Grow Solar

Local Government Solar Toolkit

PLANNING, ZONING, AND PERMITTING

Wisconsin

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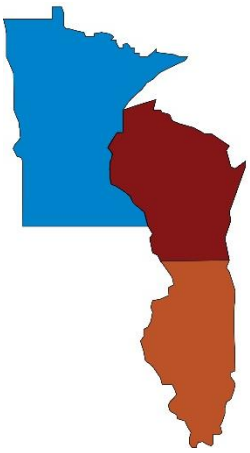
Solar Toolkit Summary

Planning, Zoning, and Permitting

As part of the Grow Solar Partnership, toolkits have been assembled to equip local governments in Minnesota, Wisconsin, and Illinois with information regarding solar development as it relates to planning, zoning, and permitting. The purpose of these toolkits is to provide resources that will assist communities in addressing barriers to solar energy installations in a manner tailored to each community's needs. The following is a summary of materials that can be found in each of the toolkits.



Solar Overview

State Solar Policy Summary

Solar policy plays an important role in the development of solar energy. This document includes highlights from each state in both the regulatory arena as well as financial incentives that are available to support solar. Additionally, the State Solar Policy Summary includes statutes that enable local governments to regulate solar in planning, zoning, and permitting. This document can be used as reference guide specific to each state.

Three State Regional Analysis

The Three State Regional Analysis looks at the 3-state region of Minnesota, Wisconsin, and Illinois to identify similarities and differences in state law and typical practices in permitting, planning, and zoning for solar energy development. This document serves as the foundation for the toolkits that were developed for each state. Using this analysis, national best practices were modified so that they could be integrated into each state's regulatory framework insofar as it relates to solar development.

Planning

Comprehensive Plan Guide

The Comprehensive Plan Guide is a tool communities can use when they update their land use plans. This document outlines considerations that communities should make and identifies elements that allow for clear priorities around solar energy objectives. Model language is included to help local governments see the types of goals and policies they could include in their plans.

Zoning

Model Ordinances

All local governments with the authority to regulate zoning should include solar development in their zoning code to recognize the value of solar and alleviate any local concerns. These model ordinances offer language to address a variety of solar land uses, tailored to local conditions and priorities.

Permitting

Local Government Permitting Checklist

Providing a clear and predictable permitting process saves time and money for both contractors and municipalities. Using national best practices, a template has been created that can be adapted locally, with notes on where municipalities might choose to modify standards based on varying circumstances.

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State Solar Policy Summary

Wisconsin

Wisconsin has policies in place that support the growth of renewable energy. The state has also seen growth in the solar industry in recent years and has a robust supply chain. Recent regulatory rulings regarding rate structures and distributed generation customers has cast some uncertainly on the solar development market in Wisconsin. Fortunately, the state has solar rights statutes that protect solar development and set a statewide standard for solar rights.

Solar Policy

Wisconsin's solar policies include:

- **Renewable Portfolio Standard (**Wisconsin Statute § 196.378). In 2005, Wisconsin enacted a Renewable Portfolio Standard, which set a goal that 10% of statewide energy would come from renewable sources by 2015.
- **Net Metering.** Net metering, initially created under Public Service Commission order (Order 6690-UR-107, effective January 1, 1993), allows owners of renewable energy systems no larger than 20 kW to sell excess generation back to the utility at retail rates.
- **Interconnection Standards.** In 2004, the Wisconsin Public Service Commission adopted interconnection standards for distributed generation systems up to 15 MW in capacity.

Solar Market

Available solar incentives and programs include:

- Milwaukee Shines is a solar program run by the city of Milwaukee that works to expand solar energy use through a comprehensive, citywide approach. The program has streamlined the permitting process, created a solar zoning ordinance, and provides financing resources for home and business owners.
- Renewable Rewards Program is a partnership between Focus on Energy and Wisconsin utilities that helps to offset solar installation costs by offering cash-back rewards for solar electric systems.
- Power Pack is an innovative, community-based solar market development program in Wisconsin. The Midwest Renewable Energy Association works in target communities to provide education and resources that simplify the process of installing solar energy systems.
- Solar and Wind Energy Equipment Exemption: any value added by a solar energy system can be exempt from general property taxes.

In 2016, 9 MW of solar electric capacity was installed in Wisconsin. Currently, almost 30 MW of solar energy is installed in the state, ranking 36th in the nation according to the Solar Energy Industries Association. Recent unfavorable regulatory rulings have slowed solar development compared to national markets. In spite of these rulings, Wisconsin has seen growing interest in community shared solar models, in both the investor-owned and the member-owned utility industry.

Statutory Context – Local Authority

Enabling Statutes for addressing solar resources

1. **Comprehensive Planning**
   - Wisconsin Statute 66.1001 *Comprehensive Planning*. Wisconsin's Comprehensive Planning statute does not single out solar energy planning requirements, but broadly calls out the need to address critical natural and economic resources in the Plan. Local governments can address solar resources and development under these provisions.
2. **Zoning**
   - Wisconsin Statute 62.23 (7) *Zoning.* grants authority to cities and villages to regulate and restrict by ordinance, the development of their jurisdiction.
   - Wisconsin Statute 60.61(2)(i), General Zoning Authority for Towns, specifically enables towns to provide for access to sunlight for solar energy systems in zoning regulation.
3. **Solar Rights**
   - Wisconsin has a strong solar rights statute that creates a common format and structure for solar zoning. Wisconsin state law, 66.0401 Regulations, relating to solar and wind energy systems states:
     No county, city, town, or village may place any restriction, either directly or in effect, on the installation or use of solar energy system […].
   - Further, 66.0401 (2) provides local governments the authority to enact an ordinance that would require the trimming of vegetation that blocks solar equipment, provided the solar energy system was installed prior to the planting of the vegetation.
4. **Home Owners' Associations**
   - Wisconsin Statute 236.292 voids all restrictions on platted land that would prevent or restrict the construction of solar energy systems. The law effectively prohibits any private land use controls from preventing the installation of solar energy systems.
5. **Solar Access**
   - Wisconsin Statute 700.35, defines a renewable energy easement which "*limits the height or location, or both, of permissible development on the burdened land in terms of a structure or vegetation, or both, for the purpose of providing access for the benefited land to wind or sunlight passing over the burdened land*."
   - Wisconsin Statute 700.41, Solar and Wind Access, protects owners of solar energy systems from obstruction of sunlight. It allows "*an owner of an active or passive solar energy system or wind energy system to receive compensation for an obstruction of solar energy by a structure outside a neighbor's building envelope as defined by zoning restrictions in effect at the time the solar collector . . . was installed.*"
   - Wisconsin Statute 844.22, Obstruction of solar or wind energy system, states:
     Any structure that tis constructed or vegetative growth that occurs on adjoining or nearby property after a solar energy system, as defined in 13.48 […] is installed on any property, that interferes with the functioning of the solar or wind energy system, is considered to be a private nuisance.

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Solar in Comprehensive Planning

Purpose

Comprehensive plans are the foundational policy document reflecting a community's priorities and values regarding development and local resources. Solar energy resources are an increasingly valuable local resource — solar development can bring environmental and economic benefits to a community through clean energy production, creation of local jobs and revenue, and improved property values. Communities are acknowledging this valuable resource and incorporating support and guidance for solar energy development into comprehensive plans, sending a strong message of commitment for sustained growth in the solar energy sector.

Communities are not, however, always familiar with the characteristics of solar resources and solar land uses. This document outlines considerations that communities should make and identifies elements that allow for clear priorities around solar energy objectives. Identifying how solar development can benefit the community will help decision-makers determine how solar resources and investments are integrated into the community in a way that balances and protects competing development or resources.

Downtown Solar Resource Map. Rochester, MN

Considerations

When addressing solar development in a comprehensive plan, it is important to acknowledge what makes solar work for a community as well as the inherent conflicts that may arise. Any comprehensive plan that includes a solar component should:

1. Address the solar resource and the different land use forms that solar development can take
2. Acknowledge the multiple benefits of solar development
3. Guide decision-makers on optimizing opportunities when solar development might conflict with other resources or land use forms

Each of these components can help a community identify how they wish to include solar as a resource and to be able to reasonably justify why and where solar development is supported.

Additionally, in Wisconsin, Statute 66.1001 Comprehensive Planning outlines the elements that must be included in a comprehensive plan. Elements where solar goals and policies may be added include: *Issues and Opportunities; Utilities and community facilities; Agricultural, natural, cultural resources; economic development; and land use.*

Solar Resource

The local landscape (e.g., topography, on-site obstructions, obstructions on adjacent land, potential future obstructions) defines whether or not a given site has a good solar resource. An adequate solar resource is a site that is unshaded for at least 6 hours a day, both now and into the future. Communities

can map their solar resource using LiDAR data that is frequently available in urban areas, and in some states even in rural areas. Such a map can allow the community to measure the size of their "solar reserves" identify areas with good and poor resources for prioritizing development in a manner consistent with other land uses, and even distinguish between opportunities for rooftop and ground-mount solar development opportunities.

In addition to measuring and recognizing the solar resource, communities should recognize that a variety of methods exist to capture the energy and provide economic value. There are several different types of solar installations a community will want to consider: rooftop, accessory ground-mount, and principal ground-mount. A community can use the comprehensive plan to determine which of these technologies to support and/or promote.

Rooftop Solar, MREA

Solar Benefits

Communities can realize a number of benefits through solar development, including environmental, energy production, and economic development. Environmental benefits include helping meet local air quality or climate protection goals. Communities with renewable energy or energy independence goals can better achieve these through explicit support of solar energy development. Economically, solar development creates construction jobs for a variety of trades, financially benefits those who install systems on their properties with lower energy bills, and increases the property value of buildings within the local housing market.

Ground Mount System, CERTs

Land Use Conflicts

Like any development, solar may come into conflict with other land uses, and solar resources are often co-located with other important local resources. Recognizing these issues in the comprehensive plan can help to mitigate future problems.

Solar Farm, CERTs

Some conflicts to consider include:

- Agricultural practices
- Urban forests
- Historic resources
- Airport control towers
- Natural areas
- Future housing or commercial development

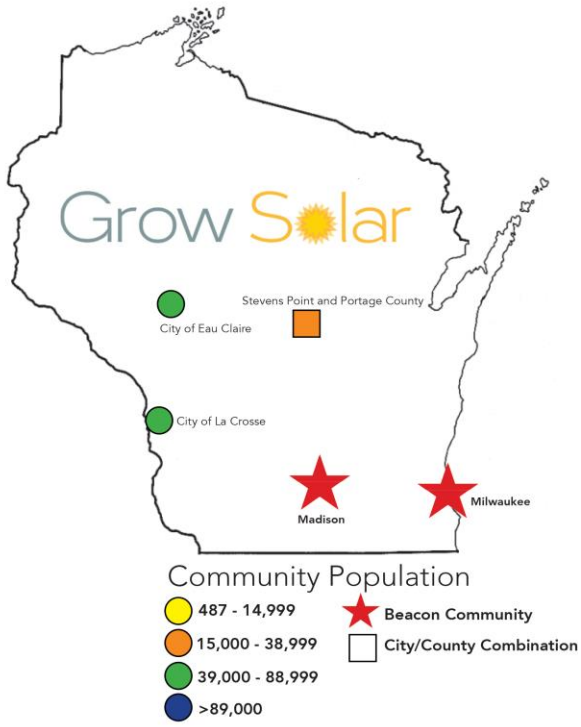
Each community is different and may see conflicts arise that are not listed here. Identifying and addressing those conflicts in comprehensive planning will need to happen at the community level.

Elements

Common features of a comprehensive plan include a discussion of existing conditions, a presentation of desired outcomes in the form of a vision and goals, and an inventory of policies and actions that support those goals. The following model language are examples of what could be incorporated into a comprehensive plan.

Existing Conditions

Understanding the potential importance of a community's solar resource requires some knowledge of both the availability of the local solar resource and the community's existing energy use. Using a solar map, like the one described above, is a useful way to demonstrate the solar potential across the area. Identifying the areas with the greatest potential can help the community plan and prepare for the best sites to locate solar investment and to achieve the goals outlined in the plan. Understanding the nature of the community's energy use – data that can be obtained from the community's utility providers – can put the solar resource within the appropriate economic and use intensity context. For instance, most communities have sufficient solar resources to theoretically meet a substantial portion of their electric energy consumption, even if only the best resources are used.



Map courtesy of Midwest Renewable Energy Association

Goals

Among communities that have added renewable energy goals and objectives to their plans, common themes include encouraging solar site design for new subdivisions, improving the energy performance of municipal facilities, removing barriers and creating incentives for small-scale or "distributed" installations, and capturing economic development opportunities associated with renewable energy investment.

Examples of goals may be:

> **Goal 1:** Encourage local production of solar energy on new residential and commercial construction.
>
> **Goal 2:** Maximize the production of solar photovoltaic energy to the extent feasible, while minimizing potential biological, agricultural, visual, and other environmental impacts.

Policies and Actions

In Comprehensive Plans, policies are statements of intent with enough clarity to guide decision-making. Policy statements should be tied to the desired goals and set a clear path to action. Examples of policies are:

> **Policy 1:** Establish clear guidelines for solar ready development in all zoning districts where solar is a permitted use.
>
> **Policy 2:** The City supports the State's effort to achieve the Renewable Portfolio Standard (RPS), which requires utilities to generate 25% of electricity from renewable energy sources, and the State's solar energy goal of having sufficient solar generation to meet 10% of electric use by 2030.

Actions are more specific statements that direct programs, regulations, operational procedures, or public investments. Action statements are intended to guide the implementation of the stated policies. Examples of action statements follow:

> **Action 1:** Provide incentives for developers who build solar-ready residential and commercial structures.
>
> **Action 2:** The City should complete a study to identify opportunities for investment in solar energy resources on public buildings and lands.

Additional Resources:

Planning for Solar Energy, American Planning Association
https://www.planning.org/store/product/?ProductCode=BOOK_P575

Planning Advisory Service Essential Info Packets, Planning and Zoning for Solar Energy
https://www.planning.org/pas/infopackets/open/eip30.htm

Iowa Smart Planning Principles, Statute, Guidance document on-line.
https://rio.urban.uiowa.edu/sites/rio/files/Iowa_Smart_Planning_Overview_0.pdf

Minnesota Solar Planning Requirement – Metropolitan Land Planning Act 473.859. Subd.2b

Metropolitan Council Local Planning Handbook

Illinois Planning Authority for Protection Solar Resources ((65 ILCS 5/11-12-5) (from Ch. 24, par. 11-12-5)
http://www.ilga.gov/legislation/ilcs/fulltext.asp?DocName=006500050K11-12-5

Photos are courtesy of the **Clean Energy Resources Teams & the Midwest Renewable Energy Association**

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Model Solar Zoning for Wisconsin Municipalities

Every Wisconsin community should have zoning language that addresses solar energy systems. Solar installations are a form of development, and development regulations, including zoning and subdivision ordinances, need to incorporate the variety of development forms that solar installations can take. Moreover, incorporating solar land uses and development in the ordinances recognizes that the community's solar resources are a valuable asset with economic and environmental value that property owners will want to capture. Solar development regulation can help educate staff and community, as well as alleviate potential conflicts or confusion.

Wisconsin has state statutes that protect a resident's right to install and operate a solar energy system, most notably 66.0401 (see text box). This statute set parameters for how and when zoning standards by local governments can limit private land owners' ability to capture solar resources. Other statutes enable or encourage other protections, such as the ability to create solar easements across properties, addresses some conflicts from shading by trees, and restrictions on solar placed by homeowner associations.

WI Statute 66.0401 Solar and Wind Systems

(1m) Authority to restrict systems limited. *No political subdivision may place any restriction, either directly or in effect, . . . on the installation or use of a solar energy system, as defined in s. 13.48 (2) (h) 1. g., or a wind energy system, unless the restriction satisfies one of the following conditions:*

(a) Serves to preserve or protect the public health or safety.

(b) Does not significantly increase the cost of the system or significantly decrease its efficiency.

(c) Allows for an alternative system of comparable cost and efficiency.

Each municipality should draft its zoning language to integrate with these state laws. Without clearly addressing solar energy in the zoning ordinance, local zoning ordinances could appear to conflict with the Wisconsin state laws and could create uncertainty of interpretation and authority for home or business owners investigating investing in a solar energy system. An ordinance that is "solar ready" will acknowledge State law, and clearly identify local standards where discretion remains with the local jurisdiction.

Development regulations that are "solar ready" will have the following characteristics:

- Address all the types of solar land uses that the community is likely to see
- Document an as-of-right solar installation opportunity for accessory use solar and, where reasonable, for principal use solar development
- Balance between solar resources and other valuable local resources (trees, soils, historic resources) in the development process

All zoning ordinances include certain basic elements that can, if not considered in the context of solar resources and technologies, create inadvertent barriers to solar development. Basic zoning elements include:

1. **Use.** Which land uses are permitted, which are conditional, which are prohibited in each zoning district? Accessory uses are protected under State law, except where health or safety issues might come into play. The municipality has more say regarding principal uses, such as solar farms or gardens, and the ordinance needs to identify where such uses are allowed.

2. **Dimensional Standards.** Municipalities can place only limited restrictions on where on the lot solar development can occur. Most communities already allow some exceptions to height and setback requirements; defining these exceptions for solar, consistent with state law, will limit conflicts and misunderstandings.
3. **Coverage and Bulk**. Accessory uses cannot be limited for aesthetic reasons, so coverage limitations must address health and safety concerns. Principal uses have coverage (impervious surface) impacts that should be explicitly addressed in the ordinance. Does the surface of a solar collector count as impervious surface for storm water standards? What mitigation or co-benefits for storm water can be built into the ordinance?

Photo Credit: Great Plains Institute

Some municipality's zoning ordinances have more advanced elements that should also be addressed to make the ordinance consistent with state law, and to take advantage of regulatory incentives where the community wants to encourage solar development. Examples include:

- **Design standards** – Solar is exempt from community aesthetic or character standards that are part of local regulations, except for historic protections.
- **Solar Easements or Cross-Property Protection.** Does local regulation protect the long-term solar resource when someone makes a long-term investment in solar infrastructure? Is there a public purpose in protecting solar access across property lines?
- **Integrating with Other Processes.** How does solar development conflict or support agricultural protection, historic preservation, urban forests, urban expansion areas, municipal utility goals? Both principal uses and accessory uses should be considered for their impact on these other community assets and resources.

The City of Milwaukee, through the City's solar program *Milwaukee Shines*, has implemented solar zoning (see description on following pages). Milwaukee's solar energy zoning was modeled after the **Wisconsin Statute §66.0401**, so it satisfies the state requirements, but also was designed to fit to the Milwaukee community. Other communities will need to address some issues differently.

Following the Milwaukee example, this toolkit provides model solar ordinance language and guidance on specific elements of zoning for accessory and principal uses. The model ordinance was developed to use national solar zoning best practices, but is consistent with Wisconsin state law.

Questions? If you would like to develop solar zoning for your community, please contact:

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City of Milwaukee Model Solar Zoning Language

Definitions: The City of Milwaukee used the definitions provided in the Wisconsin state statute to clarify what equipment is used as part of a solar energy system and for what land uses. Definitions included in the City of Milwaukee solar energy zoning were: solar collector, solar array, and solar farm.

Solar Collector: A device, structure, or part of device, the substantial purpose of which is to transform solar energy into thermal, mechanical, chemical, or electrical energy.

Solar Array: An accessory system or device that is roof-mounted or ground-mounted with poles or racks used to collect radiant energy directly from the sun for use in a solar collector's energy transformation process.

Solar Farm: An array of multiple solar collectors on ground-mounted racks or poles that transmit solar energy and is the **primary** land use for the parcel on which it is located.

Solar Electric Ground-Mounted Solar Array at Discovery World

Solar Access Rights: The authority to restrict systems is limited by Wisconsin state law. This is noted in the state statute and should be replicated in municipal zoning. Milwaukee zoning meets the minimum requirements of the state statute so residents have full access to install solar throughout the city. In addition, this language referring to the state statute helps the Milwaukee Board of Zoning Appeals if issues regarding solar access rights come before the committee. For further details, read the Wisconsin State Statute §66.0401.

General Requirements: When it comes to land use regulations, Milwaukee did not see a need for many requirements, as most urban installations of solar are typically rooftop installations. However, general setback restrictions may need to be addressed on solar ground-mounted systems and solar farms for land use purposes. The purpose of setting these minimal requirements is to provide satisfaction for neighbors while ensuring that the restrictions do not increase the price or decrease the efficiency of a property owner's solar energy system. The City of Milwaukee looked to existing structures and uses to set general requirements:

Ground-Mounted Solar Energy Systems Setback Requirements:

- If less than 20 feet in height: setback must comply with 1.5 feet from all property lines.
- If greater than 20 feet in height the ground-mounted solar energy system must comply with setback regulations for a principal building structure.

In addition, the City of Milwaukee set general requirements for signage in regards to solar energy systems. Only one sign is allowed per solar array. The display area must be less than six square feet in size and must be either for acknowledgement or educational purposes.

Permitted Uses: No resident or business owner can be restricted in installing solar due to Wisconsin State Statute §66.0401 unless the restriction satisfies one of the following conditions[1]:

- Serves to preserve or protect the public health or safety.
- Does not significantly increase the cost of the system or significantly decrease its efficiency.
- Allows for an alternative system of comparable cost and efficiency.

[1] Note here the absence of the typical language "serves to protect the public health, safety, or *welfare*" language. The legislative history of this statute indicates lawmakers specifically eliminated the term *welfare* from the language. Communities (or private subdivisions) can limit solar power only for health or safety reasons; not for other reasons like aesthetics.

Solar Farms**:** With solar energy becoming a mainstream source for energy for homeowners and business owners, solar farms are becoming more prevalent in cities across the United States, especially as an option for development on brownfield sites or other undevelopable pieces of property. Cities need to prepare for such opportunities with solar farm zoning. Below is the City of Milwaukee's definition of a solar farm:

> *Solar Farm*: An array of multiple solar collectors on ground-mounted racks or poles that transmit solar energy and is the **primary** land use for the parcel on which it is located.

Solar Farm - MATC Blue Hole Project Located on Capitol Drive in Milwaukee.

Since solar farms are the primary use for a parcel of land, setbacks were determined based on existing setback requirements for principal structures that functioned as the primary use as determined by Milwaukee's current zoning districts.

To maintain the character of certain neighborhoods and districts, the City of Milwaukee applied a special use for solar farms in some zoning districts. If a solar farm is proposed in a special district it goes before the City of Milwaukee Board of Zoning Appeals to address issues related to solar in that zoning district as applicable to the community. Below is the table that outlines permitted uses for solar farms in the City of Milwaukee:

Solar Farm Setback Requirements:

- Cannot exceed setback requirements for principal structures as primary use as determined by zoning district.

Zoning District	Use
Residential	Permitted
Commercial	Special
Commercial Services	Permitted
Downtown	Special
Industrial	Permitted
Special (Schools, parks)	Permitted
Lakefront Overlay	Special

Historic Preservation: A municipality's typical historic preservation process may also need to be clarified to be consistent with Wisconsin State Statute §66.0401. When creating solar zoning ordinance, it will be important to include the historic preservation office or staff in this process. The cities of Milwaukee and Madison developed community-specific approaches to balanced solar and historic resources. These examples are consistent with the guidance from the Department of the Interior, which manages historic designations at the national level, and the National Trust for Historic Preservation.

Resources and Reference Material

- SolSmart Zoning Credit resources, The Solar Foundation, http://www.gosparc.org/resources/
- National American Planning Association, *Planning for Solar Energy,* https://www.planning.org/store/product/?ProductCode=BOOK_P575
- National American Planning Association, Planners Advisory Service Essential information packet, https://www.planning.org/pas/infopackets/open/eip30.htm
- Model Zoning for the Regulation of Solar Energy Systems, Department of Energy Resources Massachusetts Executive Office of Energy and Environmental Affairs, http://www.mass.gov/eea/docs/doer/green-communities/grant-program/model-solar-zoning.pdf
- University of North Carolina, *Planning and Zoning for Solar Energy*, http://sogpubs.unc.edu/electronicversions/pdfs/pandzsolar2014.pdf
- Solar ABCS, *A Comprehensive Review of Solar Access Law in the United States,* http://www.solarabcs.org/about/publications/reports/solar-access/pdfs/Solaraccess-full.pdf
- The Solar Foundation, *A Beautiful Day in the Neighborhood: Encouraging Solar Development through Community Association Policies and Procedures,* http://www.thesolarfoundation.org/a-beautiful-day-in-the-neighborhood-encouraging-solar-development-through-community-association-policies-and-processes/
- National Alliance of Preservation Commissions, *Sample Guidelines for Solar Systems in Historic Districts*, http://www.preservationnation.org/information-center/sustainable-communities/buildings/solar-panels/additional-resources/NAPC-Solar-Panel-Guidelines.pdf
- National Trust for Historic Preservation, Solar Panels and Historic Preservation, http://www.preservationnation.org/information-center/sustainable-communities/buildings/solar-panels/#.VUJ32JNi91A

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Model Solar Ordinance – Wisconsin

Introduction

Wisconsin has good solar energy potential—as good as Houston, Texas and many parts of Florida. As solar energy system components have become more efficient and less costly, an increasing number of solar energy systems have been installed in Wisconsin. Market opportunities for solar development have dramatically improved in Wisconsin over the last five years, such that most communities now must address solar installations as land use and development issues. Solar energy components continue to improve in efficiency and decline in price; solar energy has reached retail cost parity for many customers, and is now approaching cost competitive status at the wholesale level.

Model Solar Energy Standards

This ordinance was developed in 2015 based on work completed under the Department of Energy's Phase I Rooftop Solar Challenge program, and updated for the three-state Grow Solar initiative, funded by Rooftop Solar Challenge Phase 2. Final update was August 2017.

But solar energy is much more than a supplement (or alternative) to utility power. Solar energy has become a symbol of energy self-sufficiency and environmental sustainability. The growth in solar installations is attributable as much to the non-economic benefits as to solar being an economic substitute for electric utility power. Households and businesses wanting to reduce their carbon footprint see solar energy as a strong complement to energy efficiency. Volatility in natural gas prices and retail electric rate increases make free solar fuel an attractive price hedge.

Solar Energy Issues

Local governments in Wisconsin are seeing increasing interest by property owners in solar energy installations, and are having to address solar land uses in their development regulation. Given the continuing decline in cost, and increasing value of clean energy, solar development will increasingly be a local development issue. Three primary issues tie solar energy to development regulations:

1. *Land use conflicts and nuisance considerations.* Solar energy systems have few nuisances, but some types of solar development can compete for land with other development options, and visual impacts and safety concerns by neighbors sometimes create opposition to solar installations. Good design and attention to aesthetics can answer most nuisance or visual concerns. But large scale development (solar farms or gardens) are becoming more common and raise the issue about whether and where such land uses are appropriate, just like other types of development.
2. *Protecting access to solar resources.* Development regulations can inadvertently limit a property owner's ability to access their solar resource. Solar access can also be limited by buildings or vegetation on adjacent lots. Communities should ensure the development of resources are protected in zoning and subdivision processes, consistent with state law (Wisconsin Statute §66.0401)
3. *Encouraging appropriate solar development.* Local governments that have set climate protection or sustainability goals can meet some of their commitment by removing regulatory barriers to solar energy and incorporating low or no-cost incentives in development regulations to spur solar investment.

Components of a Solar Standards Ordinance

Solar energy standards should:

1. *Acknowledge state law that dedicates an as-of-right solar installation path for property-owners*. Create a clear regulatory path (an as-of-right installation) to solar development for both accessory and (if appropriate) principal uses such as solar farms and ground-mount community shared solar installations, consistent with state law.
2. *Limit regulatory barriers to developing solar resources*. Access to solar resources may not be unduly limited by height, setback, or coverage standards, unless the restriction satisfies the conditions of Wisconsin Statute §66.0401 (1m) a-c.
3. *Define appropriate aesthetic standards.* Per state law, design or aesthetic standards may not restrict the installation or use of solar energy systems, unless the restriction satisfies the conditions of Wisconsin Statute §66.0401 (1m) a-c.
4. *Address cross-property solar access* issues. Ensure solar installations have protected access across property lines in the subdivision process and in all zoning districts, per state law (Wisconsin Statute §700.41).
5. *Address principal solar uses*. Define where in the community solar energy land uses are appropriate as a principal or primary use, and set development standards and procedures to guide such development.
6. *Consider "solar-ready" design*. Encourage developers and builders to use solar-ready subdivision and building design.
7. *Consider regulatory incentives*. Incorporate regulatory incentives such as density bonuses that can spur private-sector solar investment.

Different Community Types and Settings

The model ordinance language addresses land use concerns for both urban and rural areas, and thus not all of the provisions may be appropriate for every community. Issues of solar access and nuisances associated with solar energy systems are of less consequence outside urban areas, where lot sizes are almost always greater than one acre. Solar farms and gardens (principal solar land uses) are much more likely to be proposed in rural areas rather than developed cities. However, urban areas should consider where solar farms or gardens can add value to the community and enable economic development of a valuable local resource. Rural communities should also specifically address rooftop and accessory ground-mount development. The standards used in this model are designed more for the urban circumstances; rural communities can disregard many of the design standards presented here and simply list rooftop solar as a permitted accessory use.

Solar development is not one thing

Communities would not apply the same development and land use standards to an industrial facility and a single family home merely because both are buildings. Similarly, solar farm/garden development is a completely different land use than rooftop or backyard solar. Standards that are appropriate for solar farms may well be wholly inappropriate for rooftop solar, and may unnecessarily restrict or stymie solar development opportunities of home and business owners.

This ordinance includes language addressing solar energy as an accessory use to the primary residential or commercial use in an urban area, and language for principal solar uses as typically seen in rural communities. The accessory and principal land uses have different issues and need to be addressed in a substantially different manner from each other. Care should be taken to address both types of solar development.

Model Ordinance

I. **Scope -** This article applies to all solar energy installations in Model Community.

II. **Purpose** - Model Community has adopted this regulation for the following purposes:

A. **Comprehensive Plan Goals** - To meet the goals of the Comprehensive Plan and preserve the health, safety and welfare of the Community's citizens by promote the safe, effective and efficient use of solar energy systems installed to reduce the on-site consumption of fossil fuels or utility-supplied electric energy. The following solar energy standards specifically implement the following goals from the Comprehensive Plan:

1. **Goal** – Encourage the use of local renewable energy resources, including appropriate applications for wind, solar, and biomass energy.
2. **Goal** – Promote sustainable building design and management practices in residential, commercial, and industrial buildings to serve current and future generations.
3. **Goal** – Assist local businesses to lower financial and regulatory risks and improve their economic, community, and environmental sustainability.
4. **Goal** – Efficiently invest in and manage public infrastructure systems to support development and growth.

Comprehensive Plan Goals

Tying the solar energy ordinance to Comprehensive Plan goals is particularly important for helping users (both Planning Commission and community members) understand why the community is developing and administering regulation.

The language here provides examples of different types of Comprehensive Plan goals, and other policy goals that the community may have that are served by enabling and encouraging solar development. The community should substitute its policy goals for these examples.

The Comprehensive Plan may not include goals that are enhanced by solar development, (such as climate protection or local resource economic goals). The community should consider creating a local energy plan or similar policy document to provide a policy foundation for solar development regulation.

B. **Climate Change Goals** - Model Community has committed to reducing carbon and other greenhouse gas emissions. Solar energy is an abundant, renewable, and nonpolluting energy resource and that its conversion to electricity or heat will reduce our dependence on nonrenewable energy resources and decrease the air and water pollution that results from the use of conventional energy sources.

C. **Wisconsin Smart Planning** – Wisconsin Smart Planning principles must be considered when local governments make planning, zoning, development, and resource management decisions. Model Community has adopted Principle 3 – Clean, Renewable, and Efficient Energy – to encourage the promotion of clean energy use through increased access to renewable energy resources.

D. **Infrastructure** - Distributed solar photovoltaic systems will enhance the reliability and power quality of the power grid and make more efficient use of Model Community's electric distribution infrastructure.

E. **Local Resource** - Solar energy is an under used local energy resource and encouraging the use of solar energy will diversify the community's energy supply portfolio and exposure to fiscal risks associated with fossil fuels.

F. **Improve Competitive Markets** - Solar energy systems offer additional energy choice to consumers and will improve competition in the electricity and natural gas supply market.

III. Definitions

Solar Energy System - A solar energy system whose primary purpose is to harvest energy by transforming solar energy into another form of energy or transferring heat from a collector to another medium using mechanical, electrical, or chemical means.

Solar Definitions

Not all these terms are used in this model ordinance, nor is this a complete list of solar definitions. As a community develops its own design standards for solar technology, many of the concepts defined here may be helpful in meeting local goals. For instance, solar daylighting devices may change the exterior appearance of the building, and the community may choose to distinguish between these devices and other architectural changes.

Building-integrated Solar Energy Systems – A solar energy system that is an integral part of a principal or accessory building, rather than a separate mechanical device, replacing or substituting for an architectural or structural component of the building. Building-integrated systems include but are not limited to photovoltaic or hot water solar energy systems that are contained within roofing materials, windows, skylights, and awnings.

Grid-intertie Solar Energy System - A photovoltaic solar energy system that is connected to an electric circuit served by an electric utility company.

Ground-mount – a solar energy system mounted on a rack or pole that rests or is attached to the ground. Ground-mount systems can be either accessory or principal uses.

Off-grid Solar Energy System - A photovoltaic solar energy system in which the circuits energized by the solar energy system are not electrically connected in any way to electric circuits that are served by an electric utility company.

Passive Solar Energy System - A solar energy system that captures solar light or heat without transforming it to another form of energy or transferring the energy via a heat exchanger.

Photovoltaic System - A solar energy system that converts solar energy directly into electricity.

Renewable Energy Easement, Solar Energy Easement - An easement that limits the height or location, or both, of permissible development on the burdened land in terms of a structure or vegetation, or both, for the purpose of providing access for the benefited land to wind or sunlight passing over the burdened land, consistent with Wis Statutes 700.35.

Renewable Energy System - A solar energy or wind energy system. Renewable energy systems do not include passive systems that serve a dual function, such as a greenhouse or window.

Roof-mount – a solar energy system mounted on a rack that is fastened to or ballasted on a building roof. Roof-mount systems are accessory to the principal use.

Roof Pitch - The final exterior slope of a building roof calculated by the rise over the run, typically but not exclusively expressed in twelfths such as 3/12, 9/12, 12/12.

Solar Access - Unobstructed access to direct sunlight on a lot or building through the entire year, including access across adjacent parcel air rights, for the purpose of capturing direct sunlight to operate a solar energy system.

Solar Farm - A commercial facility that converts sunlight into electricity, whether by photovoltaics (PV), concentrating solar thermal devices (CST), or other conversion technology, for the primary purpose of wholesale sales of generated electricity. A solar farm is the principal land use for the parcel on which it is located.

Solar Garden – A commercial solar-electric (photovoltaic) array that provides retail electric power (or a financial proxy for retail power) to multiple households or businesses residing or located off-site from the location of the solar energy system. A community solar system may be either an accessory or a principal use.

Solar Resource - A view of the sun from a specific point on a lot or building that is not obscured by any vegetation, building, or object for a minimum of four hours between the hours of 9:00 AM and 3:00 PM Standard time on all days of the year.

Solar Collector - A device, structure or a part of a device or structure for which the primary purpose is to transform solar radiant energy into thermal, mechanical, chemical, or electrical energy.

Solar Collector Surface - Any part of a solar collector that absorbs solar energy for use in the collector's energy transformation process. Collector surface does not include frames, supports and mounting hardware.

Solar Resource

Understanding what defines a "solar resource" is foundational to how land use regulation affects solar development. Solar energy resources are not simply where sunlight falls. A solar resource has minimum spatial and temporal characteristics, and needs to be considered not only today but also into the future. Solar energy equipment cannot function as designed if installed in partial shade, with too few hours of daily or annual direct sunlight, or without southern or near-southern exposure. Many provisions of the model ordinance are predicated on the concept that a solar resource has definable characteristics that are affected by local land use decisions and regulation.

Solar Daylighting - A device specifically designed to capture and redirect the visible portion of the solar spectrum, while controlling the infrared portion, for use in illuminating interior building spaces in lieu of artificial lighting.

Solar Energy - Radiant energy received from the sun that can be collected in the form of heat or light by a solar collector.

Solar Energy System - A device, array of devices, or structural design feature, the purpose of which is to provide for generation of electricity, the collection, storage and distribution of solar energy for space heating or cooling, daylight for interior lighting, or water heating.

Solar Heat Exchanger - A component of a solar energy device that is used to transfer heat from one substance to another, either liquid or gas.

Solar Hot Air System - (also referred to as Solar Air Heat or Solar Furnace) – A solar energy system that includes a solar collector to provide direct supplemental space heating by heating and re-circulating conditioned building air. The most efficient performance typically uses a vertically mounted collector on a south-facing wall.

Solar Hot Water System (also referred to as Solar Thermal**)** - A system that includes a solar collector and a heat exchanger that heats or preheats water for building heating systems or other hot water needs, including residential domestic hot water and hot water for commercial processes.

Solar Mounting Devices - Racking, frames, or other devices that allow the mounting of a solar collector onto a roof surface or the ground.

Solar Storage Unit - A component of a solar energy device that is used to store solar generated electricity or heat for later use.

IV. Permitted Accessory Use - Solar energy systems shall be allowed as an accessory use in all zoning classifications where structures of any sort are allowed, subject to certain requirements as set forth below.

A. Height - Solar energy systems must meet the following height requirements:

1. Building- or roof- mounted solar energy systems shall not exceed the maximum allowed height in any zoning district. For purposes for height measurement, solar energy systems other than building-integrated systems shall be given an equivalent exception to height standards as building-mounted mechanical devices or equipment.
2. Ground- or pole-mounted solar energy systems shall not exceed 20 feet in height when oriented at maximum tilt.

B. Set-back - Solar energy systems must meet the accessory structure setback for the zoning district and primary land use associated with the lot on which the system is located.

1. **Roof- or Building-mounted Solar Energy Systems** - In addition to the building setback, the collector surface and mounting devices for roof-mounted solar energy systems shall not extend beyond the exterior perimeter of the building on which the system is mounted or built, unless the collector and mounting system has been explicitly engineered to safely extend beyond the edge, and setback standards are not violated. Exterior piping for solar hot water systems shall be allowed to extend beyond the perimeter of the building on a side yard exposure. Solar collectors mounted on the sides of buildings and serving as awnings are considered to be building-integrated systems and are regulated as awnings.
2. **Ground-mounted Solar Energy Systems -** Ground-mounted solar energy systems may not extend into the side-yard or rear setback when oriented at minimum design tilt, except as otherwise allowed for building mechanical systems.

C. Visibility - Solar energy systems shall be designed to blend into the architecture of the building as described in subsection C.1-3, to the extent such provisions do not diminish solar production or increase costs, consistent with WI State Statute §66.0401.

Limitations on Local Zoning Restrictions

Under Wisconsin Statute § §66.0401, local governments may not place any restriction on the installation or use of solar energy systems unless the restriction:

- *Serves to preserve or protect public health or safety*
- *Does not significantly increase the system cost or decrease the efficiency*
- *Allows for an alternative system of comparable cost and efficiency*

standard when other exceptions are granted in the ordinance. Communities should directly reference the exception language, rather than use the placeholder language here.

Height - Ground or Pole Mounted

This ordinance sets a 20-foot height limit, assuming a standard that is higher than typical height limits for accessory structures, but lower than the principal structure. An alternative is to balance height with setback, allowing taller systems if set back farther, for instance, an extra foot of height for every additional two feet of setback. In rural (or large lot) areas solar resources are unlikely to be constrained by trees or buildings on adjacent lots, and the lot is likely to have adequate solar resource for a lower (10-15 foot) ground-mount application.

Building Integrated PV

Building integrated solar energy systems can include solar energy systems built into roofing (existing technology includes both solar shingles and solar roofing tiles), into awnings, skylights, and walls. This ordinance only addresses building integrated PV, but examples of building integrated solar thermal applications may also be available.

1. **Building Integrated Photovoltaic Systems** - Building integrated photovoltaic solar energy systems shall be allowed, provided the building component in which the system is integrated meets all required setback, land use or performance standards for the district in which the building is located.

2. **Roof Mounted Solar Energy Systems** – Solar energy systems that are flush-mounted on pitched roofs are blended with the building architecture. Non-flush mounted pitched roof systems on the front ROW shall not be higher than the roof peak, and the collector shall face the same direction as the roof on which it is mounted, to minimize wind loading and structural risks to the roof.

3. **Reflectors** - All solar energy systems using a reflector to enhance solar production shall minimize reflected light from the reflector affecting adjacent or nearby properties. Measures to minimize reflected light include selective placement of the system, screening on the north side of the solar array, modifying the orientation of the system, reducing use of the reflector system, or other remedies that limit reflected light.

Roof-Mounted Solar Energy Systems

This ordinance sets a threshold for integrating the solar installation to the building architecture. Non-flush-mounted systems have additional considerations in regard to the wind and drift load on structural roof components. Safety risks can alternatively be mitigated through structural review or roof structure modification via the building code, if the community chooses to use that tool rather than the zoning code.

Reflectors

Unlike the solar collector, systems that use a reflector do create a potential glare situation that may be greater than building windows. Reflectors are designed to reflect, not absorb, light. However, the glare risk is intermittent and seasonal (usually only in the summer, early morning or late evening, and only for a limited amount of time). Communities may want to include provisions regarding reflector glare in the event that a glare nuisance situation arises in order to provide guidance for addressing the nuisance.

D. Coverage - Roof or building mounted solar energy systems, excluding building-integrated systems, shall allow for adequate roof access for fire-fighting purposes to the south-facing or flat roof upon which the panels are mounted. Ground-mount systems shall not exceed half the building footprint of the principal structure, and shall be exempt from impervious surface calculations if the soil under the collector is not compacted and maintained in vegetation. Foundations, gravel, or compacted soils are considered impervious and will be included in coverage limitations in order to protect water quality.

Lot Impervious Surface Coverage

The community should consider an important distinction between a ground-mount solar array and the roof of an accessory building; the uncompacted and vegetated ground under the array can be used to infiltrate stormwater. Having the infiltration area does not eliminate all the impacts of the collector surface, but should be considered as a significant mitigating factor.

Roof Coverage

Roof coverage limitations are generally not necessary, as some of the roof is likely to be shaded or otherwise not suitable for solar energy. Coverage is an issue of concern in order to ensure ready roof access in the event of a fire. Coverage limits can be a percentage limitation, such as 80% of the total south-facing roof, or a required setback from one or more edges.

E. Historic Buildings - Solar energy systems on buildings within designated historic districts or on locally designated historic buildings (exclusive of State or Federal historic designation) must receive approval of the community Heritage Preservation Commission, consistent with the standards for solar energy systems on historically designated buildings published by the U.S. Department of Interior.

F. Plan Approval Required - All solar energy systems shall require administrative plan approval by Model Community zoning official.

1. **Plan Applications** - Plan applications for solar energy systems shall be accompanied by to-scale horizontal and vertical (elevation) drawings. The drawings must show the location of

the system on the building or on the property for a ground-mount system, including the property lines.

a. **Pitched Roof Mounted Solar Energy Systems** - For all roof-mounted systems other than a flat roof the elevation must show the highest finished slope of the solar collector and the slope of the finished roof surface on which it is mounted.

b. **Flat Roof Mounted Solar Energy Systems** - For flat roof applications a drawing shall be submitted showing the distance to the roof edge and any parapets on the building and shall identify the height of the building on the street frontage side, the shortest distance of the system from the street frontage edge of the building, and the highest finished height of the solar collector above the finished surface of the roof.

Plan Approval

This process is generally part of the process for obtaining a building permit. If the community does not issue building permits, it can be tied to a land use permit instead. For rural areas or cities without standards for rooftop systems, the plan approval section may be eliminated.

2. **Plan Approvals** - Applications that meet the design requirements of this ordinance shall be granted administrative approval by the zoning official and shall not require Planning Commission review. Plan approval does not indicate compliance with Building Code or Electric Code.

Glare (Accessory Uses)

This ordinance does not include glare standards for accessory use solar installations (other than for system with reflectors). Solar collectors (the panels) have glass surfaces and thus will reflect light. However, the glare risk associated with accessory use solar is generally lower and less intrusive to nearby land uses than glare from glass windows, which are ubiquitous in developed areas. The surface area of a residential solar array may actually be less than the window surface area of a typical single family home. The horizontal orientation of a window is much more likely to reflect sunlight into the neighbor's home or onto a nearby street than is a solar array (which is tilted toward the sky). In most cases, a solar panel reflects less than a window.

For the most part, concerns about glare from residential systems are misplaced: local governments do not regulate reflected light from window glass or other glass building components. That is not to say that there is not occasionally glare from a solar panel - if the angle of the sun and the panel and the viewer are positioned just right. But, like windows, the reflection is intermittent and of short duration.

G. Approved Solar Components - Electric solar energy system components must have a UL or equivalent listing and solar hot water systems must have an SRCC rating.

H. Compliance with Building Code - All solar energy systems shall meet approval of local building code officials, consistent with the State of Wisconsin Building Code or the Building Code adopted by the local jurisdiction, and solar thermal systems shall comply with HVAC-related requirements of the Energy Code. **Compliance with State Electric Code** - All photovoltaic systems shall comply with the Wisconsin State Electric Code.

I. Compliance with State Plumbing Code - Solar thermal systems shall comply with applicable Wisconsin State Plumbing Code requirements.

J. Utility Notification - All grid-intertie solar energy systems shall comply with the interconnection requirements of the electric utility. Off-grid systems are exempt from this requirement.

V. Principal Uses – Model Community encourages the development of commercial or utility scale solar energy systems where such systems present few land use conflicts with current and future development patterns. Ground-mounted solar energy systems that are the principal use on the development lot or lots are conditional uses in selected districts.

A. Solar gardens – Model Community permits the development of community solar gardens, subject to the following standards and requirements:

1. **Rooftop gardens permitted** - Rooftop community systems are permitted in all districts where buildings are permitted.
2. **Ground-mount gardens conditional** - Ground-mount community solar energy systems must be less than [6] acres in total size, and are a conditional use in all districts. Ground-mount solar developments covering more than [6] acres shall be considered solar farms.
3. **Interconnection** - An interconnection agreement must be completed with the electric utility in whose service territory the system is located.
4. **Dimensional standards** - All structures must comply with setback, height, and coverage limitations for the district in which the system is located.
5. **Stormwater and NPDES** – Ground-mount solar gardens must comply with solar farm stormwater and NPDES standards, as described in section B.2.
6. **Ground cover and buffer areas** – Ground-mount solar gardens must comply with solar farm ground cover and buffer area standards, as described in section B.3.
7. **Other standards** - Ground-mount systems must comply with all required standards for structures in the district in which the system is located.

B. Solar farms - Ground-mount solar energy arrays that are the primary use on the lot, designed for providing energy to off-site uses or export to the wholesale market, are permitted under the following standards:

1. **Conditional use permit** – Solar farms are conditional uses in rural, industrial, agricultural districts, or in airport safety zones subject to (7) below, and in the landfill overlay district.
2. **Stormwater and NPDES** - Solar farms are subject to Model Community's stormwater management and erosion and sediment control provisions and NPDES permit requirements.

Community Solar or Solar Gardens

Community solar systems differ from rooftop or solar farm installations primarily in regards to system ownership and disposition of the electricity generated, rather than land use considerations. There is, however, a somewhat greater community interest in community solar, and thus communities should consider creating a separate land use category.

This language limits the size of the garden to six acres, which is an installation of approximately one MW of solar capacity. Communities should tailor this size limit to community standards, which may be smaller or larger. The current rule of thumb is that one MW of capacity is roughly equal to five to seven acres of land.

Stormwater Standards

As noted with ground-mount accessory use installations, the community needs to consider whether the solar collector is impervious surface as it pertains to stormwater standards. The collector surface is impervious, but the uncompacted and vegetated ground under the array can be used to infiltrate storm water. A solar farm will always require an NPDES permit. However, greater attention should be given, in developing the SWPPP, to how the applicant manages the ground under the panels than to the panels themselves. The ground cover standards in Section B.3. will mitigate many stormwater risks, although soil type and slope can still affect the need for additional stormwater mitigation.

Solar Farm Conditional Uses

The districts listed here are examples. Each community needs to consider its zoning districts and evaluate where solar farms are suitable.

3. **Ground cover and buffer areas** – The following provisions shall be met related to the clearing of existing vegetation and establishment of vegetated ground cover. Additional requirements may apply as required by Model Community.

   a. Large-scale removal of mature trees on the site is discouraged. Model Community may set additional restrictions on tree clearing, or require mitigation for cleared trees.

   b. Top soils shall not be removed during development, unless part of a remediation effort.

   c. Soils shall be planted and maintained for the duration of operation in perennial vegetation to prevent erosion, manage run off, and improve soil.

   d. Seeds should include a mix of grasses and wildflowers, ideally native to the region of the project site that will result in a short stature prairie with a diversity of forbs or flowering plants that bloom throughout the growing season. Blooming shrubs may be used in buffer areas as appropriate for visual screening.

   e. Seed mixes and maintenance practices should be consistent with recommendations made by qualified natural resource professionals such as those from the Wisconsin Department of Natural Resources, County Soil and Water Conservation District, Land and Water Conservation Department or Natural Resource Conservation Service.

   f. Plant material must not have been treated with systemic insecticides, particularly neonicontinoids.

   g. The applicant shall submit a financial guarantee in the form of a letter of credit, cash deposit or bond in favor of the Community equal to one hundred twenty-five (125) percent of the costs to meet the ground cover and buffer area standard. The financial guarantee shall remain in effect until vegetation is sufficiently established.

Ground Cover Standards

Perennial grasses and wildflowers planted under the panels, between arrays, and in setback or buffer areas will substantially mitigate the stormwater risks associated with solar arrays, and result in less runoff than typically seen from many types of agriculture. Moreover, establishing and maintaining native ground cover can have important co-benefits to the community or the property owner. Native grasses can be harvested for forage and wildflowers and blooming plants can create pollinator and bird habitat, and maintaining the site in native vegetation will build soils that can be turned back into agriculture at the end of the solar farm's life.

Financial Surety

Communities frequently require bonds or similar financial guarantees when infrastructure improvements are required for a development project. The beneficial habitat installation can be considered in a similar light. Establishing a self-sustaining pollinator or native habitat ground cover requires maintenance over the first 2-3 years, and some maintenance over the life of the project.

4. **Foundations** - A qualified engineer shall certify that the foundation and design of the solar panels racking and support is within accepted professional standards, given local soil and climate conditions.

5. **Other standards and codes** - All solar farms shall be in compliance with all applicable local, state and federal regulatory codes, including the State of Wisconsin Uniform Building Code, as amended; and the National Electric Code, as amended.

6. **Power and communication lines** - Power and communication lines running between banks of solar panels and to nearby electric substations or interconnections with buildings shall be buried underground. Exemptions may be granted by Model Community in instances where shallow bedrock, water courses, or other elements of the natural landscape

interfere with the ability to bury lines, or distance makes undergrounding infeasible, at the discretion of the zoning administrator.

7. **Site Plan Required** - A detailed site plan for both existing and proposed conditions must be submitted, showing location of all solar arrays, other structures, property lines, rights-of-way, service roads, floodplains, wetlands and other protected natural resources, topography, electric equipment, and all other characteristics requested by Model Community. The site plan should also show all zoning districts, and overlay districts.

8. **Aviation Protection** - For solar farms located within 1,000 feet of an airport or within approach zones of an airport, the applicant must complete and provide the results of the Solar Glare Hazard Analysis Tool (SGHAT) for the Airport Traffic Control Tower cab and final approach paths, consistent with the Interim Policy, FAA Review of Solar Energy Projects on Federally Obligated Airports, or most recent version adopted by the FAA.

9. **Agricultural Protection** - Solar farms must comply with site assessment or soil identification standards that are intended to protect agricultural soils.

10. **Decommissioning** - A decommissioning plan shall be required to ensure that facilities are properly removed after their useful life. Decommissioning of solar panels must occur in the event they are not in use for 12 consecutive months. The plan shall include provisions for removal of all structures and foundations, restoration of soil and vegetation and a plan ensuring financial resources will be available to fully decommission the site. Disposal of structures and/or foundations shall meet the provisions of the Model Community Solid Waste Ordinance. Model Community may require the posting of a bond, letter of credit or the establishment of an escrow account to ensure proper decommissioning.

Site Plan

Solar farm developers should provide a site plan similar to that required by the community for any other development. Refer to your existing ordinance to guide site plan submittal requirements.

Aviation Standards

This standard was developed for the FAA for solar installations on airport grounds. It can also be used for solar farm and garden development in areas adjacent to airports.

Glare

Solar collectors (the panels) have glass surfaces and thus can create glare. However, the glare risk is lower and less intrusive to nearby land uses than glare from glass window. Panels are pitched toward the sun and reflections are almost always upward. Moreover, solar panels are specifically designed to be anti-glare, as reflected light lowers the panel efficacy.

Agricultural Protection

If the community has ordinances that protect agricultural soils, this provision applies those same standards to solar development. Communities should understand, however, that solar farms do not pose the same level or type of risk to agricultural practices as does housing or commercial development.

VI. Restrictions on Solar Energy Systems Limited –

Homeowners' agreements, covenant, common interest community standards, or other contract between multiple property owners within a subdivision of Model Community shall not restrict or limit solar energy systems.

Certain Restrictions Void

"All restrictions on platted land that prevent or unduly restrict the construction and operation of solar energy systems […] are void."

Source: Wisconsin Statutes,. § 236.292

VII. Renewable Energy Condition for Certain Permits

A. Condition for Planned Unit Development (PUD) Approval - Model Community may require on-site renewable energy systems or zero-net-energy (ZNE) or zero-net-carbon (ZNC) building designs as a condition for approval of a PUD permit to mitigate for:

1. Risk to the performance of the local electric distribution system,
2. Increased emissions of greenhouse gases,
3. Other risks or effects inconsistent with Model Community's Comprehensive Plan.

B. Condition for Rezoning or Conditional Use Permit - Model Community may require on-site renewable energy systems or zero net energy construction as a condition for a rezoning or a conditional use permit.

1. The renewable energy or zero net energy condition may only be exercised for new construction or redevelopment projects.
2. The renewable energy condition may only be exercised for sites that have sufficient on-site or district energy access to a local energy source. Local energy sources include, but are not limited to, solar energy resources, wind energy resources, biomass energy resources, and waste heat sources that can reasonably meet all performance standards and building code requirements.

Renewable Energy Conditions, Incentives

The community can use traditional development tools such as conditional use permits, PUDs, or other discretionary permits to encourage private investment in solar energy systems as part of new development or redevelopment. This model ordinance notes these opportunities for consideration by local governments. In most cases, additional ordinance language would need to be tailored to the community's ordinances.

For instance, a provision that PUDs (or other special district or flexible design standard) incorporate solar energy should be incorporated into the community's PUD ordinance rather than being a provision of the solar standards.

Conditional use permits generally include conditions, and those conditions can include renewable energy or zero net energy design, but only if the conditions are clearly given preference in policy or plan. Moreover, the community should note the desired solar conditions (solar-ready construction, incorporation of rooftop solar, zero-net-energy design) in both policy and in the CUP section of the ordinance. Explicit reference to climate or energy independence goals in the ordinance and explicit preference for such conditions will set a foundation for including such conditions in the permit.

VIII. Solar Roof Incentives - Model Community has identified the following incentives for zoning permits or subdivisions that will include buildings using solar energy systems.

A. Density Bonus - Any application for subdivision of land in the ___ Districts that will allow the development of at least four new lots of record shall be allowed to increase the maximum number of lots by 10% or one lot, whichever is greater, provided all building and wastewater setbacks can be met with the increased density, if the applicant enters into a development agreement guaranteeing at least three (3) kilowatts of PV for each new residence that has a solar resource.

B. Financing - Model Community provides low-rate financing and loan guarantees to development that provides specific types of amenities preferred by Model Community. Development that incorporates on-site solar production or zero-net-energy buildings qualifies for such incentives.

Solar Roof Incentives

This section of the model ordinance includes a series of incentives that can be incorporated into development regulation. Most cities and many counties use incentives to encourage public amenities or preferred design. These same tools and incentives can be used to encourage private investment in solar energy. Communities should use incentives that are already offered, and simply extend that incentive to appropriate solar development.

Some of the incentives noted here are not zoning incentives, but fit more readily into incentive programs offered by the community (such as financing or incentive-based design standards).

C. Solar-Ready Buildings – Model Community encourages builders to use solar-ready design in buildings. Buildings that submit a completed U.S. EPA Renewable Energy Ready Home Solar Photovoltaic Checklist (or other approved solar-ready standard) and associated documentation will be certified as a Model Community solar ready home, and are eligible for low-cost financing through Model Community's Economic Development Authority. A designation that will be included in the permit home's permit history.

D. Solar Access Variance – When a developer requests a variance from Model Community's subdivision solar access provisions, the zoning administrator may grant an administrative exception from the solar access standards provided the applicant meets the conditions of 1. and 2. below:

1. **Solar Access Lots Identified** - At least __% of the lots, or a minimum of __ lots, are identified as solar development lots.
2. **Covenant Assigned** - Solar access lots are assigned a covenant that homes built upon these lots must include a solar energy system. Photovoltaic systems must be at least three (3) KW in capacity and solar thermal systems must have at least 64 square feet of collector area.
3. **Additional Fees Waived** - Model Community will waive any additional fees for filing of the covenant.

Solar Ready Buildings

New buildings can be built "solar-ready" at very low cost (in some cases the marginal cost is zero). Solar energy installation costs continue to decline in both real and absolute terms, and are already competitive with retail electric costs in many areas. If new buildings have a rooftop solar resource, it is likely that someone will want to put a solar energy system on the building in the future. A solar ready building greatly reduces the installation cost, both in terms of reducing labor costs of retrofits and by "pre-approving" most of the installation relative to building codes.

A community's housing and building stock is a form of infrastructure that, although built by the private sector, remains in the community when the homeowner or business leaves the community. Encouraging solar-ready construction ensures that current and future owners can take economic advantage of their solar resource when doing so makes the most sense for them.

Solar Access Subdivision Design

Some communities will require solar orientation in the subdivision ordinance, such as requiring an east-west street orientation within 20 degrees in order to maximize lot exposure to solar resources. However, many such requirements are difficult to meet due to site constraints or inconsistency with other requirements (such as connectivity with surrounding street networks). Rather than simply grant a variance, the community can add a condition that lots with good solar access actually be developed as solar homes.

Grow Solar

Solar Permitting for Wisconsin Municipalities

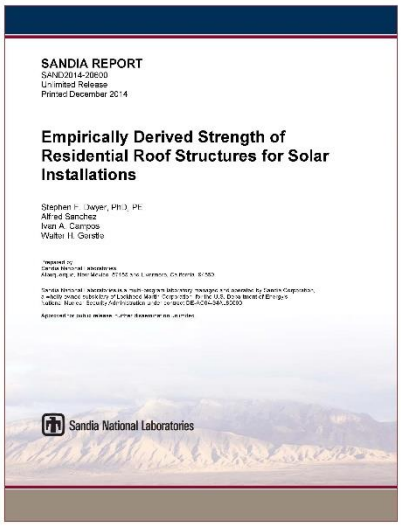
When a home or business owner makes the decision to install solar, the process begins in earnest for the solar installer. A Wisconsin municipality can help reduce the cost of solar by saving the installer time and money during the permitting and inspection process. Making the permit and inspection process transparent and predictable to contractors can help save valuable staff time for municipalities. The Solar America Board of Code and Standards (Solar ABCS) developed a set of permitting principals and standards for permitting solar installations based on thousands of installations across the nation and years of data collection and research. These standards are the national best practices that local governments across the nation can adapt to their community circumstances.

However, there is not a one-size-fits-all approach for solar permitting in Wisconsin municipalities. Communities of different sizes have different processes. Permitting in a rural village will look different than the process in the City of Milwaukee. Cities of similar size have distinct characteristics in their building stock that call for different approaches to permitting. However, all municipalities use a common building code standard, and should rely on the same principals and standards to make the permitting process transparent, predictable, and based on the best evidence and research. With a new and evolving technology such as solar energy, it is also beneficial to clarify the process so staff are familiar with requirements and the technology.

A template for adapting national permitting best practices to Wisconsin cities is provided below. The template provides standardized solar permit language for Midwestern cities, but also notes where local municipalities might choose to modify the standards. The cities of Milwaukee and Madison have adapted the national permitting best practices to their particular regulatory standards and building stock. These two solar permitting examples (also described below) demonstrate different approaches to using the national permitting standards and best practices. Wisconsin's two "beacon" cities also incorporated additional elements into their permitting processes, such as design standards and heritage preservation.

Additional resources related to permitting processes, standards, and research are included at the end of the document for reference by municipal staff, elected officials and installers.


Expedited Solar Permit
Building and Electrical Permit
Photovoltaic System 10 KW or less
1 & 2 Family Dwellings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Empirically Derived Strength of Residential Roof Structures for Solar Installations

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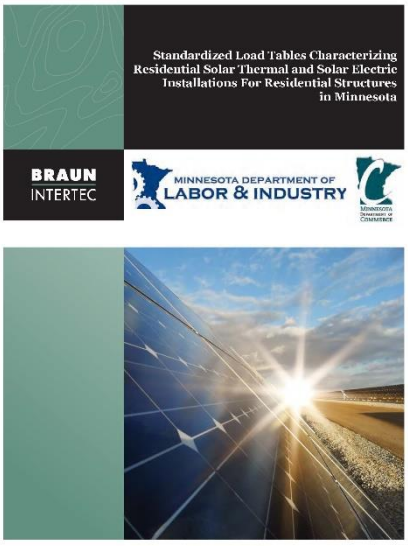
Standardized Load Tables Characterizing Residential Solar Thermal and Solar Electric Installations For Residential Structures in Minnesota

BRAUN INTERTEC

MINNESOTA DEPARTMENT OF LABOR & INDUSTRY

Grow Solar

Standardized Permitting Template

JOB SITE ADDRESS _____

NAME OF BUILDING OWNER _____

JOB VALUATION _____

Installation Contractor	Name	_____
	Address	_____
	City _____	State _____ Zip _____
	State License No. _____	Phone _____

Required Information for Permit:

1. Site plan showing location of major components on the property and a framing cross section that identifies type of support (rafter or truss), spacing, span dimension, and approximate roof slope. The drawings need not be exactly to scale, but it should represent relative location of components. PV arrays on dwellings with a 3' perimeter space at ridge and sides may not need separate fire service review.

   If location of the solar resource on the roof requires installation within three feet of sides or ridge, check with building official to determine if fire service review is needed.
2. Specification sheets and installation manuals for all manufactured components including, but not limited to, PV modules, inverter(s), combiner box, disconnects, and mounting system.
3. *If city manages electric permit process* - Electrical diagram showing PV array configuration, wiring system, overcurrent protection, inverter, disconnects, required signs, and AC connection to building (see accompanying standard electrical diagram).

Step 1: Structural Review of PV Installation Mounting System

1. Is the roof supporting the installation a pitched roof in good condition, without visible sag or deflection, no cracking or splintering of support, or other potential structural defect? Yes ___ No____
2. Is the roof a rafter system? Yes____ No ____
3. Is the equipment to be flush-mounted to the roof such that the collector surface is parallel to the roof? Yes____ No _____
4. Is the roofing type lightweight?

   Yes (composition, lightweight masonry, metal, etc…)____ No_____
5. Does the roof have a single layer roof covering? Yes____ No_____

   For truss systems, additional information may be needed to ascertain the truss' design loads. The SolarStruc tool (http://www.growsolar.org/wp-content/uploads/2012/06/Solarstruc-2.2.xls) allows contractors to calculate truss capacity for solar installations. Please contact the building official for standards on when structural analysis will be needed.

If "No" to any of questions 1 -4 above, additional documentation may be required. Documentation may need to demonstrate the structural integrity of the roof and all necessary structural modifications needed to maintain integrity. A statement stamped by a Wisconsin licensed/certified structural engineer certifying integrity may be needed. Contact the building official to determine submittal requirements.

6. Identify method and types of weatherproofing for roof penetrations (e.g. flashing, caulk).

   _____

Mounting System Information:

7. Is the mounting structure an engineered product designed to mount PV modules with no more than an 18" gap beneath the module frames? Yes___ No____

   If No, provide details of structural attachment certified by a design professional. Manufacturer's engineering specifications are sufficient to meet this requirement.

8. For manufactured mounting systems, fill information on the mounting system below:

   a. Mounting System Manufacturer _____

   b. Product Name and Model #_____

   c. Total Weight of PV Modules and Rails _____ lbs

   d. Total Number of Attachment Points_____ (attachment points must be equally distributed across the array)

   e. Weight per Attachment Point (c÷d) _____ lbs

   f. Maximum Spacing between Attachment Points on a Rail _____inches (see product manual for maximum spacing allowed based on maximum design wind speed).

   g. Total Surface Area of PV Modules (square feet)_____ ft2

   h. Distributed Weight of PV Module on Roof (c÷g)_____ lbs/ft2

Attaching the rail to each rafter or truss that passes under the array, or to blocking installed between each support, may serve to mitigate for any structural uncertainties on older roofs or wind loading concerns. Contact the building official to determine requirements.

If the outcome of e. is greater than 45 lbs or h. is greater than 5 lbs/ft2, a study or statement demonstrating the structural integrity of the installation, or a statement stamped by a Minnesota licensed/certified structural engineer, may be required. Contact the building official to determine requirements.

Step 2: Electrical Review of PV System

Please document the following information to be issued an electric permit. If the installation does not meet the following thresholds, additional information may be needed, as requested by the permit official.

This section should be included in the permit only if the local government administers electric permits and inspections. While a single permit application is preferable, the electric permit application can sometimes be a separate document.

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.
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 (NEC 2011 705.12(D), NEC 2008 690.64(B)).
5. A standard electrical diagram should be used to accurately represent the PV system. Acceptable diagrams, in interactive PDF format, are available at www.solarabcs.org/permitting.

Fill out the standard electrical diagram completely. A guide to the electrical diagram is provided at www.solarabcs.org/permitting 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.

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Step 3: Permit fee for residential installations

____ Fees $100
____ Additional inspection . . . . . $ 50.00
(Per inspection, when needed)

TOTAL FEE = $_____

RECEIPT NO. _____

DATE _____

Recommended fee for residential or small commercial solar installations is a fixed fee between $50 – 200, consistent with cost for services (permit processing, inspection) incurred by the government unit. Alternatively, the fee can be valuation based, but for a building permit should exclude the value of the solar collectors and electronics.

I HEREBY CERTIFY that I have completed and examined this application and certify that the information contained therein is correct. If a permit is issued, I agree all work will be done in conformance with all applicable ordinances and codes of this City and laws of the State of Wisconsin.

_____
CONTRACTOR OR AUTHORIZED AGENT/HOMEOWNER

Grow Solar

City of Milwaukee

The City of Milwaukee created an expedited permit for certain solar installations. The goal was to save time and money for residents who want to add solar to their home. The City created an expedited solar permit that:

1) **Reduced Time for Approval.** Reduced the time installers needed to wait for application approval to same-day, in person approval. This was a vast improvement over sometime waiting days or weeks for approval.
2) **Reduced Price of Permit.** Reduced the price to a flat fee of $70. This was reduced from a permit fee based on the cost of the project. In the past this could add a significant cost on to the total system price. Now, installers know it is a flat fee for residential systems.
3) **Reduced Second Inspection**. Consideration of residential solar electric systems as an "appliance" added to the home. If the project meets certain weight limitations, the solar system would be considered an electric appliance only. This means there is now no requirement for building inspection after the project was completed (eliminating a second trip to the home for the installer, and additional delays before interconnecting the system).

The Expedited Solar Process: The Expedited Solar Permit is for solar electric (photovoltaic) systems that are 10 KW or less on residential dwellings (one or two units). Sizes larger than this, or if installed on a commercial property will need to go through the traditional plan review process, as outlined by the Milwaukee Development Center.

The Expedited Solar Permit also requires the installer to complete a Structural Worksheet. This worksheet is designed to ensure the weight of the solar installation is at or below five (5) pounds per square foot. This is a recommended weight by the Solar America Board of Code and Standards. If the installation exceeds this weight, the installer will need to obtain an electrical AND building permit, and go through the standard plan review process.

When a solar project is completed, an inspection by the City of Milwaukee is needed. The process for inspections is as follows:

- The Installer must call the City to request inspections using the contact information listed on each permit.
- The Installer must coordinate the inspections to satisfy all permits on the solar project.
- The Installer must meet with each Inspector to close out the permits.
- Once the permits are approved and closed, the Inspector faxes the approved permits to We Energies as part of the interconnection process.
- Please note, Installers must sign a waiver taking responsibility for the project installation if the system is not accessible to the inspectors (for example if the inspector cannot get to the roof).

Source: Milwaukee Shines, 200 E. Wells St., Rm 603, Milwaukee, WI 53202, 414-286-8317, solar@milwaukee.gov

Milwaukee SHINES
FOR A SUSTAINABLE SOLAR FUTURE

Grow Solar

City of Madison

There is a 5-step process for installation of solar in the City of Madison. For details visit: http://www.cityofmadison.com/Sustainability/City/madiSUN/step.cfm

Step 1: Preparation

Find zoning information for the property on the city's assessor site. You will need that information to determine what will be needed for the building permit.

- City of Madison Assessor's Property Lookup
- **Property Class:** classification of building; commercial or residential
- **Zoning:**
  - CC, CC-T, SR-V1, TR-C1.... - commercial or residential category
  - PD – Planned Development
  - HIS – Historic District
  - UDC – Urban Design Commission
- In case of commercial building, find out the volume in ft^3 (larger or smaller than 50,000 ft^3
- In case of residential building, determine if it has more than two family dwelling units.
- **In case of PD, HIS or UDC you will need to provide additional documents (see step 3) and it might require more time. Please consider that in your construction schedule.**

Step 2: Produce documents for electrical, plumbing, and heating permits

Electrical, plumbing, and heating permits require the typical documentation to prove that all codes and requirements are met. This should not be a problem for a contractor who is in the business of installing solar systems. Documents needed include but are not limited to:

- Plumbing (for domestic hot water): A catalog cut sheet of the device. Proof that the transfer fluid is either non-toxic or the device has a double walled heat exchanger.
- Electrical: A catalog cut sheet of the electrical photovoltaic device that shows it is UL listed.
- Heating: Information that shows compliance with MGO 30.05. All materials that are used in the system must be listed.
- Proof that applicant holds all necessary licenses.

Step 3: Produce documents for building permit

You will need to pay applicable fees to obtain all the permits. Staff can tell you the exact amount for your specific project at time of application. City of Madison Fee schedule.

Structural Requirements: show with drawings and calculations that the proposed system will be safe at all conditions required by the building code

- Show at least a section of the existing roof showing the attachment and the existing structure.
- Show a catalog cut sheet of the solar device with the weight.
- Different requirements for commercial and residential installations
  - Calculations can be performed by a **knowledgeable** person if the building is in the **residential** category or a **commercial building of up to 50,000 ft^3 in volume.**
  - **Buildings larger than 50,000 ft^3 in volume require a licensed Professional Engineer or Architect** to perform the calculations.

For all applications: Provide a site plan and placement plan showing the location of the solar energy system on the lot and the design of the solar energy system. The placement plan also shall include the location of

improvements on adjoining lots as well as landscaping on the lot and adjoining lots that impacts the location of the solar system.

If the property is in a historic district:

- Inquire about special requirements and further information. Contact Preservation Planner Amy Scanlon ascanlon@cityofmadison.com or 266-6552 before application.
- Show elevation drawings.
- If collectors won't be visible from street the Landmarks Commission staff person (Amy Scanlon) can sign off, if collectors are visible from street level the Landmarks Commission needs to approve. Consider this for your schedule! Go to: Legislative Information Center.
- Maps and background information regarding historic districts are available from the Landmarks Commission.
- Consider less visible panel locations and be prepared to provide evidence that less visible locations are less economical.

If the property is in a PD:

- An "Alteration to an approved & recorded specific implementation plan" needs to be approved along with site plan and placement plan of proposed collectors
- The local alder person needs to sign the application before it is submitted to the city zoning department.
- Processing of the application can take two weeks plus the time to obtain alder's signature. Lookup your Alder
- Instructions and application for alterations to an existing PD.

If the property is in a Urban Design district:

- Provide site plan and placement plan of proposed collectors to city UDC staff person who typically can approve the application. Contact Planner Al Martin amartin@cityofmadison.com or 267-8740 before application.
- Maps of UDC districts

If the property contains a Conditional Use:

- A minor alteration to the conditional use is required.
- Provide a site plan and placement plan of proposed collectors and contact zoning staff at 266-4551.
- Instructions and application for alterations to an existing conditional use.

Step 4: Application

In case your property is in a PD, Urban Design district, or historic district, contact the appropriate staff (s. step 3) to make special arrangements prior to your application. These staff might not be available if you show up unannounced and the process might require more days.

In cases where the PD, Urban Design district, or historic issues are resolved or not applicable, show up at the permit office during business hours with all your documents and be prepared to pay the fees. If all documents are complete and acceptable, you will receive your permit right away.

Step 5: Approval

Once approved you will receive the permits, which need to be displayed at the construction site. The permit will include contact information for the inspector(s) who can answer more questions. ***You will need to schedule for inspections during and after construction.*** Work needs to be inspected before you may proceed with the next step. After completion there will be a final inspection. You are responsible to arrange those inspections with the inspector.

Resources

- National Renewable Energy Lab: *Permitting Best Practices* http://www.nrel.gov/docs/fy13osti/57104.pdf
- Interstate Renewable Energy Council: *Solar Permitting Best Practices*: http://www.irecusa.org/solar-permitting-best-practices/
- Solar America Board for Code and Standards (Solar ABCs): *Expedited Permit Process*, with sample line drawings for all installation types: http://www.solarabcs.org/
- Sandia National Laboratories, *Empirically Derived Strength of Residential Roof Structures for Solar Installations*, http://prod.sandia.gov/techlib/access-control.cgi/2014/1420600.pdf
- SolarStruc Tool, http://www.growsolar.org/wp-content/uploads/2012/06/Solarstruc-2.2.xls
- Minneapolis Saint Paul Solar Cities Program, *Standards for Rooftop Solar Thermal Retrofits*,
- Minnesota Division of Energy Resources, *Standardized Load Tables Characterizing Residential Solar Thermal and Solar Electric Installations for Residential Structures*, http://mn.gov/commerce-stat/pdfs/standardized-load-table-report.pdf
- Inspection trainings, Midwest Renewable Energy Association http://www.growsolar.org/education-training/training/training-program-development/