build an industry cluster and capitalize on market growth that is expected to triple to more than \$3 billion per year by 2019.

Microgrid Case Study

MADLINE ISLAND PLANNED MICROGRID

Madeline Island's first PV system of their planned microgrid went online in the Town of La Pointe in May 2016. The 18.2 kW array provides more than 100 percent of the electricity for the town's library and medical clinic.

The system is grid-connected through Xcel Energy so the excess electricity produced feeds into the grid. That solar system will be expanded to provide electricity to the town hall and will be connected to the grid as well. However, La Pointe plans to install battery storage and the controls needed for their solar electric systems to operate independently when the grid goes down. When storage capacity is in place, the system will be a true microgrid.

The project was supported with \$75,000 from the U.S. Department of Energy with funds administered by the Office of Energy Innovation (formerly State Energy Office), with \$20,000 in matching funds by the Town's Library



Chequamegon Bay Renewable Energy Resources

The Madeline Island Resiliency Project installed the first solar array in the Town of La Pointe in 2016 and plans are to plant a pollinator garden under the array and to install battery storage at a later time so that it becomes a microgrid

Board, and \$4,800 from Focus on Energy. North Wind Renewable Energy LLC of Stevens Point installed the solar array.



GOVERNMENT ACTIONS THAT FACILITATE SOLAR

Streamlined Permitting/Inspection

Soft costs in the United States constitute more than half of a typical rooftop solar system's costs. These include sales, permitting, inspection, zoning and connection to the utility grid. Streamlining permitting and processes for solar installation can help bring down costs. Use the [Grow Solar checklist \(pdf\)](#) as a useful tool to get started.

To help bring down soft costs of solar installation, local governments can:

- ✦ Develop an expedited process for solar permitting and installations.
- ✦ Provide simple forms and online applications and paperwork submittal.
- ✦ Simplify the review process.
- ✦ Work with neighboring communities or countywide to adopt standardized permitting procedures.
- ✦ Establish a working relationship between the municipal code official and the utility to expedite connection and inspection.

Wisconsin municipalities can tap into more resources to support solar deployment through the [Grow Solar Partnership](#). This initiative, led by the Midwest Renewable Energy Association locally and funded through the U.S. Department of Energy, is designed to help bring down the soft costs of solar in Wisconsin, Minnesota, Illinois and Iowa.

The partnership can help communities tap into resources and opportunities to improve solar processes in three specific areas: permitting (including inspection trainings), zoning and financing solutions.

Land Use Planning for Solar Siting

As utility-scale solar projects that are 1 MW or larger are becoming more common, it is prudent to integrate solar facilities into the existing municipal land use framework so that it complements other planning objectives with regard to protecting natural and cultural resources. Local and tribal governments can set aside land – typically land that is marginal for other uses, as sites for future solar system development. As part of local land use planning and zoning, assess the availability of municipal and tribal land with regard to distance to a power substation to optimize grid interconnection, for land use qualities and stormwater management.

To promote sustainable land use and realize solar electric generation goals, local governments can encourage solar siting on rooftops first, then consider locating projects in areas already developed or disturbed such as on brownfields, landfills, abandoned mining/quarry sites, and impervious areas. Avoid wetlands, productive farmland, parkland, critical ecosystems or land identified for affordable housing.

In land use ordinances, municipalities can designate solar development as a non-permitted use in a particular zone, and as a permitted use or as a conditional use in others. Designate appropriate parcels for eventual solar electric development and storage (for future microgrid).



SOLAR PERMITTING is a process for obtaining the appropriate permits to install solar. To install a grid-connected PV system, the homeowner or builder must obtain an electrical permit and in some cases a building permit from the local government. The installation must also be inspected when complete. Solar water heating systems require a plumbing permit and sometimes require a building or mechanical permit or both.

Solar-Ready Buildings

Local governments can provide guidelines to encourage that new homes and commercial buildings be designed and built so they are positioned to optimize solar orientation and roof space for solar panels. This preserves the opportunity for solar later and at a much reduced cost. Guidelines can include factors such as energy efficiency (creating an energy efficient building reduces the amount of solar needed to offset electricity use), roof slope, structural support for solar panels and strategic clustering of rooftop heating, ventilating and air conditioning (HVAC) units.

Demonstration Projects/Installations on Government Property

Local governments can lead by example by installing solar on government buildings and land and publicizing the project. Utilize local community groups, related government committees, businesses and other stakeholders to help research options and funding opportunities and to engage the community.

Education & Outreach

The main techniques to ensure community buy-in are capacity-building events and awareness-raising activities. Harness a network of stakeholders and others to assist:

- ✦ Invite banks and other financial institutions to work on new approaches to providing financial resources in support of solar systems and potentially of start-up enterprises related to solar.

- ✦ Host education forums or workshops where solar installers, renewable energy organizations, Focus on Energy, UW-Extension, utilities and nonprofit energy organizations present to residents and businesses and local officials and answer questions.
- ✦ Provide recognition as an incentive for builders and developers that incorporate energy efficiency and renewable energy in building projects.
- ✦ Publicize the solar-related activity in the community in a variety of ways and regularly such as on the local government website, in marketing materials, in the news, at schools and at events.



Fitchburg residents learn about solar options

Sherrie Gruder

Sample permitting resources:

- [Milwaukee Shines Solar Electric Permitting Process Guide \(pdf\)](#)
- [City of Milwaukee Electrical Permit](#)
- [City of Milwaukee Plumbing Permit](#)
- [City of Milwaukee Building Permit](#)
- [Expedited Solar Permit \(Word file\)](#)

CONCLUSION

The state of Wisconsin solar is robust with local and tribal governments of all sizes installing solar systems on their own roofs and land and assisting their businesses and residents with solar acquisition locally. Using a variety of financing approaches to achieve success, local governments and tribes across the state are actively engaged in furthering clean energy locally. They are investing in solar energy systems tailored to meet their power and financial needs and are partnering with a variety of public, private and not-for profit partners to create robust local solar markets.

Schools are using a number of financing methods to install solar systems and build awareness and knowledge in their students and the community, reduce costs and foster career opportunities in the solar industry.

Our research has uncovered multiple paths and sources used by Wisconsin municipalities, tribes and schools to finance solar development that reduce risk and costs and enable their residents and businesses to invest in solar as well.

RESOURCES

Better Communities, US DOE

DSIRE - State, local, utility and federal incentives and policy database

Local Government Solar Toolkit: Planning, Zoning and Permitting, Grow Solar, 2015

Power Purchase Agreement Checklist for State and Local Governments, NREL, 2009

Power Through Partnerships: Brown County and the Oneida Tribe Working Toward Energy Independence, (video) UW-Extension, 2013

Profiles In Regional Solar Planning: A Handbook And Resource Guide, NARC, U.S. DOE

Solar Power Purchase Agreements: a Toolkit for Local Governments, IREC, 2015

ORGANIZATIONS Many organizations provide funding, technical assistance, education and networking in the renewable energy arena. Some are listed below (this is not an exhaustive list).

Energy On Wisconsin – A collaboration of the University of Wisconsin Cooperative Extension and Wisconsin Office of Energy & Innovation, provides technical assistance, education and funding to further progress toward sustainable energy practices by Wisconsin communities, businesses, farms and the public.

Focus on Energy – Wisconsin’s public benefits program works with eligible Wisconsin residents and businesses to install cost-effective energy efficiency and renewable energy projects. Customers of utilities that have opted into the Focus program are eligible for assistance and incentive funding.

Grow Solar – An initiative of the Midwest Renewable Energy Association, funded by the U.S. Department of Energy, Grow Solar coordinates efforts among Midwest organizations and municipalities to build an open and advantageous solar market that provides long-term benefits to communities in WI, IL, MN and IA. Specifically, Grow Solar provides information, training and assistance with planning, zoning and permitting.

The Midwest Renewable Energy Association – Promotes renewable energy, energy efficiency and sustainable living through education and demonstration.

RENEW Wisconsin – An advocacy group that represents businesses, organizations and individuals conducting renewable energy business in Wisconsin.

Solar Energy Industries Association (SEIA) Midwest State Committee – A national trade association in the U.S. that represents all organizations that promote, manufacture, install and support the development of solar energy.

Solar Legacy Co-op – A Wisconsin member cooperative focused on customer-based energy savings on solar power projects.

Solar Outreach Partnership (SolarOPs) – Funded by the U.S. Department of Energy SunShot Initiative, SolarOPs is designed to help accelerate solar energy adoption on the local level by providing best practices, resources and technical assistance to local governments.

SolSmart – Provides national recognition and a no-cost technical assistance program for local governments designed to drive greater solar deployment and help make it possible for even more American homes and businesses to access affordable and renewable solar energy to meet their electricity needs. Sign up for a SolSmart Advisor.

SunShot – This U.S. Department of Energy initiative is a national effort to drive down the cost of solar electricity and support solar adoption.

U.S. DOE Office of Energy Efficiency and Renewable Energy (EERE) – The mission of EERE is to create and sustain American leadership in the transition to a global clean energy economy. EERE provides many resources, programs and funding to assist local governments and others with energy efficiency and renewable energy.

Utilities – Utility provider information is listed on the Public Service Commission of Wisconsin website:
psc.wi.gov/apps40/utility/default.htm

Wisconsin Counties Association – An association of county governments assembled for the purpose of serving and representing counties. WCA is a key partner in the PACE Wisconsin program.

Wisconsin Energy Conservation Corporation (WECC) – WECC partners with utilities, local and state governments, regulatory agencies and other organizations to design and implement innovative energy efficiency and renewable energy programs. WECC’s Energy Finance Solutions administers the PACE Wisconsin program.

Wisconsin Office of Energy & Innovation – Assists businesses, local governments and citizens by promoting and investing in clean energy projects that are cost-effective, balanced, reliable and environmentally responsible. The office provides assistance with energy related issues and inquiries; an annual state energy statistics report; assistance with coordinated responses to energy emergencies; and assistance to the transportation industry to reduce fuel expenses.

APPENDIX 1: Municipal/Tribal/School Solar Electric Projects (Direct Buy)

C = City T = Town V = Village

Municipality	Project	County	Utility	Size (kW)
Antigo School District	High School	Langlade	Wisconsin Public Service (WPS)	12.0
Brookfield (C)	Public Safety Building	Waukesha	We Energies	11.0
Brown County	Kress Library	Brown	WPS	20.7
	Aging and Disability Resource Center			15.0
	Sheriff's Office			22.6
	Weyers-Hilliard Library			5.6
	Fairgrounds			21.2
	Barkhausen Waterfowl Preserve			21.2
Brussels School District	Southern Door High School	Door		12.0
Dane County	Regional Airport Maintenance Facility	Dane	Madison Gas & Electric (MGE)	10.0
	Fen Oak UW-Extension			34.5
	Alliant Energy Center			770.0
	Jobs Center			
	Medical Examiner's Office			-
	Highway Garage			64.8
Edgerton (C)	City Hall	Rock	Alliant Energy	12.9
Fitchburg (C)	City Hall	Dane	MGE	12.3
	Public Works Maintenance Facility			9.9
Fort Atkinson School District	Purdy Elementary School	Jefferson	We Energies	19.7
Fox Crossing	Municipal Building	Winnebago		28.0
Green Bay School District	East High School	Brown	WPS	12.0
Greenville (T)	Town Hall	Outagamie	We Energies	13.1
Ho-Chunk Tribe	Housing and Community Development Agency Building	Monroe	Alliant Energy	780.0
Lake Mills School District	High School	Jefferson	Lake Mills Utility	10.0
Lakeland Union High School	Field House	Oneida	WPS	282.5
La Pointe (T), Madeline Island	Library and Medical Clinic	Ashland		18.2
Madison (C)	Alicia Ashman Library	Dane	MGE	7.1
	Demetral Landfill			6.3
	Engineering Operations Facility Garage			18.7
	Engineering Operations Facility Office Buildings			4.2
	Goodman Pool Shade Canopy			2.1
	Greentree Landfill			6.3
	Fire Department Station 13			25.0
	Police Department Training Center			19.1
	Police Department East District Station			9.6
	Public Library Central			18.7
	Streets East Garage			9.4

APPENDIX 1 (CONTINUED): Municipal/ K-12 School Solar Electric Projects (Direct Buy)

Municipality	Project	County	Utility	Size (kW)
Madison (C) [Continued]	Streets Waste Transfer Station	Dane	MGE	10.6
	Traffic Engineering Building C			8.7
	Warner Park Community Recreation Center			6.3
	Water Utility Office Building			9.8
	Water Utility Vehicle Storage Building			9.8
	Water Utility Well 9			5.7
	Yahara Hills Golf Course			18.6
Madison School District	Memorial High School (Solar Shade Canopy)	Dane	MGE	2.4
	All Madison High Schools			-
Menomonee Falls School District	North Middle School	Waukesha	We Energies	24.8
Middleton (C)	Police Station	Dane	MGE	97.0
Milwaukee (C)	Central Repair Garage	Milwaukee	We Energies	20.0
	Metropolitan Sewerage District			20.0
	Public Library			31.5
	Recycling Education Facility			10.1
Milwaukee School District	Shalom High School			14.8
Mole Lake Band of Lake Superior Chippewa	Casino Lodge	Forest	WPS Sokaogon Solar Authority	105.7
	Casino Central			26.4
	Casino North/Bingo			75.2
	Wastewater Treatment			47.5
	C-Store			47.5
	New Health Center			44.9
	Family Services			35.6
	Wood Inc./Roads Building			26.4
	Youth Rec Center			26.4
	Elder/Senior Center			59.7
	Tribal Administration			23.8
	Apartment Complex			16.5
	Housing Maintenance Building			15.8
	Recycling Building			11.9
	Fish Hatchery Building			11.9
	New Food Distribution Building			11.9
Cultural Building	11.9			
Housing Office	7.3			
Monona (C)	City Hall	Dane	MGE	25.0
	Public Library			47.0
	Public Works Garage			56.0
	Public Works Dept. Well No. 3			28.7

APPENDIX 1 (CONTINUED): Municipal/ K-12 School Solar Electric Projects (Direct Buy)

Municipality	Project	County	Utility	Size (kW)
Oneida Tribe of Indians of Wisconsin	Food Distribution Center/Pantry	Brown	WPS	11.0
Oneida Tribe of Indians of Wisconsin (2017 installations)	Health Center			800.0
	Activity Center of Casino			
	Food Distribution Center/Pantry			
	Rec Center			
	Elder Service Apartments			
	Anna John Resident Centered Care Community			
Forest County Potawatomi Tribe	Air Monitoring Site	Forest		12.5
	AODA			12.4
	Assisted Living Facility			86.5
	Family Resources Center			23.6
	Gte Ga Nes Preschool			24.8
	Museum			49.6
	Land and Natural Resources			22.0
	Potawatomi Tribe Ordinance			9.0
	Property Management			24.8
	Recreation Center			62.3
	Rising Sun Daycare			24.8
	Solid Waste			19.5
	Stone Lake Convenience Store			80.6
	Potawatomi Tribe Utilities			23.0
	Potawatomi Hotel and Casino	Milwaukee	We Energies	447.6
Prairie du Chien School District	High School	Crawford	Alliant Energy	70.5
Racine (C)	City Hall Annex Building	Racine	We Energies	75.0
Shorewood School District	Middle and High School	Milwaukee	We Energies	14.8
Waupaca School District	High School	Waupaca	WPS	17.3
Wauwatosa (C)	Fire House	Milwaukee	We Energies	11.6
Whitewater (C)	Innovation Center	Walworth		22.0
TOTAL				5,341.7

APPENDIX 2: Municipal/Tribal/School Solar Thermal Projects

C = City T = Town V = Village

Municipality	Project	County	Size (Square Feet)
Boscobel (C)	Boscobel Pool	Grant	1,008
Brown County	Community Treatment Center	Brown	1,123
	Jail		120
Dane County	Public Safety Building	Dane	640
Eau Claire (C)	Park Towers Housing Project	Eau Claire	1,700
Fitchburg (C)	City Hall	Dane	480
Fort Atkinson School District	Middle & High School	Jefferson	3,200
Kenosha School District	Kenosha School District	Kenosha	280
La Crosse (C)	Law Enforcement Center	La Crosse	1,280
Lakeland Union School	High School Pool	Oneida	-
Madison (C)	Henry Vilas Zoo	Dane	64
	Fire Department (13 buildings)		1,497
	Madison Streets West Office Building		120
Madison School District	East High School Pool		1,800
	LaFollette High School Pool		1,800
	Memorial High School Pool		1,800
	West High School Pool		1,800
Marshfield (C)	Fire Department	Wood	540
Menominee Tribe	Menominee Indian Tribe	Menominee	2,600
Milwaukee (C)	Cameron Yard Water Works	Milwaukee	-
	Fire Department Stations #4,5,13,23,35,36		-
Northland Pines School District	Northland Pines School District	Vilas	240
Oconomowoc (C)	Fire Department	Waukesha	706
Oneida Tribe of Indians	Anna John Resident Centered Care Community	Brown	1,920
Osceola School District	Middle School	Polk	1,280
Outagamie County	Regional Airport	Outagamie	480
Shawano School District	High School Pool	Shawano	960
Shorewood School District	High School and Fitness Center Pools	Milwaukee	1,920
Sommers (T)	Fire Department	Kenosha	80
St Croix Falls (C)	Public Library	Polk	-
Waukesha (C)	DMV	Waukesha	420
West Bend School District	High School	Washington	200
Whiting (V)	Wastewater Treatment Plant	Portage	256

APPENDIX 3: Fitchburg West Fire Station Solar Study with RFP Recommendations

Fitchburg West Fire Station Solar Study with RFP Recommendations

February 2017 (Project Pending)

Submitted by Legacy Solar Cooperative

Executive Summary:

The City of Fitchburg is interested in developing solar-electric ‘photovoltaic’ arrays on city properties at the best possible price to maximize progress toward its 25 x 25 Pledge (to procure 25% of the City’s energy from renewable resources by 2025.)

The property currently under consideration is the new West Fire Station on Marketplace Drive in MGE territory. This report concludes that the roof space and the intended loads for this property should be able to accommodate a 100 kilowatt (kW) solar array. This translates into approximately 300 solar panels (330-350 Watts/panel) .

The most expensive way to develop this project would be for the City to buy all of the equipment and forego the tax credit and depreciation that is available to tax-paying entities. A low estimate for the cost of a 100 kW array would be approximately **\$200,000.00**

Feasibly, the least expensive way to develop (and own) the array would be to use a Tax Financing model that allows for an entity other than the City to own *a portion* of the project for the first 5 tax years (6 contract years). After that, the City can buy out the unowned portion of the solar project at a depreciated Fair Market Value, in this case, estimated to be 60% of the up-front cost.

Example: If the City decides to invest **\$50,000** into this project up front, the City would own approximately 25% of the equipment for this 100 kW array. A Tax Sponsor would be responsible for making up the remainder of the costs, and would provide all installation and maintenance for the solar array for the first 6 years. In exchange, the City buys from the project the Solar Renewable Energy Certificates (sRECs) for a price negotiated to be approximately 25% of the value of the energy savings achieved in year 1. This enables the Tax Sponsor to meet regulatory and financial obligations and be able to use the tax benefits for owning 75% of the project. After 6 years, the City can buy out this portion at approximately 60% of the Tax Sponsor’s cost, about \$90,000, making the overall cost to the City approximately **\$140,000 instead of \$200,000.*** A savings of 30% with a projected payback of 5 years after the ownership flip point, or 11 years from the start. 25-year net cost savings (after capital and contract costs) are projected at over \$300,000.00 using a 3% rate hike per year assumption for MGE costs.

Environmental benefits coming from this project alone would amount to more than **5 million pounds** of reduced carbon footprint, **55 kilograms of reduced mercury** toxins from the air, a combined **100,000 pounds of reduced Nitrogen and Sulfur Oxides** from the air, approximating the air cleaning effects of over 2 million trees, and conservation measures protecting over **60 million gallons of water** and that’s just in the first 25 years.

The final two sections of this report concern the “Community Solar” nature of this model and the important elements and decision-points relating to the City’s procurement of services for this project.

GLOSSARY

MEASURES

Watt (W) – Standard unit of power, equivalent to one joule per second. It is the product of voltage and current (amperage).

Kilowatt (kW) – One thousand watts of electrical power.

Megawatt (MW) – 1,000 kilowatts, or one million watts of electrical power.

Kilowatt-hour (kWh) – A unit of electrical energy, equivalent to the consumption of 1,000 watts of energy for one hour. Electric bills show the amount of energy used in kWh. A typical household uses 650 kWh per month.

Therm – A unit for quantity of heat energy equal to 100,000 British Thermal Units (Btu) = 1.054×10^8 joules. A therm is the energy equivalent of burning 100 cubic feet (1 CCF) of natural gas.

Behind the meter – An electrical system that produces electricity to flow directly to the building consuming the power rather than directly onto the larger electrical utility grid.

Customer-sited distributed generation – Distributed generation technologies like PV installed on a utility customer's property.

Distributed energy – “On-site” solar systems (also small wind, methane digesters and micro-turbines), on residential, community and public roofs, structures and land, are most often “distributed” generation because they are connected to the distribution grid of poles and wires that transport electricity from substations. The electricity generated by the PV system can supply energy on-site first, with any excess fed back into the grid. When the customer needs additional electricity, it is supplied by the grid.

Electrical grid – An integrated system of electricity distribution, usually covering a large area.

Electricity – Energy resulting from the flow of charge particles, such as electrons or ions.

Electricity distribution system – The portion of the electricity grid that distributes lower voltage electricity from high-voltage transmission lines to individual homes and businesses.

Energy Independent Communities – More than 140 Wisconsin local governments having passed Energy Independent Community resolutions beginning in 2008. These communities have adopted the goal of generating 25 percent of their energy for local government operations (buildings, infrastructure and fleet) from renewable sources locally by 2025 (or 25 x '25).

Interconnection – The process of connecting an electricity-producing technology (such as a PV system) to the electricity grid.

LEED (Leadership in Energy and Environmental Design) – Developed by the U.S. Green Building Council, LEED is a voluntary, consensus-based national rating system for developing high-performance sustainable buildings.

Levelized Cost of Energy (LCOE) – The cost of energy of a solar system that is based on the system's installed price, its total lifetime cost, and its lifetime electricity production.

Microgrids – Local grids containing energy sources and loads that are capable of operating with or without the utility grid.

Net metering – Net metering or net energy billing allows renewable energy system owners (homeowners, businesses, schools, churches, etc.) to sell the excess electricity they generate on their property to their utility at a retail rate and receive credit on their utility bills for it. Wisconsin allows net metering only for systems up to 20 kilowatts (kW) by municipal and investor-owned utilities (does not apply to electric cooperatives). However, some utilities allow net metering for systems larger than 20 kW including NSP and MGE at 100 kW, and We Energies at 300 kW (see DSIRE). To learn what the net metering payback is for each of Wisconsin's utilities, consult Wisconsin Public Service Commission (PSC).

Forty-three states and the District of Columbia have net metering in place (DSIRE 2013). In at least 34 of those states, customers are credited for net generation at the full retail rates of electricity, not the lower wholesale rates (DSIRE 2014a). This is an important issue impacting the economics and growth of distributed solar.

Photovoltaic (PV) – A type of solar system that produces electrical current from sunlight. Photovoltaic cells or solar cells are made from semiconductor materials that immediately convert light into electrical energy.

Photovoltaic (PV) panel (often used interchangeably with PV module) – A physically connected collection of modules (i.e., a laminate string of modules used to achieve a required voltage and current).

Photovoltaic (PV) array – An interconnected system of PV **modules** that function as a single electricity-producing unit. The modules are assembled as a discrete structure, with common support or mounting. In smaller systems, an array can consist of a single module.

Renewable energy – Energy coming from resources that naturally replenish themselves and are virtually inexhaustible. Such resources include biomass, hydropower, geothermal, solar, wind, ocean thermal, and wave and tidal action.

Renewable Energy Certificate or Credit (REC) – A REC represents the property rights to the environmental, social, and other nonpower qualities of renewable electricity generation. A REC and its associated attributes and benefits can be sold separately from the underlying physical electricity associated with a renewable-based generation source. Solar RECs are sometimes called SRECs.

Revolving loan fund – A source of money from which loans are made. As loans are repaid, funds become available for new loans.

Solar access – The ability of one property or area to continue to receive sunlight without obstruction from a nearby home or building, landscaping, or other impediment.

Solar energy – Electromagnetic energy transmitted from the sun (solar radiation). The amount that reaches the Earth is equal to one billionth of total solar energy generated, or the equivalent of about 420 trillion kilowatt-hours.

Solar Power Purchase Agreement (PPA) – A contract to buy solar power based on a set rate from a third-party.

Solar Renewable Energy Credits (SRECs) – These credits show that a certain amount of electricity was produced using solar energy. An SREC is created for every megawatt-hour of solar electricity produced. Typically, they are bought and sold by regulated utilities. In the case of a power purchase agreement, they are often owned by the solar developer. SRECs are sold separately from the electricity they produce.

Solar resource – The amount of solar insolation a site receives, usually measured in kWh/m²/day, which is equivalent to the number of peak sun hours.

Solar system – An electrical system that generates heat or electricity from energy that comes from the sun – solar power. Solar systems are either photovoltaic or solar thermal.

Solar water heating or solar thermal – A solar system that uses solar radiation (heat from sunlight) to heat water directly or through a heat-transfer fluid in a collector. The heat-transfer fluid is chosen based on its ability to prevent freezing. Most solar thermal systems need a well-insulated storage tank, and systems can either be active, which have circulating pumps and controls, or passive, which do not.

Tilt angle – The angle at which a photovoltaic array is set to face the sun relative to a horizontal position. The tilt angle can be set or adjusted to maximize seasonal or annual energy collection.

Tracking array – A photovoltaic (PV) array that follows the path of the sun to maximize the solar radiation incident on the PV surface. The two most common orientations are (1) one axis where the array tracks the sun east to west and (2) two-axis tracking where the array points directly at the sun at all times. Tracking arrays use both the direct and diffuse sunlight. Two-axis tracking arrays capture the maximum possible daily energy.

Value of Solar (VOS) Tariff – A rate design alternative to net metering that separates how much energy is consumed by a customer from how much is produced and the rate at which the energy is valued. The rate (\$/kilowatt hour) customers are reimbursed for the solar energy they put on the grid includes its net costs as well as the benefits or “value” of solar. The value accounts for factors such as avoided transmission investments, the favorable health and environmental impact of clean energy and the ability to help the electric grid meet large demand on sunny days when extra power is often needed. VOS tariff compensation is based on utility-specific benefits and costs for electricity generation rather than on fixed regional retail rates. Austin, Texas is the first city and Minnesota is the first state to adopt the value of solar rate. California is moving to it.

“Virtual” net metering – This metering allows households to take advantage of solar generation that is not directly connected to their electricity meters. Such policies allow customers in multifamily buildings to take advantage of solar generated from one meter on the building or allow electricity customers to subscribe to electricity generated from a larger off-site solar system – or even own it outright – and apply the solar generation as a credit on their electricity bills.

Solar Energy Financing **GUIDE**



Empowering **Wisconsin** Local Governments

Vernon Electric Cooperative



Vernon Electric Cooperative uses sheep to mow the grass around its community solar garden

For more information please contact: UW-Extension. Visit Energy On Wisconsin at energyonwi.uwex.edu

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