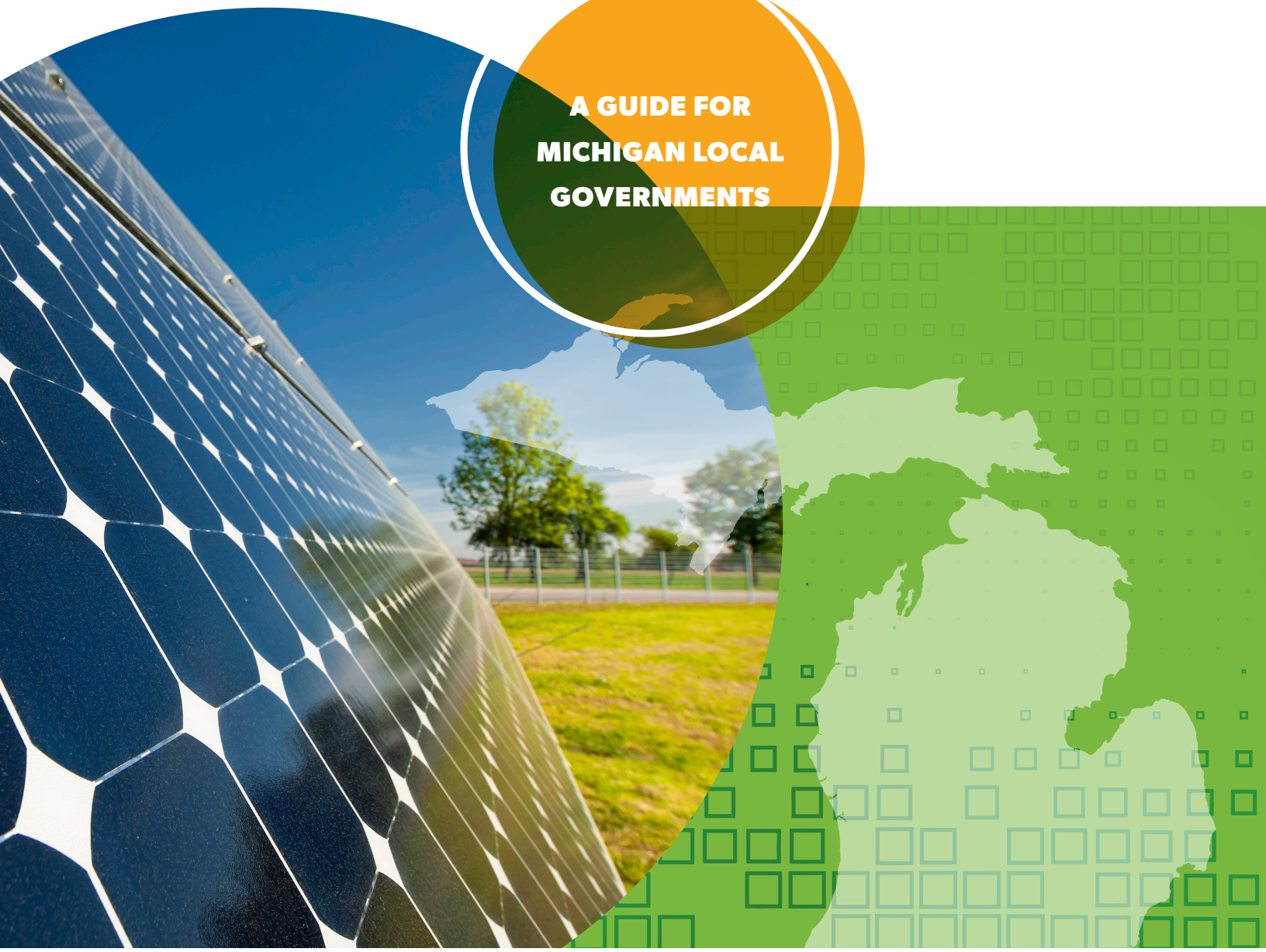
BECOMING A SOLAR-READY COMMUNITY

A GUIDE FOR MICHIGAN LOCAL GOVERNMENTS



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Michigan Chapter of American Planning Association

Michigan Municipal League

Michigan Townships Association

Midland Tomorrow

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CONTENTS

read·i·ness

/ˈredēnis/

noun

1. The state of being fully prepared.

Readiness helps local governments direct their own future by proactively determining how something will best fit into your community.

READY TO GO SOLAR?

"As Michigan transitions to the 21st Century global economy, energy source diversity, environmental stewardship and attracting knowledge-based industries continue to be important policy considerations for local and state leaders. Encouragement of solar energy technologies by local governments simultaneously furthers all of these complementary goals. As township officials lead their communities by defining and pursuing a prosperous future, encouragement of solar has proven to be a worthwhile objective in localities worldwide."

—Larry Merrill, Executive Director, Michigan Townships Association

"Solar Readiness helps Michigan's municipalities open up new opportunities for economic growth and placemaking by building upon our state's innovative heritage and establishing ourselves as leaders within this quickly advancing field. Encouragement of solar offers all of our communities a creative sustainability solution that includes generating new jobs in a high-tech industry and expanding our energy options. Michigan's municipalities will benefit by supporting and preparing the widespread adoption of solar in the effort to develop adaptable, competitive communities that are ready to meet our New Economy needs."

—Dan Gilmartin, Executive Director & CEO, Michigan Municipal League

DEFINITIONS OF KEY TERMS

AC Power (Alternating Current): An electrical current whose magnitude and direction varies. It is considered the "standard" electrical power.

Attached System: A solar system in which solar panels are mounted directly on the building, typically the roof.

Community Purchasing Program: A program that facilitates bulk purchasing of solar to help lower the installed cost per watt for PV in the community. In Michigan, the Great Lakes Bay Region is currently piloting a community purchasing program.

Community Solar: Under a Community Solar model, multiple shareholders (owners) purchase one or more solar panels in a large, centralized, PV array whose energy is sold to a third party. These shareholders then receive financial benefit (credit on their utility bills, cash payments, etc.) based on the energy produced by the solar array.

DC Power (Direct Current): An electrical current whose magnitude and direction stay constant. The photovoltaic cells on solar panels capture energy from sunlight in the form of DC and must be converted to AC by an inverter.

Detached Systems: Also known as a Ground Mounted Systems, a solar system that is not attached directly to a building, but is supported by a structure that is built on the ground.

Distributed Generation: As opposed to centralized generation, distributed generation refers to a number of small power-generating modules located at or near the point of energy consumption.

Local Governments: Michigan's townships, cities, and villages are considered a local unit of government. Michigan's constitution and Home Rule Acts provide extensive local control provisions to these entities.

Gigawatt: A unit of power equal to one billion watts.

Grid: The infrastructure of power lines, transformers and substations that delivers electric power to buildings. The utility grid is owned and managed by electric utility companies.

Hard Costs: The costs for all of the actual hardware and materials included in a solar installation.

Home Rule: The Home Rule City Act (P.A. 279 of 1909) and the Home Rule Village Act (P.A. 278 of 1908) provides a framework for cities and villages to exercise a range of self-governing powers.

Installer: A contractor that installs solar systems.

Interconnection: The link between a utility company and building that enables power to move in either direction.

Inverter: A device that converts DC power captured by the photovoltaic cells on solar panels into AC power.

Kilowatt: A unit of power equal to one thousand watts.

Master Plan: A document adopted by a local government under the Michigan Planning Enabling Act (P.A. 33 of 2008) that establishes a vision and guide for the community's future growth and land use.

Megawatt: a unit of power equal to one million watts.

Net Metering: A policy whereby utility customers with small-scale renewable power sources, including solar, receive credit from their utility provider for electricity generated in excess of their needs (also known as "net excess generation")

On/Off Grid System: A solar energy system that is interconnected with the utility grid is an on-grid or grid-tied system, while a system with battery storage is not interconnected and is an off-grid system.

Permitting: The process by which a local unit of government allows for certain development, changes, and activities in their jurisdiction.

Prescriptive Systems: Solar systems that fit within existing rules and regulations.

Photovoltaic (PV): A method of generating electrical power by converting solar radiation (sunlight) into direct current electricity using semiconductors.

Renewable Energy Credits (RECs): Also known as renewable energy certificates, RECs are tradable commodities that put a value to the environmental benefits of the renewable power in use. One REC represents 1 Mwh of electricity from renewable sources. RECs are valuable to utilities because they can act as proof of compliance to renewable portfolio standards.

Renewable Portfolio Standards (RPS): Also known as a renewable energy standard, is a policy mechanism that mandates electric utilities to supply a specified amount of power from renewable or alternative sources by a certain target date.

Soft Costs: All other costs that are not Hard Costs.

Solar Farm: An installation or area of land in which a large number of solar panels are set up to generate electricity.

Solar Photovoltaic System: The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to utilization load.

Time-of-Use (TOU) Rates: A utility billing system in which the price of electricity depends upon the hour of day at which it is used. Rates are higher during the afternoon when electric demand is at its peak. Rates are lower during the night when electric demand is off peak.

Zoning Ordinance: A document adopted by a local government of the Michigan Zoning Enabling Act (P.A. 110 of 2006) that establishes local land use regulations.

EXECUTIVE SUMMARY

As a state known for its innovation and home to several solar industry leaders, we have the foundation to become front-runners in the advancement of solar energy. Local governments are key to Michigan's success in this effort.

Local jurisdictions can help create an encouraging climate for residents and business owners to install solar, by becoming Solar Ready. Solar Readiness means:

- Proactively addressing solar in policies in procedures
- Supporting your local and statewide solar industry
- Responding to the needs of local citizens
- Helping developers, homeowners, and businesses through a cost-effective solar installation process

This Guidebook provides detail on the following ten steps to become Solar Ready along with resources that can help make Solar Readiness easy and more consistent throughout the state.

THE TEN STEPS TO BECOMING SOLAR READY

The following ten steps provide a pathway for Michigan local government to achieve Solar Readiness. Many of these steps can be taken simultaneously and all can be adapted to suit local needs.

STEP 1: BEGIN THE DISCUSSION

Introduce the concept of Solar Readiness to raise awareness and gather support for the project. Reaching out to neighboring jurisdictions and utility providers is important to consider during this step.

STEP 2: ADOPT A RESOLUTION

The resolution adoption process introduces the conversation of solar at the leadership level, helping to both inform and ensure buy-in by local officials.

STEP 3: ESTABLISH A GUIDING POLICY THAT SUPPORTS SOLAR

Planning document language that supports the advancement of solar will set the direction towards Solar Readiness and provide the basis for solar related land use regulation.

STEP 4: UPDATE CODE LANGUAGE

Solar language in your zoning codes will give clear guidance about how solar installations are to be integrated into your community.

STEP 5: CREATE AN EASY-TO-USE PERMITTING PROCESS

Common information and permit language will help residents, businesses, developers, and installers have a clearer understanding of the local and regional expectations with regard to solar installation.

STEP 6: PROVIDE EASY ACCESS TO INFORMATION

Online and printed materials that detail how solar installation works in your community will help interested property owners and installers understand local expectations and better prepare for an installation process.

STEP 7: ESTABLISH SOLAR INSTALLATION TARGETS

Establishing solar installation targets will help continue the momentum and ensure that measures are taken to truly be a solar leader in Michigan.

STEP 8: TRAIN STAFF

Increasing staff familiarity with solar technology and installation will help make the permitting process more efficient.

STEP 9: PURSUE SOLAR BUSINESS DEVELOPMENT OPPORTUNITIES

Working with development specialists on solar can leverage your Solar Ready Community's status to enhance economic reinvention.

STEP 10: GO THE EXTRA MILE

Going the extra mile is for communities that are really looking to be a solar leader by developing creative outreach efforts and encouraging programs.

INTRODUCTION

WHY TAKE ACTION ON SOLAR?

Innovation is central to Michigan's character, and with our state being home to several key solar industry leaders, we have the potential to become front-runners in the advancement of solar energy. Local governments can play a role in this by creating an encouraging climate for those wishing to install solar—that is, being Solar Ready. Solar Readiness opens opportunities for new business investment, enhanced community vitality and energy independence.

Solar Readiness helps create jobs, strengthens community, and localizes our power source.

Job creation, for example, is a major benefit of solar industry growth, Currently, Michigan ranks ninth in the nation for the number of solar industry jobs and we have the chance to help the number of jobs grow. At this time, 170 solar companies have been identified as part of the state's solar supply chain, including a global leader in the production of polycrystalline silicon.[i] [ii] By creating an encouraging environment for solar, we will be supporting these existing Michigan-based businesses and fostering conditions for new job growth. Recent research indicates that ten jobs are created per megawatt (MW) for installation, three to four jobs for wholesaling and indirect supply, and 102 jobs for research and development.[iii]

Being Solar Ready also contributes to placemaking by establishing a community identity linked to innovation, technology, and leadership. Placemaking is "capitalizing on the distinctive assets to create adaptable, economically competitive, 21st Century communities worth caring about."[iv] Solar Ready Communities will be known as a place that embraces solar, which will not only help attract businesses, entrepreneurs, and workers in the solar industry, but also those looking to invest in a distinctive, future-minded community. Solar Readiness encourages community pride and investment.

Finally, becoming Solar Ready will help us localize our power source. According Michigan's Department of Licensing and Regulatory Affairs, most of Michigan's energy source is imported, primarily from Wyoming and Montana. Michigan can become more economically competitive if we reinvest in our own industries and capitalize on energy sources that are readily available to us. Further, the time is now to do this. Michigan is entering the solar arena at the exact right time. We are at a point where solar technology has been tested and proven and is becoming increasingly more affordable.

With all of this in mind, if Michigan's local governments take this opportunity to lead the state in solar adoption, we can move towards an energy independent future, contribute to placemaking, and support a job creating industry. Solar Readiness is a real opportunity to bolster your community and the state as a whole.

PROJECT BACKGROUND

This Guidebook is the culmination of an 8-month project led by Clean Energy Coalition and funded by Michigan Economic Development Corporation (MEDC) – Energy Office. The project is based on extensive research and stakeholder input from project supporters and the project's pilot communities.

Project supporters include Bay Future, Inc., Detroit Joint Apprentice Training Center (JATC), Dow Chemical, Michigan Chapter of American Planning Association, Michigan Municipal League, Michigan Townships Association, Midland Tomorrow, and Saginaw Future, Inc.

The pilot communities include Thomas Township, Williams Charter Township, the City of Midland and City of Saginaw, all within the Great Lakes Bay Region. Through the Great Lakes Bay Economic Development Partnership, consisting of the area's three economic development organizations, we worked closely with the local jurisdictions to develop and refine the steps and tools included in this Guidebook.

Our work with the pilot community first began with a previous study titled, *Advancing Solar: Great Lakes Bay Region* (October 2012). The purpose of this study was to gain deeper understanding of local permitting, planning and zoning practices to determine the steps necessary for Michigan's communities to become Solar Ready. The main lessons derived from that research include:

- Provide ample information to help those interested in solar
- Coordinate solar permitting procedures with neighboring jurisdictions
- Develop a permitting process checklist
- Create an expedited permitting process for "prescriptive" systems
- Shorten permit review and decision time
- Develop common planning document language
- Develop common zoning language

These lessons established the foundation for this Guidebook and our continued work with the pilot communities. Over the course of this project, we held a series of four meetings to set a vision and test the steps and tools that are presented in the following sections of this Guidebook.

ABOUT THE GUIDEBOOK

This Guidebook is intended to serve as a resource to local units of government during this early stage of Michigan's path towards Solar Readiness. Given the local control provisions found in our state's constitution and Home Rule Acts, Michigan's local jurisdictions are in the position to be the key implementers of this initiative. This Guidebook offers a foundation for ideas and a framework for taking local action towards Solar Readiness.

The Guidebook is divided into three parts. The first part gets right to the "how" of becoming solar ready and provides a step-by-step guide to Solar Readiness. The second part provides answers to the common questions that are necessary to understand the background and current state of solar policy and technology. This section will help local leaders make informed decisions. The third part provides tools for implementation. These tools can be pulled from the guide as you and your local team determine how to best encourage and prepare for solar in your community.

PART 1: BECOMING SOLAR READY

WHY BECOME SOLAR READY?

In addition to energy independence, economic development, and placemaking, Solar Readiness will help properly prepare for one of the fastest growing industries in the nation—the number of installations nationwide has been growing consistently each year since 2000.[vi] This increased demand, along with improvements in technology, has caused the cost of installed solar PV to drop significantly in recent years. Research has found that local governments can cause the installed cost/watt for solar to drop even further with streamlined solar zoning and permitting.[vii]

This section provides a step-by-step guide to becoming Solar Ready.

There is no doubt that as PV prices fall and technology advances, interest in solar will rise. Local governments that are prepared for this quickly growing marked will be ahead of the curve. The solar ready market is now ripe for Michigan.

WHAT DOES SOLAR READINESS MEAN?

Local jurisdictions are Solar Ready when they create an encouraging climate for residents and business owners to install solar by simplifying local processes, such as permitting and zoning. By reducing the complexity, cost, and time involved in these processes, the "soft costs" portion of solar installations are reduced, making solar more financially viable for customers while increasing local government efficiency.

To help succinctly characterize a Solar Ready Community, the following definition provides a description of a Solar Ready Community. Following the definition is a Vision Statement, which was developed with the assistance of the project's pilot communities and can be used by local governments to set the direction as they embark on Solar Readiness.

Solar Ready Community Definition
A Solar Ready Community seeks to encourage solar as means to enhance economic vitality and community reinvention. Solar Ready Communities do this by preparing local policies and procedures in a way that supports increased numbers of solar installations. In addition, Solar Ready Communities explore initiatives, such as energy-related incentives, technical assistance, and community solar, that are designed to lower the cost per watt for solar systems. Communities that become Solar Ready benefit from job creation, placemaking, and more energy independence.

Solar Ready Community Vision Statement
Being a Solar Ready Community means that we have chosen to be a leader in Michigan and have proactively addressed solar in our local policies and procedures. We are prepared for this emerging technology and supportive of the solar industry in this state – Michigan has thousands of jobs in the solar industry and we want to help this number grow. Developers, homeowners, and businesses know that as a Solar Ready Community, they can rely on us to help them through a successful, cost-effective installation process.

WHAT ARE THE STEPS TO BECOMING SOLAR READY?

The following ten steps provide a guideline on how to become a Solar Ready Community. Depending your community needs, several of these steps can be rearranged and/or completed

simultaneously. As part of these steps, tools are provided in Part Three of this Guidebook. These tools offer a writing template or launch pad for discussion and decision-making.

STEP 1: BEGIN THE DISCUSSION

As a new concept, Solar Readiness will need to be introduced to the community (e.g. members of the planning department, planning commission, permitting staff, zoning administrators, economic development specialists, educators, installers, businesses, and relevant non-profits, realtors, home-owners and business groups, the local Chamber of Commerce, and others). Discussions with local groups will help you understand where your community stands in relation to solar. In addition, these discussions will help gauge the level of interest in becoming Solar Ready along with generating interest and support for the project.

During this first step, it is also important to consider reaching out to neighboring jurisdictions. Coordinating with one or several of your neighboring townships, cities or villages will help strengthen your own efforts in addition to bolstering the region. Keep in mind that sometimes all it takes is inviting someone out to coffee to initiate a collaborative effort.

Another key group that is important to engage is your utility provider. It is important to understand how they want to be involved and can support your goal to becoming Solar Ready. Some utility providers offer incentives (see utility programs listed under Tool A – Financing Resources in Part Three of this Guidebook), and if they are a small electric cooperative, they can even establish a community program, similar to Cherryland Electric Cooperative's initiative (see Step 10).

During this phase it may be important to identify champions. One option to accomplish this would be to establish a *Solar Ready Community Taskforce*. This type of taskforce might include:

- Member(s) of the planning commission
- Local official(s)
- Staff, such as employees in the planning, permitting, zoning and environmental departments
- Local leaders in sustainability (e.g. businesses that support "going green")
- Manufacturers and installers of solar equipment
- Educational institutions
- Utility representatives
- Relevant non-profits (e.g. groups with an environmental or housing focus)
- Solar equipment consumers
- Economic Development Organizations

Another option to consider is to designate or hire a Solar Coordinator. This position can be outsourced to a non-profit organization or incorporated as staff. The role of the Coordinator would be to organize the work of departments and participating jurisdictions. New York is an example of a community that has a Solar Coordinator.

STEP 2: ADOPT A RESOLUTION

The resolution adoption process introduces the conversation of solar at the leadership level, helping to both inform and ensure buy-in by local officials. Information provided in this Guidebook can help with this conversation and the sample resolution (Tool B in Part Three of this Guidebook) can serve as the basis for a resolution that fits your community. As presented in the sample resolution, key points to consider including in the resolution are:

- The desire to support and attract local companies that are part of the solar industry
- How solar can bring positive recognition to the community
- The benefits of reducing dependency on imported energy sources
- The health and environmental benefits of reducing emissions
- How solar supports any existing local planning goals

Ideally, adjacent jurisdictions will collaborate on advancing solar in their region, jointly resolving to work towards widespread adoption and new policies that support solar.

STEP 3: ESTABLISH A GUIDING POLICY THAT SUPPORTS SOLAR

Master plans provide a basis and justification for land use regulation and help guide the development of the local government. Does your Master Plan or another planning document contain language that supports the advancement of solar?

If yes, determine the strength of the policy. Are people aware of the policy? Is it aspirational in that it contains very general language or is it specific enough to generate action steps towards achievement? Determine what has already been done to ensure implementation of the policy. If nothing has been done, determine what the barriers are.

If your planning documents are silent on solar, during the next update cycle, take the opportunity to include solar language. Language found throughout this Guidebook along with the sample planning language found in Tool C in Part Three of this Guidebook can offer you a starting point.

STEP 4: UPDATE CODE LANGUAGE

Is there language in your zoning codes that gives clear guidance about how solar installations are to be integrated into your community? If so, are these regulations supported by your Master Plan (if not, you will need to modify one or both of the documents)? If you do not have zoning language related to solar or find a need to modify your existing language, the sample ordinance in Tool D of Part Three of this Guidebook offers a template. Language in this template is mainly derived from existing Michigan-based ordinances and addresses what is understood to be today's primary concerns regarding solar. These concerns include:

- Abandonment
- Agricultural Land Use
- Height
- Impervious Surface/Stormwater
- Reflection/Glare
- Screening
- Setbacks

When developing zoning language, some options are to have the Solar Ready Taskforce or Coordinator (if established) work with staff and/or planning commissioners to complete this effort, hire a consultant with expertise in solar to develop or review the language, and/or gather community data before developing the code language by surveying residents, businesses, and installers to understand local barriers to solar installation. This kind of survey data could also be used to inform other work being completed under the other Solar Ready Community steps. As this Guidebook is not intended to be construed as legal advice, please consult your local government's legal counsel before adopting any Master Plan components or zoning regulations.

STEP 5: CREATE AN EASY-TO-USE PERMITTING/PROJECT APPROVAL PROCESS

Securing approval for a solar PV project involves several key steps. First, property owners, or contractors on behalf of property owners, will need to submit permit applications (some jurisdictions require both building and electrical, with other just require electrical) to the local permitting agency. Once the permit application is approved, the applicant has permission to build the solar installation. After the solar installation is constructed, building and electrical inspectors check the installation to make sure that the system complies with applicable building codes, local ordinances, and the State Electrical Code. If the system is "net-metered" it may also need an inspection from the utility company.

Making this process clear to the public will help all parties involved complete an efficient and successful solar installation project. Further, you can help make the permitting process easier if you streamline the procedure by:

- Providing a solar permitting process checklist to those wishing to install solar. This checklist will help consumers be well prepared for your permitting requirements. Tool E in Part Three of this Guidebook provides two samples of a permitting process checklist. The first is a simplified, easy to understand template that walks consumers through the requirements and where to find information. The second, is an example provided by the Solar America Board for Codes and Standards, which offers a wealth of resources, including this checklist for systems that can be expedited (see next bullet).
- Expediting small residential and commercial PV permit applications for simple, "prescriptive" installations. This expedited processing could apply to contractors that possess reliable solar installation track records and separate building and electrical permits. Through a checklist, as described in the previous bullet, everyone can determine whether a system requires more or less review.
- Allowing for online permitting submissions and notification options. This will help with quick turnaround.
- Reducing the appointment time windows given for inspection. Short inspection windows will help installers complete projects in a more timely, cost-effective manner, further reducing the "soft costs" component of solar installation.
- Coordinating with neighboring jurisdictions. Common information, shared permitting language, and similar regulations can help property owners and installers have a clearer understanding of the local and regional expectations with regard to solar installation. When coordinating with your neighbors, a good starting point is to engage in is our fictional "Solar Sam" exercise, which is provided as Tool F in Part Three of this Guidebook. In this exercise, participants review what it would be like for Solar Sam and his friends to try and install the same solar installation in each of the participating jurisdictions. The purpose of this exercise is to highlight differences to determine a path towards coordination.
- Showcasing examples of successful installations to serve as a model. People can learn from successes as they engage in their own installations process.
- Providing knowledgeable assistance to help homeowners and others answer any questions they may have (see Step 8).
- Considering waiving or reducing permit fees to help encourage solar during its initial stage. If working with neighboring jurisdictions, consider waiving/reducing permit fees together or standardizing a rate that is specific to solar. This will help create a regional Solar Readiness approach.

STEP 6: PROVIDE EASY ACCESS TO INFORMATION

Develop website content in addition to printed materials. This will help those installing solar understand your process. Useful information to include on the website includes:

- Your stated goal as a Solar Ready Community
- A description of the approval process
- Zoning language that pertains to solar
- Permitting applications
- Informational resources, such as a local installer listing
- A link to the statewide Solar Ready Community clearinghouse website, which is a site that posts information on and for Michigan's Solar Ready Communities. The site can be reached through http://cec-mi.org/

An outline of what is useful to include in your website and printed material is provided in Tool G. In your informational materials you can clearly identify yourself as a Solar Ready Community by using the official logo. You can receive a copy of the logo through Clean Energy Coalition at http://cec-mi.org/. The logo will help installers, companies, and others involved in the solar industry know that they are entering a community with an encouraging environment.

STEP 7: ESTABLISH SOLAR INSTALLATION TARGETS

Establishing solar installation targets will help continue the momentum and ensure that measures are taken to truly be a solar leader in Michigan. To begin this step, conducting an inventory of existing PV installations in your community will help you determine a baseline from which growth is measured. Ideally, you will be able to map this data and any growth in solar installations. The Renew Boston Solar Interactive map provides a good example of this type of map: http://gis.cityofboston.gov/solarboston/#. It will also be useful to connect this inventory with the National Renewable Energy Laboratory's Open PV Project: https://openpv.nrel.gov/

Once the initial baseline is set, determine your solar installation targets and progress towards solar installation targets. An example of this includes Boston, who has set a goal for 1,600 megawatts of solar energy by 2020. That is enough to generate power for 240,000 homes per year. To learn more about their program, visit: http://www.cityofboston.gov/environmentalandenergy/conservation/solar.asp

One way to help advance toward your goal is be proactive and ask developers to consider solar installations with their projects. Provide them information and guidance on how to include a solar installation as an asset that fits with community goals. You can also develop local education and community purchasing programs to help incentivize solar installations.

STEP 8: TRAIN STAFF

With solar being new territory, most staff will be unfamiliar with how to approach installations. However, this lack of familiarity can slow down the permitting process, making it expensive for you in addition to installers and customers. The problem may not be very apparent at this time due to the low number installations occurring, but any increase in local installations might cause the issue to be more pronounced.

Some options to help train staff include working with local solar industry representatives and training institutions/colleges on how to check for safe installations along with collaborating with neighboring jurisdictions to host or attend training courses. One training opportunity is at Northwestern Michigan College in Traverse City. This program is a one-week course on PV installations and helps individuals prepare for the North American Board of Certified Practitioners (NABCP) Solar PV Entry Level exam. For more information, visit here: https://www.nmc.edu/resources/extended-education/find-a-class/energy-construction/

STEP 9: PURSUE SOLAR BUSINESS DEVELOPMENT OPPORTUNITIES

Above all else, solar energy is a business that has a rapidly growing global footprint. Working with an economic development specialist can leverage your Solar Ready Community's status to enhance economic reinvention (i.e., solar-related business creation, retention, expansion and attraction). Economic development specialists have programs and tools that can help foster solar-related business creation, retention, expansion and attraction, such as the Great Lakes Bay Region Solar Industrial Park: http://www.saginawfuture.com/media/docs/GreatLakesTechPark.pdf

NextEnergy, for example, is a Detroit-based nonprofit with the mission to drive advanced energy investment and job creation in Michigan and can help local communities and businesses understand, evaluate and pursue diversification opportunities in the global solar supply chain (e.g., raw materials, components, sub-systems, complete-systems and original equipment manufacturers).

As another example, local Michigan Small Business and Technology Development Center (MiSBTDC) specialists can help solar entrepreneurs and innovators collaborate with Michigan universities and research institutes to procure grants to research, develop and commercialize solar-related technology innovations (see Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants.).

Finally, many local universities and colleges have solar-related programs which can be used to supply training for solar energy businesses and their employees.

STEP 10: GO THE EXTRA MILE

This final step is for local governments that are really looking to be leaders and encourage solar in their communities. This is where local governments can get creative with public outreach efforts and programs. One successful program for promoting solar to homeowners by bridging the information gap and tackling financial barriers is the Solarize program model. First launched as a grassroots effort in neighborhoods of Portland, Oregon, this program works through community groups to educate homeowners about the advantages of installing solar, partnering with a local installer (or installers) to utilize bulk purchase discounts of solar panels. The limited timeframe, simplified approach, and cost-reducing aspects of the program address three of the main obstacles in the current solar market: high upfront costs, complexity, and customer inertia.[viii] The Solarize program has been replicated in nearly two dozen communities since its launch in 2009. More information on this program can be found here: http://www.portlandoregon.gov/bps/article/405686

A similar effort would be to work with organizations already working to advance solar, such as Michigan Interfaith Power and Light (IPL). Michigan IPL is an organization that works with faith based groups across the state to promote and implement energy efficiency and renewable energy to help meet earth stewardship goals. Currently, Michigan IPL is engaged in a solar bulk purchasing feasibility initiative. More information on this initiative can be found here: http://www.miipl.org/projects-grants-proposals/current-projects/solar-aggregation-feasibility-study/

Exploring community solar is another option. Community Solar Systems are Distributed Generation/ Distributed Energy (DG/DER) systems powered by solar photovoltaics. Community Solar expands the ways in which solar PV can be used and offers an alternative to individually-owned and metered PV systems. Under a Community Solar model, multiple shareholders (owners) purchase one or more solar panels in a large, centralized, PV array whose energy is sold to a third party. These shareholders then receive financial benefit (credit on their utility bills, cash payments, etc.) based on the energy produced by the solar array.

One Michigan electric cooperative has designed a community solar program to offer to its members. Cherryland Electric Cooperative, which serves more than 33,000 members in the Grand Traverse region, is the first electric utility in the state to create a community solar program. The project, known as Solar Up North (SUN) was slated to offer 48 panels to customers on a 25-year lease for a one-time fee of $470 per panel. Due to the high level of interest in the program, the initial offering was raised to 80 panels, with plans to add almost 150 more panels in the future. Customers are eligible for an energy optimization rebate of $75 for each panel. Traverse City Light and Power, a municipal utility in the same region, plans to join the program, adding about 12,000 additional eligible customers.[x] Each panel is expected to provide the equivalent of about a day's usage for the average Michigan household, which will amount to about a $2.00 credit per month.[x, xi]

The Great Lakes Renewable Energy Association (GLREA) is publishing a companion to this Solar Ready Community Guidebook – *Community Solar Guidebook* – for communities interested in exploring Community Solar options. For more information, see: www.glrea.org

A third "Extra Mile" action is to work with local foundations, educators, and others to integrate solar education in the new STEM (Science, Technology, Engineering, and Math) Common Core Standards work taking place in your community. This effort would provide ready-made solar curriculum materials that could be woven into STEM curriculums, so that efforts to support and promote a STEM-ready workforce would also promote solar technology and expertise.

A fourth option is to lead by example and install solar on government buildings and other publically owned structures. It may be especially interesting to couple solar energy with other innovative projects, such as solar powered electric vehicle charging stations. Tool H provides more background on this type of application, including two Michigan based case studies.

Finally, a community can offer local residents and businesses access to creative financing options to install solar. A description and list of some financing options are included in Part Three of this Guidebook.

PART 2: UNDERSTANDING SOLAR

This section offers the background necessary to understand solar and make informed decisions related to Solar Readiness.

WHAT IS THE HISTORY OF SOLAR AND HOW DOES IT WORK?

Solar energy technologies harness energy from the sun to create electricity. This electricity can be used for everything from heating homes to powering electronics or charging vehicles. Converting the sun's energy into electricity is not a new concept. A French scientist discovered the photovoltaic effect in 1839, and in 1953, American physicists developed the first silicon solar cell capable of powering everyday electronics. [xii, xiii]

In 1952 President Harry S. Truman's Material Commission Report, *Resources for Freedom*, urged that solar energy be developed by the United States. During this time, vastly improved photovoltaic cells were developed by Bell Telephone Labs (Murray Hill, New Jersey) – primarily for the Space Program and NASA. By 1956, *Look Magazine* was running advertisements for Solar PV ("*Bell System Solar Battery Converts Sun's Rays into Electricity*").[xiv] In 1975, Michigan's own, President Gerald R. Ford, signed the Energy Policy and Conservation Act, which among other things, called for increased use of solar energy as a way to achieve energy independence.

HOW SOLAR PANELS WORK

1. Solar arrays are made up of panels that contain many solar cells. Each solar cell converts sunlight into electricity.
2. The electricity is fed into an inverter that converts it from DC to AC power so it is compatible with standard U.S. electrical systems.
3. AC electricity is used to power the building's appliances and other energy needs.
4. Any excess electricity is sent back to the utility grid through a meter.

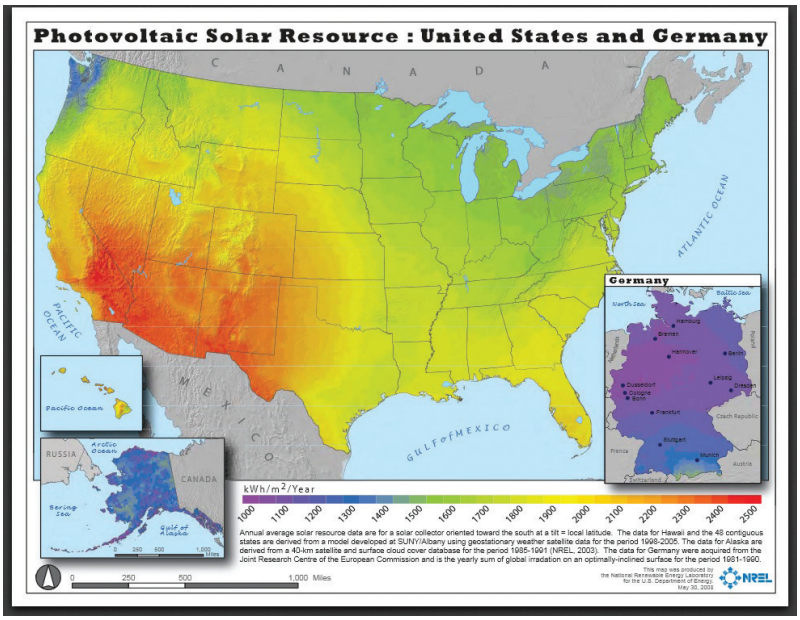
Today, PV cells are used in a wide variety of applications, from charging a calculator battery, to PV systems, which contain many interconnected solar cells, that provide power to homes or businesses, or, in a large array, to the grid. Most solar systems installed today are either roof-mounted or ground-mounted, depending on the location and size of the installation.

Photovoltaics, a Greek term that means "light volt," are more commonly known as "solar panels," but the technology is not just limited to panels. Advanced photovoltaics manufacturers are creating new thin film technology to reduce the size and breadth of PV systems to integrate into buildings by replacing traditional building materials. Michigan-based Dow Chemical Company is currently manufacturing a shingle product, which protects like a standard shingle and contains solar cells that can power a home.[xv]

WHAT IS THE VIABILITY OF SOLAR IN MICHIGAN?

One of the most common questions raised when discussing the potential for solar in Michigan, is whether it is viable given our fluctuating weather and seasonal conditions. Despite the fact that Michigan is not known for its abundant sunshine like the southwestern states, the opportunity to harness energy from the sun in Michigan is great. Germany, for example, is not particularly sunny, but due to their solar advancement policies and programs, they have put solar to the test in a setting that experience lower levels of sun access than Michigan (see map, next page). From its southern to

northern border, Germany's Latitude runs from 48 to 54 degrees. In Michigan, the highest Latitude in the state is 47 Degrees (Upper Peninsula-Houghton). The highest Latitude in the Lower Peninsula is 45 Degrees (Mackinaw City) and the lowest is 41 Degrees (New Buffalo). Yet, despite having less access to sun, Germany is setting the global record solar power production. [xvi, xvii]



WHAT DOES TODAY'S SOLAR MARKET LOOK LIKE?

Solar installations in the U.S. increased 76 percent between 2011 and 2012 alone, and the market continues to grow dramatically.[xviii] Currently, there are about 6.4 gigawatts (GW) of solar capacity installed in the U.S. generated from approximately 270,000 PV installations across the country.[xix]

Solar energy demand has grown at about 30% per annum over the past 15 years (hydrocarbon energy demand typically grows between 0-2% per annum). According to Mark Jacobson & Mark Delucchi, in their work titled, *A Path to Sustainable Energy by 2030*, Global Energy Demand by 2030 will reach 11.5 Trillion Watts (TW). The authors cite estimates that 40% (4.6 TW) of this amount can be supplied by Solar Photovoltaics (PV).[xx]

More than half of the installed capacity is the result of utility-scale solar plants, which are large installations owned and operated by the utility, usually ranging from a few megawatts (MW) to hundreds of megawatts in size.[xxi] These large-scale "solar farms" are connected to transmission systems, which transmit the power to electrical substations. The remaining installed PV capacity in the U.S. comes from relatively smaller, residential and non-residential installations, ranging in size from a few kilowatts (kW) for residential, to hundreds of kilowatts for large commercial systems.[xxii] These types of installations are categorized as distributed generation, because some or all of the electricity generated is used onsite. Most PV systems are "grid-tied," meaning they are connected to the power grid and none of the electricity produced is stored for later usage.

WHAT ROLE ARE TAX POLICIES & GOVERNMENT INCENTIVES PLAYING IN MICHIGAN?

On June 11, 2013, the State Tax Commission determined that solar panels are to be considered industrial personal property and to be reported on Table B – Machinery and Equipment on the personal property statement.

Michigan does not have tax incentives available for solar installations. A list of utility provider incentives in included in Part Three of this Guidebook.

HOW DO HOMEOWNER ASSOCIATION REGULATIONS WORK WITH SOLAR?

Homeowners association rules, which are typically outside the control of local governments, can sometimes enhance or impede (i.e. restrict, or prohibit) the installation of solar PV.[xxiii] Forty states have adopted some form of solar access law that either limits restrictive or prohibitive covenants, or allows local jurisdictions to do so. Michigan does not currently have any solar access laws. The Solar Foundation has released a guide for homeowner's associations to help encourage solar development through community association policies and processes. A copy of the guide can be found here: http://thesolarfoundation.org/blog/encouraging-solar-development-hoa-communities

HOW COMPETITIVE IS THE U.S. IN THE GLOBAL SOLAR MARKET?

A recent study by The Pew Charitable Trusts concluded that the U.S. is losing its share of the revenues from the global clean energy sector, which are expected to total $1.9 trillion between 2012 and 2018, and calls for the President and Congress to introduce a national clean energy standard to replace the current piecemeal approach of the state-by-state RPS.[xxiv] The report also notes that although PV installations in the U.S. have doubled in the last two years, the added capacity is less than one-third of that added by Germany or Italy, and China surpassed the U.S. for the first time in 2011. The clean energy sector represents a massive economic opportunity for the U.S., but the opportunity could slip away if we fail to invest in it now. Pew projects that the combination of public-sector incentives and access to capital and credit to develop businesses and technology could develop an industry that is fully cost competitive and free from the need of federal incentives by 2020.

WHAT ARE RENEWABLE PORTFOLIO STANDARDS AND HOW DO THEY WORK IN MICHIGAN?

A renewable portfolio standard (RPS), also known as a renewable energy standard, is a policy mechanism that mandates electric utilities to supply a specified amount of power from renewable or alternative sources by a certain target date. There is no U.S. federal RPS; each of the 30 states with RPS-type directives in place has their own widely varying standards. Michigan's RPS sets the requirement for 10 percent renewable energy by 2015. Some states have "carve-outs" in the policy to promote a specific technology, such as solar.

A small number of Michigan cities have set their own formal timeline and goals for renewable energy usage in municipal facilities, including Ann Arbor, Grand Rapids, and Lansing. Communities primarily meet this goal by executing purchase agreements with local utilities to provide a specified percentage of their electricity use with renewable energy. Ann Arbor relies on local sources of renewable energy, mostly from landfill gas and two hydroelectric dams.

The following Michigan Regulated Electric Utility Companies have Net Metering programs:

- Alger Delta Cooperative Electric Association
- Alpena Power Company
- Cherryland Electric Cooperative
- Cloverland Electric Cooperative
- Cloverland (formerly Edison Sault)
- Consumers Energy Company
- The Detroit Edison Company
- Great Lakes Energy Cooperative
- Indiana Michigan Power –American Electric Power
- Midwest Energy Cooperative
- Ontonagon County Rural Electrification Association
- Presque Isle Electric & Gas Co-op
- Thumb Electric Cooperative
- Tri-County Electric Cooperative
- Upper Peninsula Power Company
- Wisconsin Electric Power Company – We Energies
- Wisconsin Public Service Corporation
- Xcel Energy (formerly Northern States Power)

WHAT IS NET METERING AND HOW DOES IT WORK IN MICHIGAN?

Net metering is a policy whereby utility customers with small-scale renewable power sources, including solar, receive credit from their utility provider for electricity generated in excess of their needs (also known as "net excess generation"). For all net excess generation, the customer receives credit from the utility to offset future electricity purchases.

Net metering policies and practices vary by state. In 2008, the Michigan Public Service Commission (MPSC) established statewide net metering protocols for renewable energy systems applicable for all investor-owned utilities, electric cooperatives, and alternative electric suppliers.[xxv]

The net metering program enables Michigan's utility, cooperative and AES customers to develop on-site renewable energy electric generation projects to meet some or all of their electric energy needs and reduce their electric bills. Under the net metering program, Michigan customers may install an on-site renewable energy electric generation project, such as a solar photovoltaic panel. The project must be sized small enough so that it is no larger than what is needed to meet a customer's electric energy needs. The customer will be able to reduce their electricity purchases from the utility by using their generated electricity "behind the meter." Under a net metering program, when customers produce electric energy in excess of their needs, power is provided back to the serving utility, permitting the customer to receive a credit.

Municipal Utilities in Michigan are not regulated by the Michigan Public Service Commission. To learn about net metering and interconnection policies for Michigan Municipal Electric Utilities, please contact them directly. A directory is available on the Michigan Public Service Commission web site, at http://www.dleg.state.mi.us/mpsc/electric/address.htm#MunicipalUtilities.

An example of a net metering application for Consumers Energy is in Tool I in Part Three of this Guidebook.

Virtual Net Metering

Virtual net metering (VNM) is a policy that allows the owner of a renewable generation source to share net metering credits from their source amongst several meters (i.e. "tenants") who may not be physically located on the property itself. VNM creates a framework for shared renewable resources, such as "community solar" installations, where multiple customers share the benefits of one or more solar or other renewable generation sources. In Michigan, it is currently not clear as to whether P.A. 295, the legislative act governing the MPSC's statewide net metering protocols, expressly prohibits VNM.[xxvi]

HOW DOES SOLAR ENERGY IMPACT THE POWER GRID?

Solar arrays can help offset electricity demand during peak times. The grid is most taxed on the hot, sunny days when most people are running air conditioning units—conditions favorable to solar efficiency, meaning that at a residential or commercial application, less electricity is required from the utility. In the vast majority of installations, any excess electricity generated is sold back to the grid, further reducing the amount of power needed from the utility. An additional "backwards" meter is used to record the excess power, hence the term for the policy of net metering for electricity sold back to the grid. See the previous question for more on net metering.

HOW DO ELECTRICAL AND CONSTRUCTION CODES IMPACT SOLAR?

Michigan Electrical Code

The Michigan Electrical Code, to which all local jurisdictions must abide, is based on the 2011 National Electrical Code (see: http://archive.org/details/gov.law.nfpa.nec.2011).

Chapters one through three in the Michigan Electrical Code are not limited to the scope of PV systems, but all pertain. In particular, Article 250 addresses grounding. Article 705, Interconnected Electrical Power Production Sources, is also key. However, the section that specifically addresses solar photovoltaic systems is Article 690:

> **690.1 Scope**. The provisions of this article apply to solar photovoltaic (PV) electrical energy systems, including the array circuit(s), inverter(s), and controller(s) for such systems.
>
> **Solar Photovoltaic (PV) Systems**
>
> I. General
> II. Circuit Requirements
> III. Disconnecting Means
> IV. Wiring Methods
> V. Grounding
> VI. Marking
> VII. Connection to Other Sources
> VIII. Storage Batteries
> IX. Systems over 600 Volts

The Michigan Department of Licensing and Regulatory Affairs (LARA), Bureau of Construction Codes, amended the Construction Code Rules, Part 8. The state electrical code rules are published in code section order for use with the National Electrical Code, 2011 edition. The National Electrical Code, 2011 edition, is adopted by reference in R 408.30801. The provisions set forth in this publication are either added to the national code or amend the national code.

All units of government that administer and enforce the state electrical code are required to enforce the amended state electrical code effective July 1, 2013. The rules adopt by reference the National Electrical Code, 2011 edition, and include deletions, additions, and amendments to the national code.

LARA, Bureau of Construction Codes notes that there are a number of potential issues besides just compliance with the code such as licensing and permitting. The Bureau of Construction Codes recommends individuals considering Solar PV review the following document:
Department of Licensing and Regulatory Affairs 2011, MICHIGAN ELECTRICAL CODE RULES, Part 8 (INCORPORATING THE 2011 EDITION OF THE NATIONAL ELECTRICAL CODE, BUREAU OF CONSTRUCTION CODES)
(see: http://www.michigan.gov/lara/0,4601,7-154-35299_10575_17394_17415---,00.html).

For further information on the Michigan Electrical Code and Solar PV please contact the Electrical Division, LARA, Bureau of Construction Codes (see below):

Mailing Addresses:
P.O. Box 30254 (Codes: general correspondence)
P.O. Box 30255 (Codes: permits, licenses, and other documents containing payments)
P.O. Box 30704 (Office of Land Survey and Remonumentation)
Lansing, Michigan 48909

Physical Address:
2501 Woodlake Circle, Okemos, MI

Fax Numbers:
Administration; Office of Administrative Services Fax: 517-241-9570
Office of Management Services; Plumbing Division Fax: 517-373-8547
Office of Land Survey and Remonumentation; Elevator Safety Division; and Boiler Division Fax: 517-241-6301
Building Division; Electrical Division; Mechanical Division; and Plan Review Division Fax: 517-241-9308

Web site:
www.michigan.gov/bcc

Telephone Numbers:
Administration: 517-241-9302
Office of Administrative Services (OAS): 517-335-2972
Office of Management Services (OMS): 517-241-9313
Boiler Division: 517-241-9334
Building Division: 517-241-9317
Electrical Division: 517-241-9320
Elevator Safety Division: 517-241-9337
Mechanical Division: 517-241-9325
Office of Land Survey and Remonumentation (OLSR): 517-241-6321
Plan Review Division: 517-241-9328
Plumbing Division: 517-241-9330

Michigan Building Codes

The Michigan Residential Code is for one and two family dwellings, townhouses, and accessory buildings and is based on the 2009 International Code Council (ICC) International Residential Code (See: http://archive.org/details/gov.law.icc.irc.2009).

The Michigan Building Code is for all buildings not covered by the Michigan Residential Code and is based on the 2009 ICC International Building Code (See: http://archive.org/details/gov.law.icc.ibc.2009).

For Solar Thermal Systems also refer to Section M2301 in the Michigan Residential Code, 2009 Michigan Plumbing Code, and to the 2012 Michigan Mechanical Code.

For further information on the Michigan Residential Code & Michigan Building Code please contact the Building Division, LARA, Bureau of Construction Codes (see below):

Mailing Addresses:
P.O. Box 30254 (Codes: general correspondence,)
P.O. Box 30255 (Codes: permits, licenses, and other documents containing payments)
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Elevator Safety Division: 517-241-9337
Mechanical Division: 517-241-9325
Office of Land Survey and Remonumentation (OLSR): 517-241-6321
Plan Review Division: 517-241-9328
Plumbing Division: 517-241-9330

HOW DOES UTILITY INTERCONNECTION WORK WITH SOLAR?

Interconnection is the process by which a customer with an onsite renewable energy generation source physically connects this source to the local power grid. In Michigan, a customer who seeks to receive net metering credits must apply to their utility for permission to interconnect with the grid. Generally, any customer who wants to install a renewable generation source, like wind or solar, should contact their utility as early in the planning process as possible in order to facilitate a smooth interconnection process.

MPSC rules adopted in 2008 spell out interconnection requirements and procedures for utilities and customers, including: system capacity limits, application processes, and fees.[xxvii] The rules delineate five categories of generating systems based on system size, to which varying rules and protocols are applicable. Interconnection applications are processed by the utility, and these forms can normally be found on the utility's website. The MPSC rules limit interconnection application fees to $75 for Category 1 installations (systems up to 20 kW). Also, the rules prohibit insurance requirements for Category 1 and Category 2 (20 kW to 150 kW systems). Category 1 and Category 2 application forms are standardized by MPSC and can be found at their website: http://www.michigan.gov/mpsc/. The MPSC rules also define specific timelines for utilities to process interconnection applications.

WHAT ARE THE HARD COSTS ASSOCIATED WITH SOLAR?

Although the cost of installing solar has dropped rapidly in recent years, the majority of the price drop has come from the declining cost of equipment, known as the hard costs. The hard costs associated with a solar PV installation include the cost of the actual solar cells, modules, hardware, and inverters. These costs are reliant on the cost of manufacturing, raw materials, and shipping costs. Prices have fallen as the industry has matured over time—the cost of PV modules declined about 95 percent between 1976 and 2010—largely due to increases of scale and efficiency of the industry, and economies of scale being realized. Solar PV panels have traditionally used silicon as the semiconductor necessary for converting sunlight into electricity, which is the most expensive component of conventional solar modules. Module prices are expected to continue to fall, thanks to emerging technological advances using alternative, less expensive and more earth-abundant materials.[xxviii]

Hard costs can be reduced when solar is purchased in bulk quantities. Not only are the material and equipment costs lower, but labor costs can be greatly reduced as well, due to increased competition, and because most installers are willing to give a volume discount when given the promise of a large amount of work.

As much as 40 percent of the cost of a solar installation, can be attributed to soft costs, which include things like labor, taxes, customer acquisition, design, permitting, fees, and paperwork.[xxix] Solar Readiness can help with soft costs.

PART 3: TOOLS FOR IMPLEMENTATION

TOOL A:
FINANCING RESOURCES

TOOL B:
SAMPLE RESOLUTION

TOOL C:
SAMPLE PLANNING LANGUAGE

TOOL D:
SAMPLE ZONING LANGUAGE

TOOL E:
SAMPLE CHECKLISTS

TOOL F:
SOLAR SAM EXERCISE

TOOL G:
SUGGESTED WEBSITE AND BROCHURE INFORMATION

TOOL H:
ELECTRICAL VEHICLES AND SOLAR INFORMATIONAL SHEET

TOOL I:
OTHER RESOURCES

TOOL A: FINANCING RESOURCES

Unlike traditional forms of energy that utility customers pay for on a monthly basis, installing solar PV typically puts the initial, significant cost burden on the customer. Robust financing options are vital to make the solar dream come true.

FEDERAL INCENTIVES

Solar Investment Tax Credit (ITC)
The Solar Investment Tax Credit is a 30 percent federal investment tax credit for solar energy systems in place until December 31st, 2016. Both residential and commercial customers can take advantage of this tax credit. The ITC was first put in place in 2006, and has since been extended twice.

1603 Treasury Program
In lieu of the ITC, the 1603 Treasury Program allows developers for residential and commercial renewable energy projects to receive a direct federal grant for 30 percent of the project cost. Enacted as part of the American Recovery and Reinvestment Act of 2009, the program provides developers with access to upfront capital, which can be a valuable tool in a down economy.

UTILITY INCENTIVES

P.A. 295, which was signed into law in 2008, requires all regulated utilities to generate 10 percent of their retail load from renewable energy. The state's largest utilities, DTE Energy and Consumers Energy are required to meet additional targets. The law also required the MPSC to create a statewide net metering program that requires rate-regulated utilities, cooperatives, and alternative electricity suppliers to offer customers net metering based on the size of the system installed.[xxx] See Part 1 for more on net metering.

In order for electric providers to demonstrate compliance with the new RPS standard, they must purchase and/or produce Renewable Energy Credits (RECs) to meet the ten percent threshold. In response, Michigan's two largest investor-owned utilities (IOUs), Consumers Energy and DTE Energy, both launched programs to incentivize customers to install solar generation sources. Through both programs, the utility ultimately receives ownership of the RECs generated by the solar asset in exchange for rebates (DTE Solar Currents Program) or outright purchase of the electricity from the source (Consumers). Participants in each program are limited to installing systems that cover their annual electricity use.[xxxi]

While it was running, the pilot phase of DTE's SolarCurrents program provided incentives for customers to install solar PV systems up to 20 kW. The initial $25 million SolarCurrents pilot program began in 2009 and provided for a total of 20 MW for solar PV systems. 15 MW of installed capacity was set aside for large-scale installations owned by DTE, and the other 5 MW was designated for customer-owned PV systems for DTE's customers. According to NREL, 94 percent of Ann Arbor's total installations in 2010 are attributable to the SolarCurrents program.[xxxii]

The pilot phase concluded in May of 2011 when it had reached their 5 MW target. The pilot phase of the program was incredibly popular, and resulted in 606 installations by over 100 solar installers. Approximately 79 percent of the installations were residential systems, and all but one used Michigan-based labor for installation.[xxxiii]

The second phase of SolarCurrents began in 2013. Rebates for solar installations are now available

through a random lottery in four phases over two years of 500 kW for each offering. To keep updated on any DTE's activities related to solar, visit: https://www2.dteenergy.com

Consumers Energy's Experimental Advanced Renewable Energy Program (EARP) is a performance-based incentive, meaning that the utility pays the customer for each kW produced by the PV system. This means that the homeowner does not use the electricity generated by their PV system, and instead it is fed back to the grid. Eligible residential solar systems are limited to 20 kW, while non-residential systems may range from 1 kW to 150 kW generation capacity. Applicants are selected through a lottery process. Consumers Energy customers participate in either EARP (if selected) or net metering, but not both for a single PV system. The most up-to-date information about the Consumers EARP program can be found on the company's website (http://www.consumersenergy.com/content.aspx?id=4844).

LOCAL PROGRAMS AND INCENTIVES

SmartBuildings Detroit

The Detroit Economic Growth Corporation (DEGC) offers energy program grants and loans out of a revolving loan Green Fund made possible by a grant from the DOE. SmartBuildings Detroit is part of the BetterBuildings for Michigan Program and is intended to offer ongoing grants and loans up $100,000 to commercial, institutional, and public buildings for eligible energy-saving projects, including solar PV. The program is limited to a specific geographic area in downtown Detroit, and available funding is expected to fluctuate. Visit http://www.degc.org/special-initiatives.aspx/smartbuildings-detroit-program-2 for more information.

LOAN PROGRAMS

Michigan Saves

Through its Home Energy Loan Program, Michigan Saves works with participating local credit unions to offer financing for a number of energy-related home improvements, including PV. Systems must be connected to the grid and under 20 kW in size. Interest rates are below 7 percent. Homeowners must choose a Michigan Saves authorized contractor. To access update information on this program, visit http://michigansaves.org/.

FINANCING ALTERNATIVES

Many creative financial mechanisms are being implemented across the country to reduce the up-front costs associated with installing solar. The following may represent possibilities for use across the state:

PACE

Property Assessed Clean Energy (PACE), which was enabled by the State of Michigan in 2010, allows local jurisdictions to finance energy efficiency and renewable energy upgrades to commercial and industrial properties. The City of Ann Arbor launched the state's first PACE program in 2011; more information on this program as well as an explanation of how PACE works is available at http://www.a2energy.org/pace. Best practices from this program could be used to craft an "Advancing Solar PACE Program." For example, third-party sponsored funding could seed a revolving loan-loss reserve program to underwrite a financing program for solar installations in the region. Under such a program, the sponsored funding would be paid back to the third-party sponsor through a series of payments added on to the borrower's loan. As the borrower pays in to the revolving loan program, the sponsor would withdraw an equal amount.

Contact Clean Energy Coalition (http://cec-mi.org/) or Michigan Lean and Green (http://www.leanandgreenmi.com/) to learn more about PACE.

Impact Investing

Impact Investing refers to investments made based on the practice of assessing not only the financial return on investment, but also the social and environmental impacts of the investment that happen in the course of the operations of the business and the consumption of the product or service which the business creates. An Impact Investing initiative could be designed specifically to advance solar in

Michigan, with the intention of generating measurable social and environmental impact alongside a financial return.

Power Purchase Agreements (PPA) and Solar Leasing

Third-party financing mechanisms can make installing solar more attractive to homeowners, business owners, or public entities by reducing the risk and complexity involved in installing a PV system. Instead of paying for the PV installation upfront, a home or business owner enters into an agreement with the third-party company to lease the system (solar leasing) or buy all the electricity that the PV system generates (PPA). Maintenance and repairs are typically the responsibility of the third-party provider. The lease payment is usually competitive or less than previous utility bills before the solar installation. Private sector solar leasing firms find these models attractive because they allow them to take advantage of tax credits and accelerated depreciation of the PV system.[xxxiv] Terms for PPAs and solar leasing arrangements are usually between 10 and 20 years.

ECONOMIC DEVELOPMENT PROGRAMS

There are several programs available to incentivize high-tech and research companies, including those in the alternative energy sector, to base their offices in Michigan.

SBIR/STTR + ETF

Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) are federal, competitive award programs that enable innovative and entrepreneurial small businesses to explore their technological potential and provide the incentive to profit from commercialization.[xxxv] These programs expand funding opportunities in the innovation research and development arena by encouraging small businesses to partner with nonprofit research institutions and commercial investors/partners to bridge the gap between performance of basic science and commercialization of resulting innovations.[xxxvi]

The Michigan Emerging Technologies Fund (ETF) further expands funding opportunities for Michigan-based technology companies in the federal innovation research and development arena by matching federal SBIR/STTR awards.[xxxvii] Applicants must be in one of the four technology sectors supported by the ETF, including Advanced Automotive, Manufacturing, Materials, Information, and Agricultural Processing; Alternative Energy; Homeland Security and Defense; and Life Sciences. ETF funds are used for commercialization purposes, such as the purchase of equipment, legal costs, sales and marketing costs, business planning costs and fundraising costs. [xxxviii] For more on Michigan's ETF, visit http://www.mietf.org.

ADDITIONAL OPTIONS

Made in Michigan Preference

Renewable energy that is generated from a system that was constructed using Michigan-made equipment qualifies for Michigan incentive renewable energy credits equal to 1/10th REC per MWh for the first three years (subject to a calculation that takes into account all components of the renewable energy system). For example, if the solar panels qualify for the Michigan Equipment incentive RECs, but the inverters and racking do not, then the 1/10th REC would be prorated unless a threshold level of Michigan Equipment is met. If a threshold level of Michigan Equipment is used, then the entire 1/10th REC is awarded. Additionally, if the system is constructed using Michigan labor the 1/10th incentive credit for Michigan Labor is granted for the first three years in a manner similar to the Michigan Equipment provision. The Michigan Equipment and Michigan Labor incentive credits are only available for the first three years.

TOOL B:
SAMPLE RESOLUTION

RESOLUTION NO.

AUTHORIZING A COMMITMENT TO THE ADVANCEMENT OF SOLAR ADOPTION WITHIN THE REGION AND COOPERATIVE EFFORTS BETWEEN _____ IN PURSUIT OF THIS GOAL.

WHEREAS, Because Michigan (or local government if applicable) is home to key solar companies, the community wishes to take leadership on promoting solar energy generation and views supporting advancement in solar adoption an essential contributor to the region's economic prosperity; and

WHEREAS, Becoming a statewide leader in solar adoption will bring positive recognition to _____; *and*

WHEREAS, The United States, Michigan, and this region import sources of energy, adoption of solar helps localize the energy source, thereby helping our country, state, and region reduce its dependence on imported energy sources; *and*

WHEREAS, Solar installations help preserve our natural resources and reduce greenhouse gas and other harmful emissions; *and*

WHEREAS Michigan has reached its 10 percent goal for renewable energy and is well positioned to set higher goals in this area; *and*

WHEREAS renewable energy resources, such as community solar, offer many potential community, economic, environmental, national security, and societal benefits for the state; *and*

WHEREAS communities that become *Solar Ready* benefit from enhanced Community Vitality and new Business Investment; *and*

WHEREAS, Solar is proving to be a viable energy source in Michigan, *and*

WHEREAS, Encouraging solar adoption helps support the several goals found in local planning documents.

NOW, THEREFORE, BE IT RESOLVED THAT _____ supports the continued exploration of reducing barriers to solar adoption and earnest consideration of new polices and processes that help support solar adoption and becoming a *Solar Ready Community*.

BE IT FURTHER RESOLVED THAT _____ (will work cooperatively with *neighboring jurisdiction name(s)* if applicable) to explore policy and process change and engage in an exchange of information regarding solar adoption in the region.

TOOL C: SAMPLE PLANNING LANGUAGE

The character of planning documents varies among jurisdictions. The text below provides local governments with sample language that each jurisdiction can tailor to suit local needs. Additional language can also be drawn from the main body of this text (see Introduction). Please consult your local legal counsel for advice on the appropriateness and applicability to your jurisdiction's Master Plan.

SAMPLE REASONING AND BACKGROUND LANGUAGE

1. **Secure Energy Supply:** A solar-electric infrastructure helps protect the power supply during brownouts, blackouts, power interruptions and price fluxuations.

2. **Stimulate Jobs and Industries:** Support for and adoption of solar infrastructure will create economic opportunities for Michigan-based manufacturers and suppliers.

3. **Save Our Fresh Water Resources:** In contrast to other forms of energy, solar installations use no water in the generation of clean, renewable electricity.

4. **Reduce Operating and Maintenance Costs:** Many rooftop solar-electric installations actually act to insulate the building below. In addition, large photovoltaic installations can shade and protect a rooftop from damaging ultraviolet radiation, slowing the need for rooftop maintenance or replacement.

5. **Reduce Emissions:** Solar energy does not contribute to greenhouse gas emissions and will help reduce emissions by replacing polluting sources of power.

SAMPLE GOAL LANGUAGE

1. Demonstrate Leadership in Public Buildings by holding building public facilities to a higher energy efficient standard and by using on-site renewable energy in new buildings and facilities where technically and economically practical.

2. Protect Unobstructed Sunlight in planning and development processes to promote the use of solar energy.

3. Work with Developers to consider renewable energy resources in the layout and construction of new development.

4. Provide Information and Education to help property owners easily navigate permitting processes as they relate to solar.

5. Update Regulations to help support solar adoption and keep current with technologies.

6. Share Information to help other local governments interested in supporting solar successfully prepare for future demand.

7. Become a Solar Ready Community to send the message to developers, homeowners, and businesses that they can rely on us to help them through a successful, cost-effective installation process.

TOOL D: SAMPLE ZONING LANGUAGE

The character of zoning ordinances varies among jurisdictions. The text below is based on several, primarily Michigan based, existing solar ordinances, and provides local governments with sample language that each jurisdiction can customize to suit local needs. *Please consult your local legal counsel for advice on the appropriateness and applicability to your jurisdiction's zoning ordinance.*

As a guideline, the different scale of solar collection devices would be suitable for the following:

- Attached: All zoning districts
- Small Freestanding: Medium to low-density districts
- Large Freestanding: Industrial and possibly Agriculture

PURPOSE

The purpose of this ordinance is to add provisions to the Zoning Ordinance to address the permitting of small, medium, and large solar energy systems. The Ordinance recognizes the potential need for solar energy systems, while also supporting agricultural and habitat conservation. These changes are also necessary and appropriate to improve and enhance public welfare and safety, and to implement the Master Plan.

SAMPLE DEFINITIONS

GENERAL DEFINITION

Solar Collection Devices–General: Solar collection devices are designed to capture and utilize the energy of the sun to generate electrical power. A solar collection device is the actual material(s) used to collect solar rays and all associated ancillary and structural devices needed to support and convert/transmit the energy collected. These devices may be either freestanding or attached to a structure and are sized to meet the various user needs and/or utility requirements.

SMALL

Solar Collection Devices–Attached: An array of solar collection materials secured to the exterior walls or roof of a principal or accessory building and generate up to but not exceeding the manufacturer's rating of 20kW.

Solar Collection Devices–Small Freestanding: An array of freestanding (not attached to a principal or accessory structure) solar collection materials that generate up to but do not exceed the manufacturer's rating of 20kW.

MEDIUM

Solar Collection Devices – Medium Freestanding: An array of freestanding (not attached to a principal or accessory structure) solar collection materials that exceed the manufacturer's rating of 20kW, but do not occupy more than 10 acres of land.

Large Solar Collection Devices – Large Freestanding: An array of freestanding (not attached to a principal or accessory structure) of utility-scale solar collection materials that exceed the manufacturer's rating of 20kW and occupy more than 10 acres of land.

SAMPLE GENERAL REGULATIONS

Abandonment: Any Freestanding solar collection site or device which is not used for six (6) months shall be deemed to be abandoned. The applicant/permit holder will be so notified in writing by the municipality and requested to dismantle the site and return it to its original state. If there are mitigating circumstances as to why the site has not been used, the applicant/permit holder may contact the municipality and request a three-month extension. If a site has been deemed abandoned and no request for an extension is received, the applicant/permit holder will again be notified to dismantle the site and return it to its original state. If the applicant/permit holder does not do this, the municipality will have the removal and restoration done at the owner/applicant's expense (note that this last provision in particular should be reviewed by local legal counsel). Removal shall include removing posts, equipment, panels, foundations and other items so that the ground is restored to its preconstruction state and is ready for development as another land use.

Agricultural Land Preservation: Freestanding solar devices proposed in agricultural and open space zones are encouraged to locate on predominantly (more than 60 percent) non-prime farmlands. If they do not meet this standard, the use shall be deemed a Special Land Use, which requires a public hearing. The Application for a Special Land Use permit shall include an analysis of the potential for agricultural use on the subject site by expert in agriculture or soil science, as determined by the Planning Commission.

Height: Attached solar panels or Building Integrated Photovoltaics installed on a sloped roof of a building shall not project vertically above the peak of the roof. Solar panels attached to a flat roof shall not project vertically more than 10 feet above the roof. Solar panels attached to the side of a structure shall not project vertically above the building height allowed for that zoning district.

Small Freestanding solar devices, where the solar panels are attached to the ground by a pole, metal frame or other similar support structure, shall comply with existing regulations for accessory structures but in no instance shall the panels exceed twenty (20) feet in height in residential zones.

Medium and Large Freestanding solar devices shall meet the height limit requirements for the zone in which they are located.

Impervious Surface/Stormwater: If more than 8,000 square feet of impervious surface will be located on the site, the application shall include a drainage plan prepared by a registered civil engineer showing how stormwater runoff will be managed and demonstrating that runoff from the site will not exceed the agricultural runoff rate or otherwise cause undue flooding. If detergents will be used to clean solar panels, details on the type of detergent, frequency and quantity of use, and stormwater quality protection measures shall be provided. Any necessary permits from outside agencies for off-site discharge shall be provided.

Inspection: The municipality shall have the right, upon issuing the required permit for an Attached or Building Integrated solar system, to inspect the premises on which the solar collection devices are located at all reasonable hours.

The municipality shall have the right upon issuing the required permits to inspect the premises on which a **Freestanding** solar collection device is located at all reasonable times. The municipality, within its reasonable discretion, may retain the services of a recognized professional in the area of solar conversion systems to assist and/or advise it in the review of the application or site if deemed necessary. The expense thereof shall be the responsibility of the applicant/permit holder. The Planning Commission or Council/Board may request the applicant to post a deposit or secure a bond for such contingency.

Reflection/Glare: **Attached, Building Integrated or Freestanding** solar collection devices, or combination of devices, are designed and located to avoid glare or reflection onto adjacent properties and adjacent roadways and shall not interfere with traffic or create a safety hazard. This may be accomplished by both the placement and angle of the collection devices as well as human-made or environmental barriers. Glare intensity is considered an issue if it measures more than 20% of the incident sun intensity. Plans to reduce glare may be required in the initial materials submitted.

Responsibilities/Permits: **Attached** solar collection devices must be installed in compliance with the electrical code adopted by the local jurisdiction and the manufacturer's specifications. A copy of the manufacturer's installation instructions must be submitted to the local jurisdiction. If the applicant's intent is to install a customer-owner system that will be interconnected to the power grid, written evidence that the area's electrical utility provider has been notified will be required. Off-grid systems are exempt from this requirement.

Freestanding solar collection devices require a site plan to be secured for each site requested and should contain the following specific information in addition to all general information required: exact placement of the collection devices on the property; height, length, and angle of collection devices, lot size, zoned district setback requirements, detailed description of all land/timber clearing that is proposed; percent of prime farmland being used; site access roads for development and service; and provisions for mitigating reflection/glare and details on site security. The height of the solar collection device must not exceed the height allowed for accessory buildings in the zoned district where the collection devices are located.

Screening: Screening capable of providing year round screening for **Freestanding** devices, is provided along the back of the panel of the solar collection device or collection of devices.

Small Freestanding solar devices shall be screened from view from any public street, residential district, or agricultural district by use of a masonry screen wall, evergreen vegetation or other screening of a similar effectiveness and quality, as determined by the Planning Commission.

Setbacks: Freestanding solar devices shall meet the front, rear, and side yard setback requirements for the zone in which they are located, with the following exception: In all zones abutting a residential district (including Agriculture Zones) or residential use, the setbacks shall be at least 50 feet from all property lines adjoining said district(s) or use.

TOOL E:
SAMPLE PERMITTING PROCESS CHECKLISTS FOR CUSTOMERS

EXAMPLE 1: SIMPLE CHECKLIST FOR PERMITTING PROCESS AND REQUIREMENTS

SOLAR PERMITTING PROCESS CHECKLIST FOR JURISDICTION NAME

(Text in green is to be filled out by jurisdiction.)

Applicant Information: _____

Applicant Address: _____

Installation Address, if different: _____

Installer Name: _____

Contact Information: _____

GENERAL INFORMATION

System size:

____ Less than 5kW
____ More than 5kW but less than 14kW
____ More than 14kW but less than 20kW
____ Greater than 20kW

System location:

____ Ground-mounted
____ Roof-mounted

Grid connection intentions:

____ Off-grid system
____ Grid-tied system
(See <insert website of utility provider> for interconnection arrangement)

EXPEDITED PROCESS

As a Solar Ready Community, we have established a streamlined process for approving the most common residential solar PV installations. Your system may qualify for this expedited process if it meets all of the following criteria:

- An array composed of 4 or fewer series strings.
- An inverter with rated output of 13.44 kW or less.
- Use of an engineered mounting system on a code-compliant roof and a rooftop distributed weight of less than 5 lb/sq. ft. and less than 40 lbs. per attachment.

____ **YES**, my system qualifies for the expedited permitting process.
____ **NO**, my system does not meet these requirements—proceed to next section
(provide information and link application form for non-expedited systems)

...Continued

❶ Additional Information Requirements

a. For ground-mounted systems:

   i. Site plan (describe what you want the applicant to include in site plan)

b. For roof-mounted systems:

   i. Roof information (describe want you want the applicant to include—this request can include roof plan diagram, type of structural roof deck type, condition of roof, roofing material)

c. For all systems:

   i. Electrical diagram

   ii. Installation manuals

d. OTHER: (if there are other requirements that your jurisdiction has)

❷ Permits Required

a. You will be directed to the permits required for your system; all permits can be found here (insert URL or location for each jurisdiction)

b. When completed, permit(s) should be submitted to (who/where) for review. The review process may take up to three business days.

❸ Fees

a. Fees are based on the type of permit(s) required for your system. The standard fee schedule for (jurisdiction) is:

(List your permit fees here)

❹ Inspections

a. Completed installations will require inspections based on the types of permits that were required by the system. In most cases, only one final inspection is required; if your system is specialized and requires in-process inspections in addition to a final inspection, you will be notified at the time of application.

b. Inspection appointments are scheduled by contacting (who/where). Appointments will be scheduled for 1-3 days out, and will be given in appointment windows of 2-3 hours.

c. Inspections will confirm compliance for health, safety, and code requirements. Although not an exclusive list, the following are common requirements that will be addressed during a final solar inspection:

- Number of PV modules and model number matches plans, and specification sheets.
- Array conductors and components are installed in a professional manner.
- PV array is properly grounded.
- Electrical boxes are accessible and connections are suitable for environment.
- Array is fastened and sealed according to attachment detail.
- Conductors ratings and sizes match plans.
- Appropriate signs are property constructed, installed, and displayed.
- Equipment ratings are consistent with application and installed signs on the installation.

(Add contact information for your jurisdiction)

EXAMPLE 2: SOLAR AMERICAN BOARD FOR CODES AND STANDARDS (SOLAR ABC'S) SAMPLE EXPEDITED PERMITTING PROCESS CHECKLIST

(For more information on this template, sample worksheets and other Solar ABC resources, visit http://www.solarabcs.org/)

Expedited Permit Process for PV Systems

The information in this guideline is intended to help local jurisdictions and contractors identify when PV system installations are simple, needing only a basic review, and when an installation is more complex. It is likely that 50%-75% of all residential systems will comply with these simple criteria. For projects that fail to meet the simple criteria, resolution steps have been suggested to provide as a path to permit approval.

Required Information for Permit:

1. Site plan showing location of major components on the property. This drawing need not be exactly to scale, but it should represent relative location of components at site (see supplied example site plan). PV arrays on dwellings with a 3' perimeter space at ridge and sides may not need separate fire service review.
2. Electrical diagram showing PV array configuration, wiring system, overcurrent protection, inverter, disconnects, required signs, and ac connection to building (see supplied standard electrical diagram).
3. Specification sheets and installation manuals (if available) for all manufactured components including, but not limited to, PV modules, inverter(s), combiner box, disconnects, and mounting system.

Step 1: Structural Review of PV Array Mounting System

Is the array to be mounted on a defined, permitted roof structure? ☐ **Yes** ☐ **No**

If No due to non-compliant roof or a ground mount, submit completed worksheet for the structure WKS1.

Roof Information:

1. Is the roofing type lightweight (Yes = composition, lightweight masonry, metal, etc…)_____
   If No, submit completed worksheet for roof structure WKS1 (No = heavy masonry, slate, etc…).
2. Does the roof have a single roof covering? ☐ **Yes** ☐ **No**
   If No, submit completed worksheet for roof structure WKS1.
3. Provide method and type of weatherproofing roof penetrations (e.g. flashing, caulk).____

Mounting System Information:

1. Is the mounting structure an engineered product designed to mount PV modules? ☐ **Yes** ☐ **No**
   If No, provide details of structural attachment certified by a design professional.
2. For manufactured mounting systems, fill out information on the mounting system below:
   a. Mounting System Manufacturer _____Product Name and Model#_____
   b. Total Weight of PV Modules and Rails _____lbs
   c. Total Number of Attachment Points_____
   d. Weight per Attachment Point (b ÷ c)_____lbs (if greater than 45 lbs, see WKS1)
   e. Maximum Spacing Between Attachment Points on a Rail _____inches (see product manual for maximum spacing allowed based on maximum design wind speed)
   f. Total Surface Area of PV Modules (square feet)_____ ft^2
   g. Distributed Weight of PV Module on Roof (b ÷ f)_____ lbs/ft^2
   If distributed weight of the PV system is greater than 5 lbs/ft^2, see WKS1.

Step 2: Electrical Review of PV System (Calculations for Electrical Diagram)

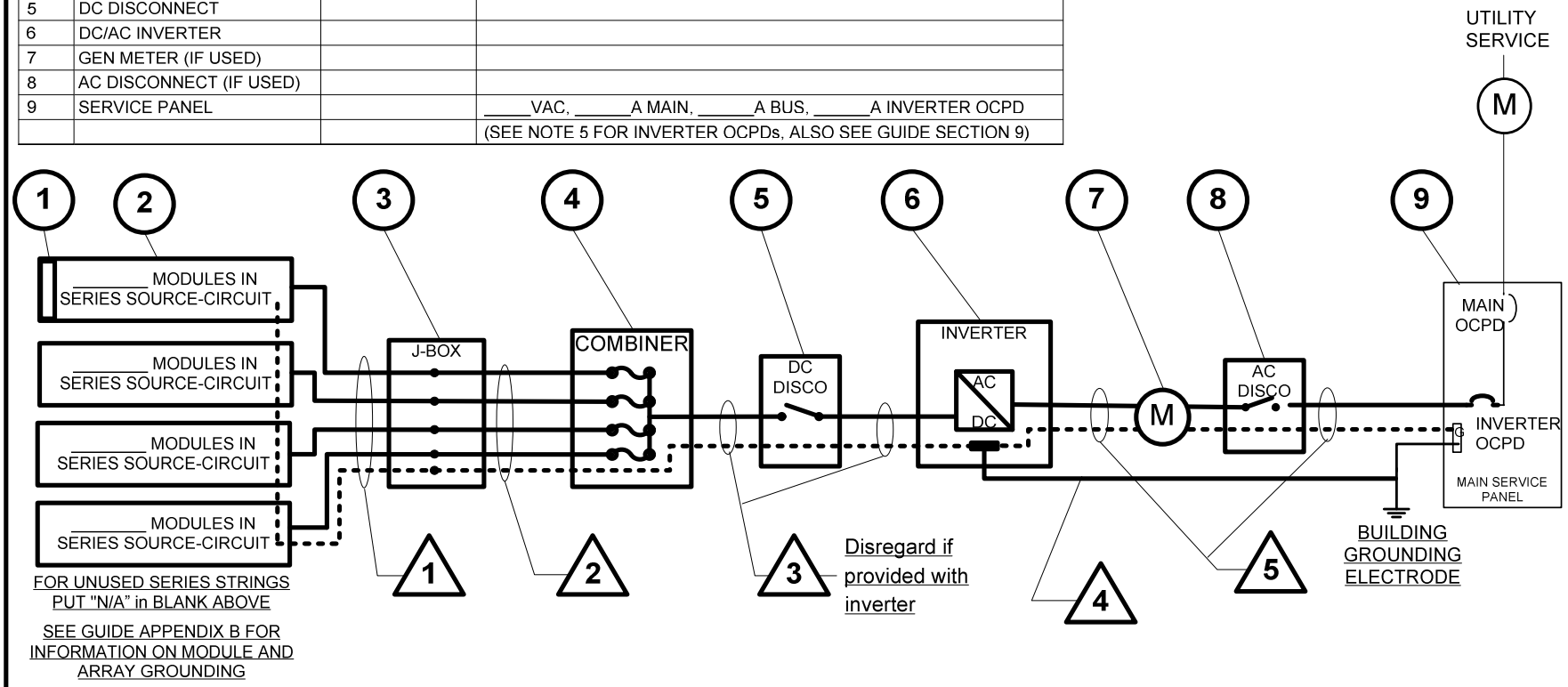
In order for a PV system to be considered for an expedited permit process, the following must apply:

1. PV modules, utility-interactive inverters, and combiner boxes are identified for use in PV systems.
2. The PV array is composed of 4 series strings or less per inverter, and 15 kWSTC or less.
3. The total inverter capacity has a continuous ac power output 13,440 Watts or less
4. The ac interconnection point is on the load side of service disconnecting means (690.64(B)).
5. The electrical diagram (E1.1) can be used to accurately represent the PV system.

Fill out the standard electrical diagram completely. A guide to the electrical diagram is provided to help the applicant understand each blank to fill in. If the electrical system is more complex than the standard electrical diagram can effectively communicate, provide an alternative diagram with appropriate detail.

Contractor Name, Address and Phone: _____ _____ _____ _____	Site Plan for Small-Scale, Single-Phase PV Systems Site Name: _____ Site Address: _____ System AC Size: _____			
Drawn By:	SIZE	FSCM NO	DWG NO S1.1	REV
Checked By:	SCALE NTS	Date:	SHEET	

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1	SOLAR PV MODULE		
2	PV ARRAY		
3	J-BOX (IF USED)		
4	COMBINER (IF USED)		
5	DC DISCONNECT		
6	DC/AC INVERTER		
7	GEN METER (IF USED)		
8	AC DISCONNECT (IF USED)		
9	SERVICE PANEL		_____VAC, _____A MAIN, _____A BUS, _____A INVERTER OCPD
			(SEE NOTE 5 FOR INVERTER OCPDs, ALSO SEE GUIDE SECTION 9)



CONDUIT AND CONDUCTOR SCHEDULE					
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 ☐ or PV WIRE ☐			N/A	N/A
	BARE COPPER EQ. GRD. COND. (EGC)			N/A	N/A
2	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
3	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	INSULATED EGC				
4	DC GROUNDING ELECTRODE COND.				
5	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	INSULATED EGC				

Contractor Name, Address and Phone:

One-Line Standard Electrical Diagram for Small-Scale, Single-Phase PV Systems

Site Name: _____

Site Address: _____

System AC Size: _____

Drawn By:	SIZE	FSCM NO	DWG NO	REV
			E1.1	
Checked By:	SCALE NTS	Date:	SHEET	

PV MODULE RATINGS @ STC (Guide Section 5)

MODULE MAKE	
MODULE MODEL	
MAX POWER-POINT CURRENT (I_{MP})	A
MAX POWER-POINT VOLTAGE (V_{MP})	V
OPEN-CIRCUIT VOLTAGE (V_{OC})	V
SHORT-CIRCUIT CURRENT (I_{SC})	A
MAX SERIES FUSE (OCPD)	A
MAXIMUM POWER (P_{MAX})	W
MAX VOLTAGE (TYP 600V_{DC})	V
VOC TEMP COEFF (mV/ºC ☐ or %/ºC ☐)	
IF COEFF SUPPLIED, CIRCLE UNITS	

NOTES FOR ALL DRAWINGS:

OCPD = OVERCURRENT PROTECTION DEVICE

NATIONAL ELECTRICAL CODE® REFERENCES SHOWN AS *(NEC XXX.XX)*

INVERTER RATINGS (Guide Section 4)

INVERTER MAKE	
INVERTER MODEL	
MAX DC VOLT RATING	V
MAX POWER @ 40ºC	W
NOMINAL AC VOLTAGE	V
MAX AC CURRENT	A
MAX OCPD RATING	A

SIGNS–SEE GUIDE SECTION 7

SIGN FOR DC DISCONNECT

PHOTOVOLTAIC POWER SOURCE	
RATED MPP CURRENT	A
RATED MPP VOLTAGE	V
MAX SYSTEM VOLTAGE	V
MAX CIRCUIT CURRENT	A

WARNING: ELECTRICAL SHOCK HAZARD–LINE AND LOAD MAY BE ENERGIZED IN OPEN POSITION

SIGN FOR INVERTER OCPD AND AC DISCONNECT (IF USED)

SOLAR PV SYSTEM AC POINT OF CONNECTION	
AC OUTPUT CURRENT	A
NOMINAL AC VOLTAGE	V

THIS PANEL FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)

NOTES FOR ARRAY CIRCUIT WIRING (Guide Section 6 and 8 and Appendix D):

1.) LOWEST EXPECT AMBIENT TEMPERATURE BASED ON ASHRAE MINIMUM MEAN EXTREME DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. LOWEST EXPECTED AMBIENT TEMP _____ºC

2.) HIGHEST CONTINUOUS AMBIENT TEMPERATURE BASED ON ASHRAE HIGHEST MONTH 2% DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. HIGHEST CONTINUOUS TEMPERATURE _____ºC

2.) 2005 ASHRAE FUNDEMENTALS 2% DESIGN TEMPERATURES DO NOT EXCEED 47ºC IN THE UNITED STATES (PALM SPRINGS, CA IS 44.1ºC). FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN ROOF-MOUNTED SUNLIT CONDUIT AT LEAST 0.5" ABOVE ROOF AND USING THE OUTDOOR DESIGN TEMPERATURE OF 47ºC OR LESS (ALL OF UNITED STATES),

a) 12 AWG, 90ºC CONDUCTORS ARE GENERALLY ACCEPTABLE FOR MODULES WITH Isc OF 7.68 AMPS OR LESS WHEN PROTECTED BY A 12-AMP OR SMALLER FUSE.
b) 10 AWG, 90ºC CONDUCTORS ARE GENERALLY ACCEPTABLE FOR MODULES WITH Isc OF 9.6 AMPS OR LESS WHEN PROTECTED BY A 15-AMP OR SMALLER FUSE.

NOTES FOR INVERTER CIRCUITS (Guide Section 8 and 9):

1) IF UTILITY REQUIRES A VISIBLE-BREAK SWITCH, DOES THIS SWITCH MEET THE REQUIREMENT? YES ☐ NO ☐ N/A ☐

2) IF GENERATION METER REQUIRED, DOES THIS METER SOCKET MEET THE REQUIREMENT? YES ☐ NO ☐ N/A ☐

3) SIZE PHOTOVOLTAIC POWER SOURCE (DC) CONDUCTORS BASED ON MAX CURRENT ON NEC 690.53 SIGN OR OCPD RATING AT DISCONNECT

4) SIZE INVERTER OUTPUT CIRCUIT (AC) CONDUCTORS ACCORDING TO INVERTER OCPD AMPERE RATING. (See Guide Section 9)

5) TOTAL OF _____ INVERTER OCPD(s), ONE FOR EACH INVERTER. DOES TOTAL SUPPLY BREAKERS COMPLY WITH 120% BUSBAR EXCEPTION IN 690.64(B)(2)(a)? YES ☐ NO ☐

Contractor Name, Address and Phone:

_____
_____
_____
_____

Notes for One-Line Standard Electrical Diagram for Single-Phase PV Systems

Site Name: _____
Site Address: _____
System AC Size: _____

Drawn By:	SIZE	FSCM NO	DWG NO	REV
			E1.2	
Checked By:	SCALE NTS	Date:	SHEET	

TOOL F:
SOLAR SAM EXERCISE

GOALS OF EXERCISE:

1. **Understand what the customer experience is like now**
2. **Determine ways to improve this experience as a region**

This tool is to help determine differences so that jurisdictions can find ways to move forward in coordinated, regional Solar Ready approach.

EXPLORATION OF THE CUSTOMER EXPERIENCE

Solar Sam and his three friends want to each install a 5 kW residential rooftop solar PV system (total cost approximately $25,000) on their individuals homes. Each of them lives in a different jurisdiction and has found that the levels of information vary and that the permitting processes are different. How can the jurisdictions come together to improve this experience?

Solar Sam and his friends try to access information.
When exploring a new topic, typically the first step for anyone today is to look up information on the Internet. Sam and his friends each go to each of their jurisdiction's website. They find that there is (little/ample/competing/similar?) information that specifically addresses solar. What can be done to make this information more accessible?

STEP 1

Solar Sam and his friends begin applying for permits.
When applying for permits, Solar Sam and his friends learn that some jurisdictions require their own forms and processes. What can be done to make this more consistent?

STEP 2

Solar Sam and his friends pay for permits.
The fees vary greatly between Solar Sam and his friends. For one the cost is only $_____, for another the cost is $_____. They wonder why there is such a big difference. What can be done to help explain the differences and/or make the fees more consistent?

STEP 3

Solar Sam and his friends await approval.
For several the friends, the approval process is fairly quick, but for others it takes up to _____. What can be done to make approval process quicker?

STEP 4

Solar Sam and his friends undergo inspection for the installation.
The total number of inspections for Solar Sam and his friends ranged from _____ to _____ or more and that the inspection time window was about ___ hours. Research suggests that eliminating the requirement for in-process (or "double") inspections for basic residential PV installations along with scheduling specific inspection times saves both the inspector's time as well as the time of the resident or installer. What could be done to reduce the number of inspections and focus the time of the inspection

STEP 5

TOOL G:
SUGGESTED WEBSITE AND BROCHURE INFORMATION

Copies of this logo can be attained from Clean Energy Coalition: http://cec-mi.org/

IDENTIFY YOURSELF AS A SOLAR READY COMMUNITY

- Use the Solar Ready logo to signify that you are part of the larger Solar Ready community and that you are prepared for and welcoming of solar installations
- Post Solar Ready Vision Statement
- Provide Solar Ready definition
- Offer background on why you chose to be Solar Ready

LIST PARTNERS

- Any collaborating jurisdictions
- All supporting/collaborating organizations
- Taskforce team members (if established)

PROVIDE WHO TO CONTACT

- Solar Coordinator (if established)
- Other relevant staff

EXPLAIN WHAT TO EXPECT DURING THE PERMITTING PROCESS

- Overview of process
- Application requirements
- Fees
- Timing
- Number and timing of inspections
- How to qualify for expedited permitting

DIRECT WHERE TO FIND AND SUBMIT APPLICATIONS

- Links to all application materials
- How to submit online, if available

INCLUDE EXTRA MILE ACTIVITIES AND ONLINE RESOURCES

- Information on Extra Mile Initiatives
- Solar calculators and other tools that will be useful to the public

TOOL H:
ELECTRIC VEHICLE CHARGING STATIONS AND SOLAR APPLICATIONS

Increasing fuel prices, concerns about energy security, and air quality improvement goals have spurred an interest in pairing automotive technology with renewable energy sources. Plug-in electric vehicles (PEVs) offer this opportunity.

As the automotive capital, Michigan has a high interest in PEVs. A 2012 study by Pike Research showed that Michigan is ranked 7th in the nation in PEV adoption. In addition, numerous automotive suppliers that develop PEV charging stations and advanced vehicle battery technology are calling Michigan home. However, as Michigan residents take to the adoption PEVs, our state's energy sources remain primarily imported and emissions producing, which negates many of the benefits that PEVs have to offer.

To help move away from imported energy and capitalize on the clean mobility potential that PEVs provide, charging stations can be coupled with a renewable energy source. The following case studies provide two successful examples of a renewable energy/charging station application in Michigan.

Western Michigan University

In an effort to green its fleet, Western Michigan University (WMU) purchased five electric vans, a hybrid-hydraulic bucket truck, and a 50-kilowatt (kW) photovoltaic (PV) array with 15 charging stations in 2012. WMU's purchase was made possible through a grant by the U.S. Department of Energy's Clean Cities program.

The PV system at WMU consists of 18 adjustable arrays that are each made up of 12 230-Watt panels (totaling 50 kW). The PV system converts the sun's energy into electricity and sends this electricity to the WMU electric grid. WMU receives this energy and provides electricity to the vehicle charging stations 24 hours a day.

The University's electric vehicles currently operate on WMU's campus and wherever the University conducts business. To date, the vehicles have traveled 31,631 miles total. The solar panels generate enough energy each day, on average, to fully charge approximately 11 Chevrolet Volts, 7 Nissan Leafs, or 6 Azure Ford Battery Electric Transit Connects. The 15 WMU charging stations are available for any electric vehicle owner to use.

To learn more, visit: http://www.wmich.edu/sustainability/projects/electric-vehicles

Lansing Board of Water and Light

In April 2013, the Lansing Board of Water and Light (LBWL) installed a solar carport as a demonstration project to study charging electric vehicles via a solar array. The carport consists of a 5-kW grid-tied solar array with two publicly available electric vehicle charging stations. The carport, located at the riverside City Market, is a modular aluminum structure designed to be waterproof and fully wind, snow and seismic code compliant. The project was funded through the U.S. Department of Energy.

As the electrical grid in Michigan becomes cleaner, so will the miles driven by a PEV.

LBWL will study the data from the project after a year of use to determine if the PV system produces enough electricity to offset the electricity consumed by the PEVs using the parking spaces.

To learn more, contact Tim Rowden at tjr@lbwl.com.

USEFUL LINKS AND FURTHER READING

Plug-in Ready Michigan: An Electric Vehicle Preparedness Plan
http://cec-mi.org/plugin

Plug-in Electric Vehicle Handbook for Consumers, DOE Clean Cities
http://www.afdc.energy.gov/pdfs/51226.pdf

Plug-in Electric Vehicle Handbook for Electrical Contractors, DOE Clean Cities
http://www.afdc.energy.gov/pdfs/51228.pdf

TOOL I:
NET METERING APPLICATION EXAMPLE

Consumers Energy

NET METERING APPLICATION

ELECTRIC UTILITY CONTACT INFORMATION	FOR OFFICE USE ONLY
Consumers Energy Interconnection Coordinator 1945 West Parnall Road (Room P24-332B) Jackson, MI 49201 (517)788-1432 Net Metering E-Mail: net_metering@cmsenergy.com	Application Number Date and Time Application Received

CUSTOMER / ACCOUNT INFORMATION
Electric Utility Customer Information (As shown on utility bill)

Customer Name (Last, First Middle)	Customer Mailing Address
Customer Phone Number ( )	Customer E-Mail Address (Optional)
Electric Service Account #	Electric Service Meter Number
Are you interested in selling Renewable Energy Credits (REC's)? ☐ Yes ☐ No	**Do you have an Alternative Electric Supplier?** ☐ Yes ☐ No If Yes, Name _____

Notes: Enter name ONLY if your energy is supplied by a 3rd party, not the utility.
You must apply to both the Distribution Utility and your Alternate Energy Provider (if applicable) for Net Metering

GENERATION SYSTEM SITE INFORMATION

Have you Completed a Generator Interconnection Application ☐ Yes ☐ No	Interconnection Application Number, if Known
Have you Executed an Interconnection and Parallel Operating Agreement ☐ Yes ☐ No	Physical Site Service Address (If Not Billing Address)
Annual Site Requirements Without Generation in Kilowatt Hours kWh/year	Peak Annual Site Demand in Kilowatts (only for customers billed on Demand Rates) kW

GENERATION SYSTEM INFORMATION

System Type (Solar, Wind, Biomass, Fuel Cell, Geothermal, etc)	
Generator Nameplate Rating kW	Expected Annual Output in Kilowatt Hours kWh/year

CUSTOMER SIGNATURE AND FEES

Attach $25 Net Metering Application Fee

☐ Check #_____ ☐ Money Order # _____

Sign and Return Completed Application with Application Fee to Electric Utility Contact

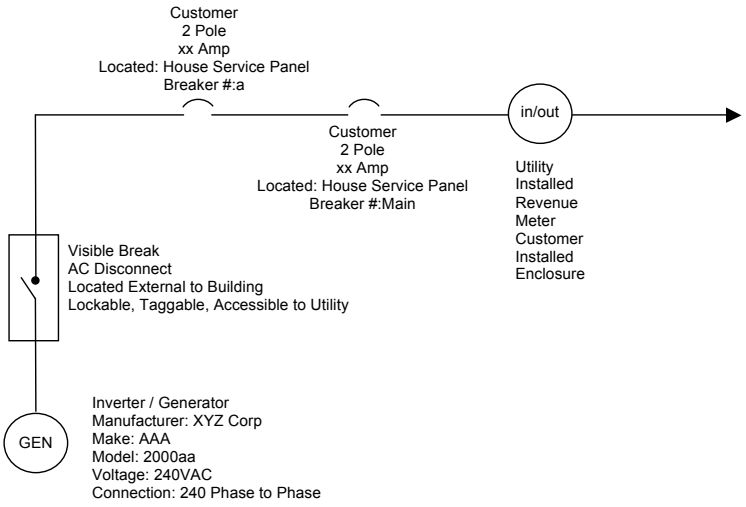
To the best of my knowledge, all the information provided in this application form is complete and correct.

Customer Signature: _____ Date _____

Form 1217 6-2009 Page 1 of 2

SAMPLE ONE-LINE DRAWING
NET METERING

UL 1741 SCOPE 1.1A COMPLIANT



Note: Legible Hand Drawn One-Line is Acceptable

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This application can be dowloaded from Consumer Energy's website:
http://www.consumersenergy.com/content.aspx?id=1800

TOOL J:
OTHER RESOURCES

Solar Energy Overview

Michigan Energy Office:
http://michigan.gov/documents/mdcd/Solar_Overview_365723_7.pdf

Solar Viability Calculators

Salt Lake City:
http://solarsimplified.org/

Weather Underground:
http://www.wunderground.com/calculators/solar.html

Solar Planning Documents & Programs

City of Ann Arbor:
http://www.a2gov.org/government/publicservices/systems_planning/energy/solarcities/Documents/Final_Solar_Plan_7-7-10.pdf

Salt Lake City:
http://www.utahcleanenergy.org/our_work/solar_salt_lake_project

Boston:
http://www.cityofboston.gov/environmentalandenergy/conservation/solar.asp

Solar Zoning and Permitting

American Planning Association:
http://www.planning.org/research/solar/faq.htm

Solar ABC's:
http://www.solarabcs.org/

Michigan Energy Office Resource listing:
http://www.michigan.gov/documents/mdcd/Solar_Zoning_and_Permiting_392576_7.pdf

City of Boston Permitting Guide:
http://www.cityofboston.gov/images_documents/Solar%20Boston%20Permitting%20Guide%20NEW%20Sept%202011_tcm3-27989.pdf

Boulder County Solar Permitting Checklist:
http://www.bouldercounty.org/doc/landuse/b46solarphotovoltaicchecklist.pdf

Solar Websites and Mapping Applications

American Planning Association:
http://www.planning.org/research/solar/briefingpapers/solarmapping.htm?print=true

Salt Lake City:
http://solarsimplified.org/

Boston:
http://gis.cityofboston.gov/solarboston/#

New York City:
http://nycsolarmap.com/

National Renewable Energy Laboratory's Open PV Project:
https://openpv.nrel.gov/

Public Information and Brochures

Salt Lake City:
http://solarsimplified.org/

City of Berkeley:
http://www.ci.berkeley.ca.us/solarpvpermitguide/

Los Alamos County brochure:
http://www.losalamosnm.us/utilities/DPUDocuments/DPU_BR100701SolarResidentialPrimer.pdf

Training

Northwestern Michigan Community College:
https://www.nmc.edu/resources/extended-education/find-a-class/energy-construction/

Detroit JATC:
http://www.greencareersguide.com/detroit-jatc-photovoltaic-systems-course-photovoltaic-seminar.html

Cost Calculator

Solar Estimate:
http://www.solar-estimate.org/?page=solar-calculator

Sample Permit Applications

Marion County, Oregon:
http://www.co.marion.or.us/NR/rdonlyres/CF9354BD-E35D-42E8-9EFD-A41FCE74B4BC/37676/B01SSolarPrescriptiveInstallationApplication4.pdf

Installed Solar In Michigan

The National Renewable Energy Laboratory Open PV Project:
https://openpv.nrel.gov/gallery

Solar Energy Business Development

Michigan Office of Energy:
http://michigan.gov/documents/mdcd/Solar_Business_Devel_9-29-11_365729_7.pdf

Solar Energy Employment and Education

Michigan Energy Office Resource Listing:
http://michigan.gov/documents/mdcd/Solar_Business_Devel_9-29-11_365729_7.pdf

Comprehensive Initiatives

Solar America Cities:
http://solaramericacities.org/

Milwaukee Shines:
http://city.milwaukee.gov/milwaukeeshines

Salt Lake City:
http://solarsimplified.org/

City of Madison, MadiSUN Solar Energy project:
http://www.cityofmadison.com/sustainability/city/madisun/

Solar Survey

City of San Diego:
http://www.sandiego.gov/environmental-services/sustainable/pdf/090925SOLARCITYSURVEYREPORT.pdf

REFERENCES

[i] http://thesolarfoundation.org/solarstates/michigan

[ii] Environmental Law and Policy Center (ELPC), the Solar and Wind Energy Supply Chain in Michigan, 2010, pg. 6

[iii] Greenpeace & European Photovoltaic Industry Association (EPIA). Solar Generation – IV, 2007, p. 48-49

[iv] http://placemaking.mml.org/

[v] http://www.dleg.state.mi.us/mpsc/reports/energy/energyoverview/

[vi] Vote Solar, Solar Growth Trends. [online]

[vii] Vote Solar, Solar Cost Trends. [online]

[viii] http://www.nrel.gov/docs/fy12osti/54738.pdf

[ix] http://mibiz.com/news/energy/item/20599-utility-co-op-offers-community-based-approach-to-access-solar-energy

[x] Average monthly residential electricity consumption, prices, and bills by state (2011), EIA, http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3

[xi] http://www.cherrylandelectric.com/content/community-solar

[xii] http://www1.eere.energy.gov/solar/pdfs/solar_timeline.pdf

[xiii] http://www.gosolarcalifornia.ca.gov/about/gosolar/california.php

[xiv] For a more detailed history of Solar Energy, please see: Ken Butti and John Perlin, A Golden Thread: 2500 Years of Solar Architecture and Technology, 1980 and Amory B. Lovins, Reinventing Fire: Bold Business Solutions for the New Energy Era, 2012.

[xv] http://www.dowpowerhouse.com/

[xvi] http://cleantechnica.com/2013/08/19/germany-breaks-monthly-solar-generation-record/

[xvii] http://www.njcleanenergy.com/renewable-energy/programs/solar-renewable-energy-certificates-srec/new-jersey-solar-renewable-energy

[xviii] http://www.seia.org/sites/default/files/resources/ZDgLD2dxPGYIR-2012-ES.pdf

[xix] http://www.energymanagertoday.com/more-than-6-4-gw-solar-electric-capacity-installed-in-us-087753/

[xx] 1.7 Billion Rooftop PV Systems (sized for a moderate house or commercial roof; 49,000 Concentrated Solar Power Plants (300 MW); and, 40,000 PV Power Plants (300 MW).

[xxi] http://www.seia.org/sites/default/files/resources/ZDgLD2dxPGYIR-2012-ES.pdf

[xxii] http://www1.eere.energy.gov/solar/pdfs/47927.pdf

[xxiii] http://www.planning.org/research/solar/briefingpapers/localdevelopmentregulations.htm?print=true

[xxiv] http://www.pewenvironment.org/uploadedFiles/PEG/Newsroom/Press_Release/Innovate,%20Manufacture,%20Compete.pdf

[xxv] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MI15R

[xxvi] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MI15R

[xxvii] MPSC interconnection website: http://www.michigan.gov/mpsc/0,4639,7-159-16393_48212_58223---,00.html

[xxviii] http://www1.eere.energy.gov/solar/pdfs/47927_chapter4.pdf

[xxix] http://energy.gov/articles/finding-solutions-solars-soft-cost-dilemma

[xxx] http://www.nrel.gov/docs/fy12osti/54574.pdf

[xxxi] http://www.michigan.gov/documents/mpsc/NetMeteringReport_Aug2012_396259_7.pdf

[xxxii] http://www.nrel.gov/docs/fy12osti/54574.pdf

[xxxiii] http://www.dteenergy.com/pdfs/pilotProgramReport.pdf

[xxxiv] http://www4.eere.energy.gov/solar/sunshot/resource_center/sites/default/files/solar-powering-your-community-guide-for-local-governments.pdf

[xxxv] http://www.sbir.gov/about/about-sbir

[xxxvi] http://www.sbir.gov/about/about-sttr

[xxxvii] http://www.mietf.org/Default.aspx

[xxxviii] http://www.mietf.org/Guidelines.aspx