

# ***Guidebook for Residential Solar PV***



## Table of Contents

General Information .....	3-4
Project Milestones .....	5
Municipal Zoning Considerations .....	6-7
Documents Required .....	8-9
Contact Information .....	10-11
Frequently Asked Questions .....	12-13
Sample Truss Roof Drawings .....	14
Sample Rafter Roof Drawings .....	15
Non-Flush Mounted .....	16
Ground Mounted Solar Panels/Panels Mounted Beyond Roof Edge .....	17
Solar Panels Mounted in Special Zoning District .....	18
PV Electrical Inspection Checklist .....	19-22
Solarstruc .....	23

## Acknowledgements

This guidebook was developed in collaboration with the following individuals and organizations:

Abby Attoun-Tucker	City of Middleton
Adam Gusse	H&H Solar Energy
Alan Harper	City of Madison
Ararik Rosenlund	Midwest Solar Power
Bill Neitzel	City of Madison
Brian Flannery	City of Verona
Marty Pilger	City of Monona/ Village of McFarland

Matt Tucker	City of Madison
Mike Joyce	Full Spectrum Solar
Mike Kleish	Village of Oregon
Niels Wolters	Madison Solar Consulting
Ryan Jonely	City of Madison
Steve Kittleson	City of Stoughton
Tim Semman	City of Sun Prairie

## General Information

**Code Compliance:** Wisconsin's state building codes provide uniform requirements for buildings throughout the state. All photovoltaic systems shall be installed in accordance with the current edition of all applicable State and local codes:

- Wisconsin Electrical Code SPS 316, NEC 2008
- Wisconsin Uniform Dwelling Code SPS 320-325

**License and Credential Requirements:** All photovoltaic systems shall be installed by licensed contractors.

- Wisconsin Dwelling Contractor
- Wisconsin Dwelling Contractor Qualifier
- Wisconsin Electrical Contractor
- Wisconsin Master Electrician

**Equipment:** All equipment, array modules, inverters, racking, combiner boxes, DC disconnects, fittings, etc., shall be installed per approved plans and manufacturer installation instructions. All material and equipment shall be listed and labeled by an approved testing agency.

**State Solar Rights:** Wisconsin has several laws that protect a resident's right to install and operate a solar or wind energy system. These laws cover zoning restrictions by local governments, private land use restrictions, and system owner rights to unobstructed access to resources. The state's original laws, enacted in 1982, have subsequently been amended and expanded numerous times.

**Limitations on local zoning restrictions:** Under Wis. Stat. § 66.0401, local governments -- counties, towns, cities and villages -- may not place any restriction on the installation or use of solar systems unless the restriction:

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

This law effectively prohibits unreasonable public land use controls covering solar and wind energy systems by defining a fairly narrow set of "reasonable" conditions. The law subsequently allows for a local permitting procedure for guaranteeing unobstructed access to solar resources. A permit will not be granted if obstruction already exists or if the construction of such an obstruction is already well into the planning stages. The effect of the permit is similar to a private solar easement agreement, except it does not require the consent of a neighboring property owner.

## General Information

It is important to note that system owners are not required to obtain a permit under this subsection prior to installing a solar system. If a permit is necessary as the result of a local ordinance, the permitting burden may not deviate from Wis. Stat. § 66.0401 as described above.

**Limitations on private land use restrictions:** A separate law, Wis. Stat. § 236.292, voids all restrictions on platted land that prevent or unduly restrict the construction or operation of solar energy systems. This law effectively prohibits private land use controls (e.g., deed restrictions, homeowner association regulations, easements, etc.) from preventing the installation and operation of solar energy systems. In the case of both access laws - public and private - solar energy systems are defined broadly to include both thermal and electrical technologies.

**Right to sun and wind:** Other sections of Wisconsin law address a solar owner's right to retain unobstructed access to the wind or sun. Wis. Stat. § 700.41 effectively freezes the permitted building envelope of properties adjacent to a solar or wind system to whatever it was at the time the system was constructed. This allows the system owner to construct a system based on existing zoning regulations and be certain that future zoning amendments and development will not render the system ineffective. Separately, Wis. Stat. § 844.22 states that any structure or vegetative growth that occurs after the installation of a solar or wind energy system and interferes with its function is considered to be a private nuisance. The purpose of this law is to provide system owners with a remedy to prevent interference with their systems in a situation where none of the other statutory protections can be applied. The right to unobstructed resource access can only be applied to actions that take place after a system is constructed.

# Project Milestones

## Step 1A: Apply for interconnection agreement

**Instructions:** Submit documentation for interconnection pre-approval from local utility.

**Documentation Required:**

- Standard Distributed Generation Application ( [PSC 6027 Form](#) )
- Check with utility for additional document requirements.
- Include certificate of liability insurance

## Step 1B: Look up address land-use

**Instructions:** Identify zoning district by locating property on local zoning “map” or contacting zoning department. Applicable zoning maps and codes can be found on “Contact Information” page.

**Documentation Required:**

- See page 6 - Important Municipal Zoning Considerations

## Step 2: Complete permit and additional documentation

**Instructions:** Complete and submit applicable permit forms, fee and other additional supporting documentation required by the municipality

**Documentation Required:**

- See pg 6-7 - Zoning considerations
- See pg 8 - Supporting documents required for standard solar PV permit
- See pg 9 - Supporting documents required for non-standard solar PV permit
- See pg 10-12 - Zoning maps, applicable codes, fee schedule, links to forms

## Step 3: Schedule final inspection

**Instructions:** Contact the municipality building inspector to schedule a final inspection after the project is complete. Inspection contact information can be found on “Contact Information” page.

**Documentation Required:**

- See Page 20 - PV Electrical Inspection Checklist

## Step 4: Schedule interconnection inspection

**Instructions:** Contact utility to schedule interconnection inspection.

**Documentation Required:**

- Standard Distributed Generation Agreement ( [PSC 6029 Form](#) )

## Municipal Zoning Considerations

Note: If a new building or structure that serves more than a solar purpose is being proposed additional zoning review may be required, because it is not just a solar feature. All ground-mounted solar PV systems must adhere to local set-back requirements or must apply for a zoning variance.

**Madison** • **Located in Historic District:** If collectors won't be visible from street the Landmarks Commission staff person (ttroester@cityofmadison.com or 266-6552) can sign off, if collectors are visible from street level the Landmarks Commission needs to approve. Maps, meeting schedule and background information available from the Landmarks Commission.

• **Located in Planned Development District/District with Conditional Use restriction:** An "alteration to an approved & recorded specific implementation plan" needs to be approved. Instructions and application for alterations to an existing conditional use. The local alder person also 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 Alder](#)

• **Located in Urban Design District:** UDC staff person who typically can approve the application. Contact Planner Al Martin [amartin@cityofmadison.com](mailto:amartin@cityofmadison.com) or 267-8740 before application See [map of UDC districts in Madison](#)

**McFarland** • **Located in Planned Development District** – Project requires a Plan Commission Review

**Middleton** • **Located in Planned Development District:** If the proposal does not meet the requirements of the Specific Implementation Plan, an SIP modification is required. Any application materials and plans should be submitted to the Planning Department at least two weeks before the Plan Commission meeting at which the applicant would like to appear. The Plan Commission meets on the second and fourth Tuesday of each month at 7pm.

• **More than 3 units** - Requires design review for exterior site modifications (including solar panels). Any application materials and plans should be submitted to the Planning Department at least two weeks before the Plan Commission meeting at which the applicant would like to appear. The Plan Commission meets on the second and fourth Tuesday of each month at 7pm.

• **Located in Historic District** - Requires prior approval by the Middleton Landmarks Commission.

## **Municipal Zoning Considerations**

Note: If a new building or structure that serves more than a solar purpose is being proposed additional zoning review may be required, because it is not just a solar feature.

- Monona**
- **Located in Community Design District or Planned Community District -** Any application materials and plans should be submitted to the Planning Department at least two weeks before the Plan Commission meeting at which the applicant would like to appear. Plan Commission calendar meeting can be found [here](#)
  - **Review Screening of Rooftop Mechanicals ordinance (pg. 379)**

- Oregon**
- **To attach solar to a facade or roof of a building in the Downtown Historic Preservation District -** Obtain Certificate of Appropriateness from Historic Preservation Commission

- Stoughton**
- **To attach solar to the exterior of a building listed as a Local Landmark -** Obtain Certificate of Appropriateness from the Landmarks Commission

- Sun Prairie**
- **Located in Planned Development -** If the proposal does not meet the requirements of the General Development Plan or Precise Implementation Plan, a PIP or GDP amendment is required. Any application materials and plans should be submitted by 12:00 NOON on the filing day as identified in the Plan Commission Development Review Calendar.

- Verona**
- **No applicable zoning district restrictions**
  - **Review Glare Standards related ordinance**

# Documents Required

## **Standard Solar PV Permit**

### **Eligibility:**

- Property is a residential one or two story dwelling (one family or multi-family)
- Solar array installed on principal or detached accessory structure
- Solar array is within rooftop envelope\*
- Property is not in a special zoning district

### **Installation Plan: ([Link to example](#))**

- Building outline, layout and cross-section of panels with attachment points
- Rafter size, spacing, span, grade and species of lumber
- Detailed hardware description, detailed drawing or cut sheet of roofing structure
- Any modifications required to the roof structure.

### **Structural Calculations**

- Catalog cut sheet of the solar panel
- Completed SolarStruc (Truss roof only)  
OR
- Calculations performed by a knowledgeable person including:
  - o Load capacity of structure
  - o Total loads (live and dead)

### **Site Plan**

- None Required

### **Elevation Plan ([Link to example](#))**

- Required for non-flush mount solar array only



# Documents Required

## ***Non-Standard Solar PV Permit***

### ***Eligibility:***

- Property is a residential one or two story dwelling (one family or multi-family)
- Property is in a special zoning district and/or
- Solar array is ground-mounted OR mounted outside or beyond the envelope of the roof

***Installation Plan: (Link to example)*** • Same as Standard Solar PV

***Structural Calculations*** • Same as Standard Solar PV

### ***Site Plan (Link to example)***

- Prepare a scaled site plan showing:
  - Property lines
  - All buildings on the lot
  - Location of the panels
  - Buildings and structures on adjacent lots
  - Significant vegetation that may affect placement
- Detailed drawing (rendering/schematic) views of the panels showing the buildings and any supporting structures

### ***Elevation Plan (Link to example)***

- Prepare an elevation plan showing location of panels

### ***Zoning Information (Link to example)***

- See "Important Municipal Zoning Considerations"

## Contact Information

### McFarland

Address: 5915 Milwaukee St  
Building Inspection Phone #: 608-838-3154  
Building Inspection Email: [marty.pilger@mcfarland.wi.us](mailto:marty.pilger@mcfarland.wi.us)  
Zoning Phone #: 608-838-3154  
Zoning Email: [pauline.boness@mcfarland.wi.us](mailto:pauline.boness@mcfarland.wi.us)  
Inspection Request Phone#: 608-838-3154  
Hours of Operation: T, TH, 8:00am - 12:00pm, M, F 12:00pm - 4:00pm  
Utility Provider: Alliant Energy or MG&E  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: **Less than 1 week**  
Expected Turnaround Time for Non-Standard Solar PV Permit: **If Plan Commission approval required 4 weeks**  
Email Submission Acceptable: [marty.pilger@mcfarland.wi.us](mailto:marty.pilger@mcfarland.wi.us)  
**Required Building Permit Application:** [Link](#)  
Fee for Standard Solar PV Permit: \$80

### Madison

Address: 215 MLK Jr. Blvd.  
Building Inspection Phone #: 608.266.4558  
Building Inspection Email: [AHarper@cityofmadison.com](mailto:AHarper@cityofmadison.com)  
Zoning Phone #: 608) 266-4551  
Zoning Email:  
Inspection Request Phone#: 608 -266-4551  
Hours of Operation: M-F, 7:30 - 4:30pm  
Utility Provider: Alliant Energy or MG&E  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: **3 days**  
Expected Turnaround Time for Non-Standard Solar PV Permit:  
Online Submission Acceptable: **Yes**  
**Required Building Permit Application Form: None**  
Required Electrical Permit application: [Link](#)  
Fee for Standard Solar PV Permit: Bldg permit \$46, Electrical permit \$2 per panel plus \$30

### Middleton

Address: 7426 Hubbard Ave.  
Building Inspection Phone #: 608-821-8370  
Building Inspection Email: [sellarson@ci.middleton.wi.us](mailto:sellarson@ci.middleton.wi.us)  
Zoning Phone #: 608-821-8370  
Zoning Email: [ekelley@ci.middleton.wi.us](mailto:ekelley@ci.middleton.wi.us)  
Inspection Request Phone#: 608-821-8370  
Hours of Operation: M-F, 7:45 - 4:30pm  
Utility Provider: MG&E or Alliant (limited)  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: **2 days**  
Expected Turnaround Time for Non-Standard Solar PV Permit: **If Plan Commission approval required 4 weeks**  
Email Submission Acceptable: [sellarson@ci.middleton.wi.us](mailto:sellarson@ci.middleton.wi.us)  
**Required Building Permit Application:** [Link](#)  
Required Electrical Permit Application: [Link](#)  
Fee for Standard Solar PV Permit: \$5 per \$1000 plus a \$50 base fee  
\* In some instances, may request a PE stamp.

### Monona

Address: 5211 Schluter Rd.  
Building Inspection Phone #: 608-222-2525  
Building Inspection Email: [bldinspec@ci.monona.wi.us](mailto:bldinspec@ci.monona.wi.us)  
Zoning Phone #: 608-222-2525  
Zoning Email: [sreichertz@ci.monona.wi.us](mailto:sreichertz@ci.monona.wi.us)  
Inspection Request Phone#: 608-219-0620  
Hours of Operation: M, W, F 8:00am - 12:00pm, T, TH 12:00pm – 4:00pm  
Utility Provider: MG&E  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: **less than 1 week**  
Expected Turnaround Time for Non-Standard Solar PV Permit: **If Plan Commission approval required 4 weeks**  
Email Submission Acceptable: [bldinspec@ci.monona.wi.us](mailto:bldinspec@ci.monona.wi.us)  
**Required Building Permit Application:** [Link](#)  
Fee for Standard Solar PV Permit: \$45 plus \$.05/square foot, \$45 minimum

## Contact Information

### Oregon

Address: 117 Spring St.  
Building Inspection Phone #: 608-835-6291  
Building Inspection Email: [mkleisch@vil.oregon.wi.us](mailto:mkleisch@vil.oregon.wi.us)  
Zoning Phone #: 608-835-6290  
Zoning Email: [mbelow@vil.oregon.wi.us](mailto:mbelow@vil.oregon.wi.us)  
Inspection Request Phone#: 608-835-6291  
Hours of Operation: M, W, F 8am - 12pm  
Utility Provider: Alliant Energy  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: 1-5 days  
Expected Turnaround Time for Non-Standard Solar PV Permit: [If Plan Commission approval required 4 weeks](#)  
Email Submission Acceptable: [mkleisch@vil.oregon.wi.us](mailto:mkleisch@vil.oregon.wi.us)  
**Required Building Permit Application:** In-person /mail only  
Fee for Standard Solar PV Permit: 2% of electrical cost, \$25 minimum.

### Stoughton

Address: 381 E. Main St.  
Building Inspection Phone #: 608-873-7626  
Building Inspection Email: [skittelson@ci.stoughton.wi.us](mailto:skittelson@ci.stoughton.wi.us)  
Zoning Phone #: 608-646-0421  
Zoning Email: [mstacey@ci.stoughton.wi.us](mailto:mstacey@ci.stoughton.wi.us)  
Inspection Request Phone#: 608-873-7626  
Hours of Operation: M-F, 7:30 - 4:30pm  
Utility Provider: Stoughton Utilities  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: 1 day  
Expected Turnaround Time for Non-Standard Solar PV Permit:  
Email Submission Acceptable: [skittelson@ci.stoughton.wi.us](mailto:skittelson@ci.stoughton.wi.us)  
**Required Building Permit Application:** [Link](#)  
Zoning Permit Application (If required with EVERY application): Same as Building permit  
Fee for Standard Solar PV Permit: \$40

### Sun Prairie

Address: 300 E. Main St.  
Building Inspection Phone #: 608-825-1184  
Building Inspection Email: [buildinginspection@cityofsunprairie.com](mailto:buildinginspection@cityofsunprairie.com)  
Zoning Phone #: 608-825-1107  
Zoning Email: [tsemmann@cityofsunprairie.com](mailto:tsemmann@cityofsunprairie.com)  
Inspection Request Phone#: 608-825-1184  
Hours of Operation: M-F 8:00am - 4:30pm  
Utility Provider: Sun Prairie Utilities  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: 5-7 days  
Expected Turnaround Time for Non-Standard Solar PV Permit: [Expected Turnaround Time for Non-Standard Solar PV Permit: 7-8 weeks](#)  
Email Submission Acceptable: [buildinginspection@cityofsunprairie.com](mailto:buildinginspection@cityofsunprairie.com)  
**Required Building Permit Application:** [Link](#)  
Fee for Standard Solar PV Permit: \$6/\$1,000 cost of project, \$25 minimum

### Verona

Address: 111 Lincoln St  
Building Inspection Phone #: 608- 845-0963  
Building Inspection Email: [brian.flannery@ci.verona.wi.us](mailto:brian.flannery@ci.verona.wi.us)  
Zoning Phone #: 608-848-9941  
Zoning Email: [adam.sayre@ci.verona.wi.us](mailto:adam.sayre@ci.verona.wi.us)  
Inspection Request Phone #: 608-845-0964  
Hours of Operation: M-F, 8:00 - 4:30pm  
Utility Provider: Alliant Energy  
Zoning Map/Look-up: [Map](#)  
Municipal Code: [Link](#)  
Zoning Code: [Link](#)  
Expected Turnaround Time for Standard Solar PV Permit: 1-3 days  
Expected Turnaround Time for Non-Standard Solar PV Permit:  
Email Submission Acceptable: [brian.flannery@ci.verona.wi.us](mailto:brian.flannery@ci.verona.wi.us)  
**Required Building Permit Application:** [Link](#)  
Required Electrical Permit Application: Same as Building Permit  
Fee for Standard Solar PV Permit: Fees are based on est. # of inspections and plan review

# Frequently Asked Questions

Structural FAQs	Answer
Version of building code being enforced	WI Uniform Dwelling Code SPS 320-325
Application paper size requirements	Either 8" x 11" or 11" x 17"
Application scale requirements	Building = 1/8" or larger • Site Plan = 1/20
Do property boundaries need to be shown for systems mounted flush to the roof and not overhanging the roof? If yes, specify when in "other" field?	No
Roof surface description required (Layers of shingles noted?)	Yes
Roof rafter size/spacing required?	Yes
Roof load calculations required?	Yes
Stamped engineering letter required	No
Basic wind speed info required?	Show on calcs
Snow load info required?	Show on calcs
Exposure category info required?	No
Attachment location with array layout required?	Yes
Attachment detail required on drawings?	Yes, cut sheet, drawing or description
Can studor vents be used to remove existing plumbing vents from roof?	Yes, as allowed by plumbing code
Does every module need to be drawn or "modules in series" represented by rectangle okay?	Building Plan – Every module Site Plan – Rectangle or Every module
Electrical FAQs	Answer
Version of electrical code being enforced?	WI Electrical Code SPS 316 / NEC 2008
Is an electric diagram required?	No
Are line side taps permitted?	Utility specific
If line side taps permitted, can this be done inside main panel or is a separate j-box required?	Utility specific

# Frequently Asked Questions

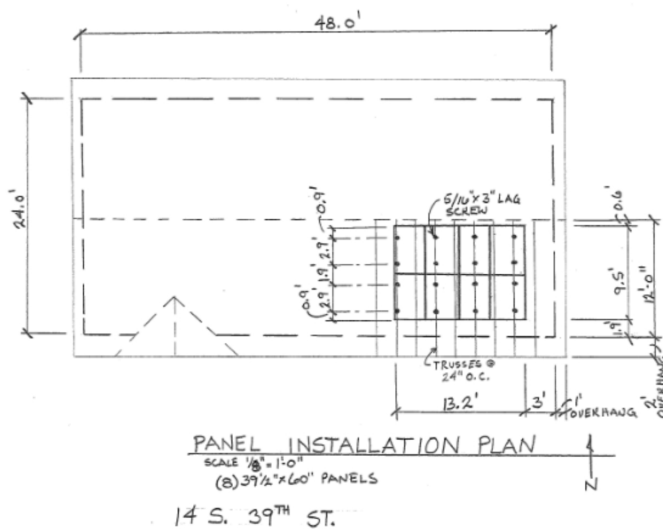
Electrical FAQs	Answer
Do on line side taps require an additional ground electrode at the fused AC disconnect?	Utility specific
Is an additional array grounding electrode required?	Yes, for ground mounted only
Are WEEBs (Washer, Electrical Equipment Bond) acceptable for module grounding?	Yes
Should residential load calculations be provided if main breaker is reduced?	Yes
Are ASHRAE min/max design temps acceptable?	Yes
Can attic vents be covered by array?	Yes. Vents must continue to properly function.
DC/AC placard specs required on diagram?	No
Should the electrical conduit run be shown on site plan?	No
Are conductor size calculations required?	No
Are voltage drop calculations required?	No
Are DC/AC placard specs required on page?	No
Inspection FAQs	Answer
Is a rough structural inspection required?	No
Is a rough electrical inspection required?	Yes, for anything covered
What % of the modules are permitted to be attached prior to the rough inspection?	100%
Access to roof required for inspections?	Yes
Is access to attic required for roof mounted system inspections?	Yes

# Truss Roof Drawings

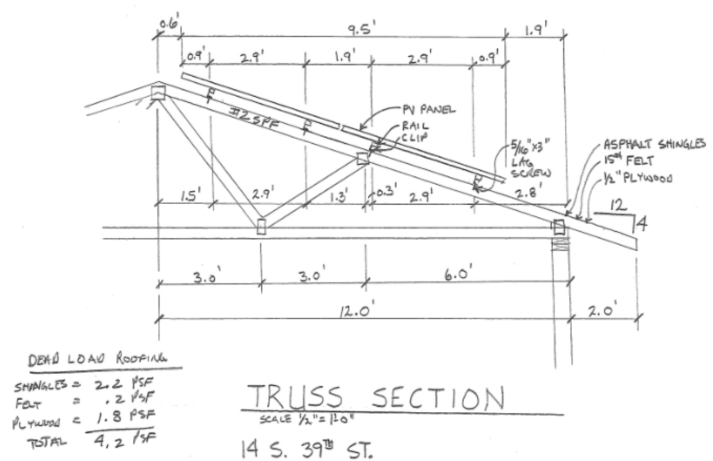
Drawings submitted for building permit approval on truss roof systems should include the following:

- Title of drawing
- Property address
- Cardinal north direction arrow
- Scale of drawing
- Number and size of panels
- Building outline with dimensions and layout of panels with attachment points and dimensions
- Size, spacing, span, grade and species of lumber
- Any modifications required to the roof structure
- Outline of the truss with span dimensions and panel points
- Solar panels and connections with locations dimensioned
- Callouts for installation components, callouts for roofing materials, species and grade of truss top chord, and a dead load summary for roofing materials

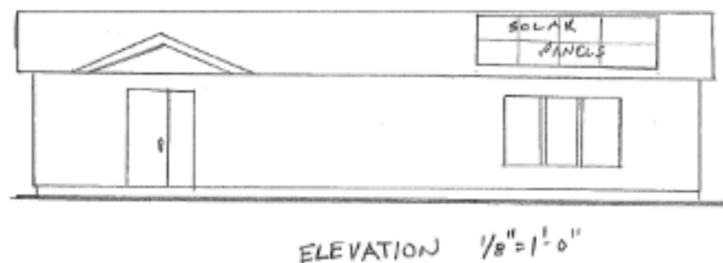
Example:



Example:



Example:

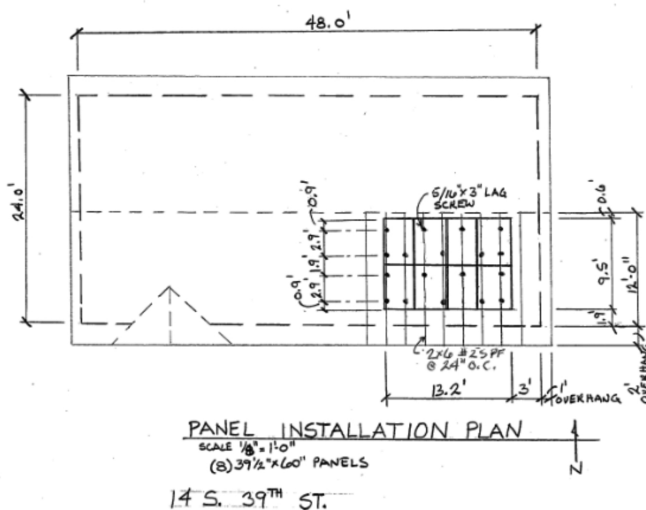


# Rafter Roof Drawings

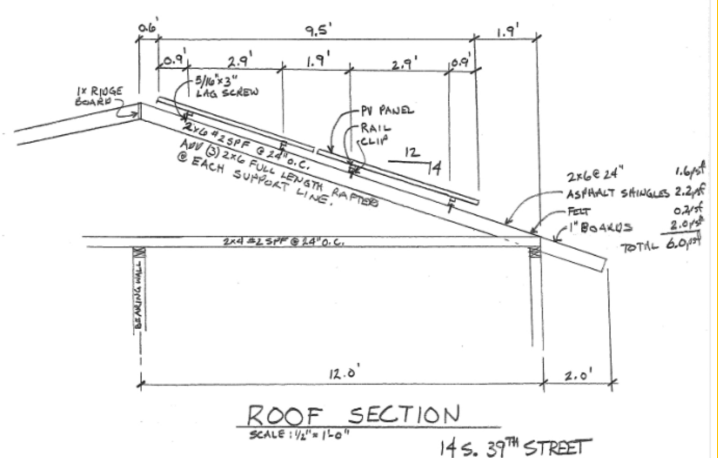
Drawings submitted for building permit approval on rafter roof systems should include the following:

- Title of drawing
- Property address
- Cardinal north direction arrow
- Scale of drawing
- Number and size of panels
- Building outline with dimensions and layout of panels with attachment points and dimensions
- Rafter size, spacing, span, grade and species of lumber
- Outline of the rafters and ceiling joists with dimensions and panel points
- Solar panels and connections with dimensions
- Callouts for installation components, callouts for roofing materials, and a dead load summary for roofing materials.

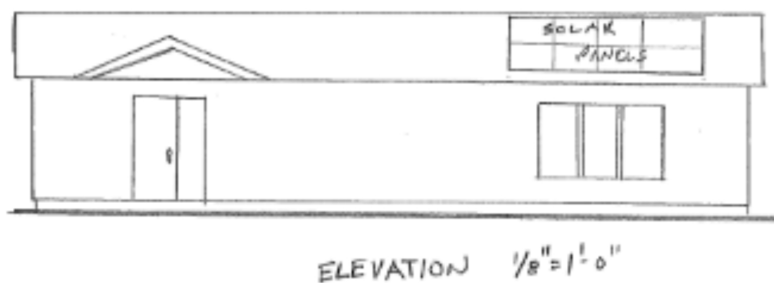
Example:



Example:



Example:

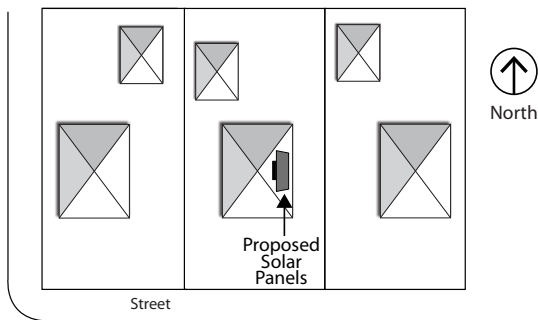


# Non Flush Solar Panels

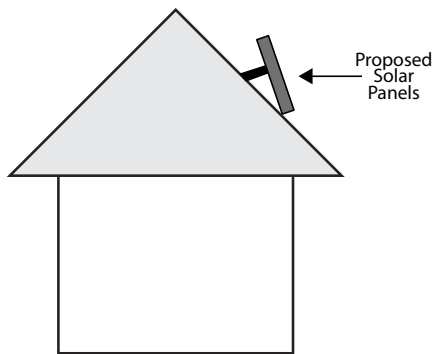
## Site and Elevation Plan Template

Project Address:

Non-Flush Mount Solar Array Examples

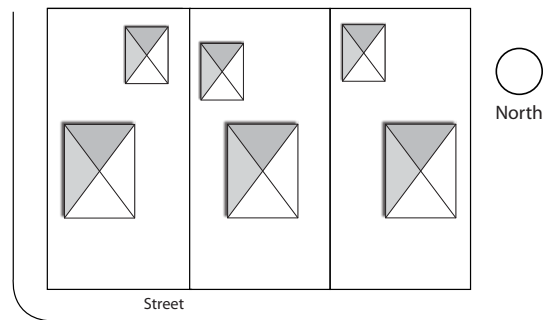


Site Plan

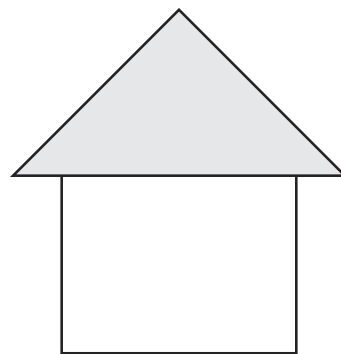


Elevation

Your Plan



Site Plan



Elevation



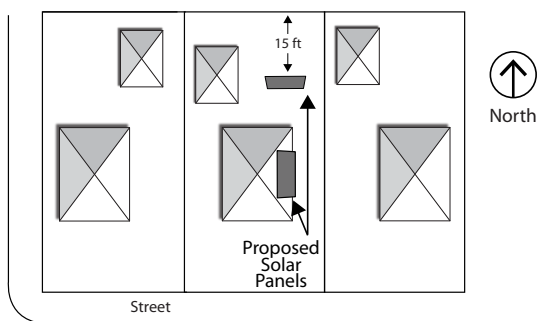
# Ground-Mounted Solar Panels/ Panels Mounted Beyond Roof Edge

## Site and Elevation Plan Template

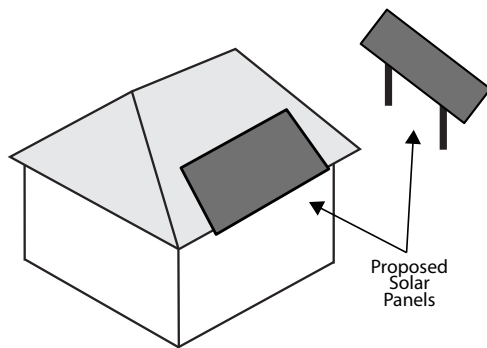
Project Address:

Proposed Solar Array is Located Outside,  
or Beyond the Roof Envelope

\*Minimum 3 foot setback from any property line and building



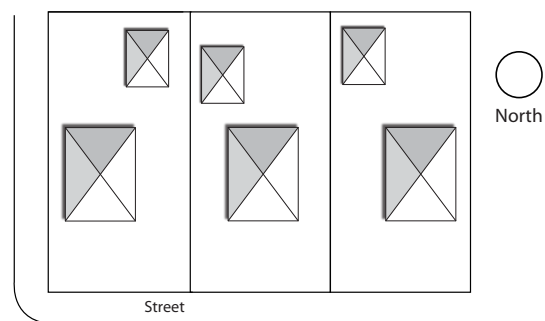
Site Plan



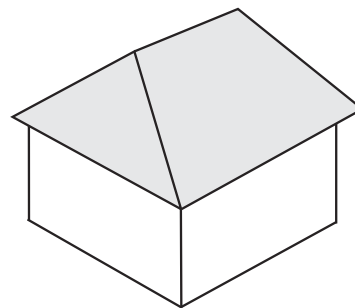
Elevation

Your Plan

\*Please provide all necessary setback data



Site Plan



Elevation

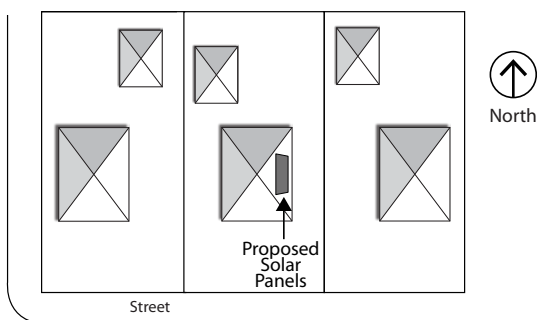
# Solar Panels Mounted in Special Zoning District

## Site and Elevation Plan Template

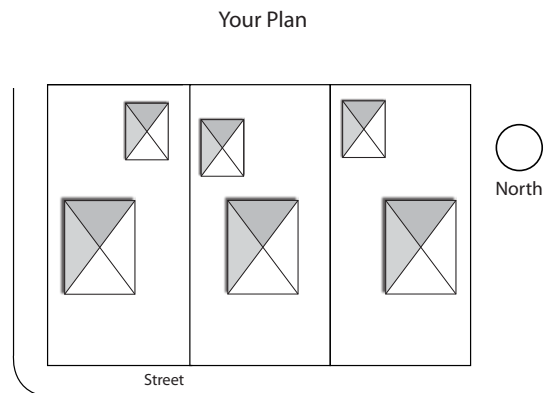
Project Address:

Proposed Solar Array is Located In:

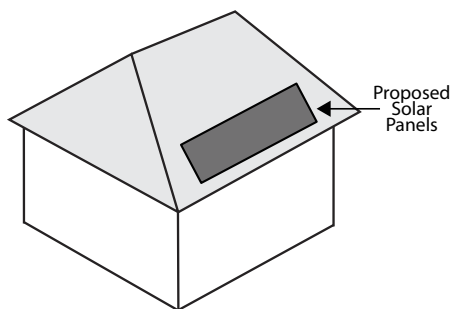
- ☐ Historic District
- ☐ Urban Design District
- ☐ PD Zoning District
- ☐ Other \_\_\_\_\_



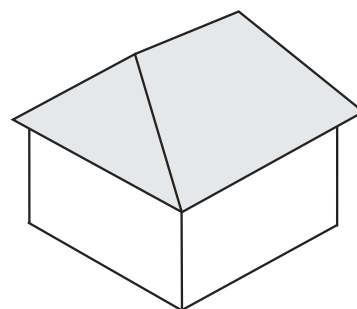
Site Plan



Site Plan



Elevation



Elevation

# PV Electrical Inspection Checklist

## Field Inspection – Roof / Pole

1. Modules – Properly labeled per NEC 690.51 \_\_\_\_\_ Number & Type match specifications and plans \_\_\_\_\_  
UL Listed 1703 \_\_\_\_\_
2. Modules & Arrays installed securely and properly \_\_\_\_\_
3. PV Source and Output conductors – Approved for location – Wet \_\_\_\_\_ Sunlight \_\_\_\_\_ 90°C \_\_\_\_\_  
Protected from Damage \_\_\_\_\_ Flexible for Trackers or Movable Arrays \_\_\_\_\_ Properly Sized \_\_\_\_\_
4. Connectors – Polarized, non-interchangeable, guarded, latching or locking, “first make – last break” for grounded conductor,  
rated for interrupting current if less than 30 volts or tool to open \_\_\_\_\_
5. Junction Boxes, Combiners, Wire Connectors, Wiring Methods and Conductors – approved for the environment and installed  
per appropriate NEC code section \_\_\_\_\_
6. Disconnecting Means.
  - a. Approved disconnect installed between the PV power system output and other building conductors at a readily  
accessible location outside or directly inside the building and must disconnect all PV system conductors  
from other conductors in a building \_\_\_\_\_
  - b. Not required to be suitable for use as service equipment \_\_\_\_\_
  - c. Must be permanently marked to identify it as a PV system disconnect \_\_\_\_\_
  - d. Must be suitable for the location and conditions \_\_\_\_\_
  - e. Not more than 6 disconnecting means & must be grouped \_\_\_\_\_
7. Equipment likely to be energized while inspecting, testing or servicing to comply with NEC 110.26 for working clearances \_\_\_\_\_
8. Conductors – Sized properly for maximum circuit current (sum of parallel module short-circuit current x 125%) \_\_\_\_\_
9. Grounding electrode sized properly (min #6 copper check w/local authority) \_\_\_\_\_
10. Non current carrying metal parts components are grounded and bonded. Grounding and bonding fittings,  
connection points and routing of conductors approved for environment and installed per manufacturer’s instructions  
(module mounting hardware must be approved for such use & removal of a module must not interrupt a ground path \_\_\_\_\_
11. Ground fault protection is provided for grounded arrays \_\_\_\_\_
12. Other items \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# PV Electrical Inspection Checklist

## Routing of PV Source, Output and Inverter Input Circuits

1. PV Source and Output circuits not run with other conductors \_\_\_\_\_
2. DC Source, Output circuits conductors run in metal raceways installed and supported per applicable NEC Article \_\_\_\_\_
3. AC Inverter Output circuits to be installed in a NEC Chapter 3 wiring method installed, supported and protected per applicable NEC Article (check with local authority) \_\_\_\_\_
4. Conductors sized properly – 125% of derated ampacity (ampacity after ambient temperature, rooftop ratings & conduit fill if applicable) applied to maximum circuit current. (sum of parallel short-circuit current ratings x 125% plus another 125%) \_\_\_\_\_
5. Equipment grounding conductors installed with circuit conductors and sized properly per 250.122 for AC or 250.166 for DC \_\_\_\_\_
6. Grounding electrode conductors routed and protected as required. If routed in a metal raceway, installed with assured bonding per NEC 250.64 \_\_\_\_\_

## Grounding Electrodes

1. Run as close as practicable to roof-mounted or pole mounted arrays \_\_\_\_\_
2. Permitted to have auxiliary grounding electrode if more than 6 feet from premises grounding electrode (otherwise required to use premises grounding electrode) \_\_\_\_\_
3. If system includes both AC & DC systems the grounding electrode systems must be bonded together and may use separate grounding electrodes, or may use the premises grounding electrode(s). Grounding electrode conductor size is the larger of AC per 250.122 or DC per 250.166 \_\_\_\_\_

## Disconnects and Overcurrent Protection

1. Disconnects for DC Source or Output circuits must be rated for DC and installed as required (Fuses must be listed for DC, DC fused disconnects may require special routing and disconnecting procedures) \_\_\_\_\_
2. No more than 6 disconnecting means for each source of power, disconnects must be grouped \_\_\_\_\_
3. Must disconnect all ungrounded conductors from all power sources for equipment such as inverters, batteries, charge controllers, etc. \_\_\_\_\_
4. Must have "ON/OFF" and appropriate interrupting ratings \_\_\_\_\_

# PV Electrical Inspection Checklist

5. DC disconnect must be labeled with: Maximum power current \_\_\_\_\_  
Maximum power voltage \_\_\_\_\_  
Maximum power current \_\_\_\_\_  
Maximum system voltage \_\_\_\_\_  
Short-circuit current \_\_\_\_\_
6. PV Source and Output circuit overcurrent protection must have a rating 125% of maximum circuit current. (sum of parallel short-circuit current ratings x 125% plus another 125%) \_\_\_\_\_
7. AC disconnect must be labeled with: Inverter operating AC voltage \_\_\_\_\_  
Rated AC output current \_\_\_\_\_

## Inverters

1. UL listed 1741 \_\_\_\_\_
2. Maximum inverter input \_\_\_\_\_ and output \_\_\_\_\_ circuit currents based on inverter ratings
3. Interactive inverters will de-energize if utility power is disconnected \_\_\_\_\_

## Point of Connection

1. Permitted on line side of service disconnecting means (verify local utility requirements) \_\_\_\_\_
2. Disconnects for the connection on line side of the service disconnecting means shall be suitable for use as service equipment and have adequate fault current ratings \_\_\_\_\_  
Such disconnects shall be identified as a PV disconnect \_\_\_\_\_
3. Inverter output connections on the load side of the service disconnecting means shall be made at a dedicated circuit breaker or fusible disconnect \_\_\_\_\_
4. The sum of all breakers supplying power to a busbar or conductor must not exceed 120% of the busbar or conductor rating \_\_\_\_\_
5. Equipment containing overcurrent devices in circuits supplying power to a busbar or conductor supplied from multiple sources shall be marked to indicate the presence of all sources \_\_\_\_\_
6. Backfed circuit breakers shall be identified for such operation (must not indicate "line" or "load") \_\_\_\_\_

# PV Electrical Inspection Checklist

7. Unless the panelboard is rated not less than the sum of all overcurrent devices supplying it, a connection in a panelboard shall be positioned at the opposite end from the input feeder location or main circuit location \_\_\_\_\_

Such devices shall be labeled "WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE" \_\_\_\_\_

## Other Markings & Labels

1. Exterior visible notice indicates and identifies the locations of array disconnect and utility service disconnect of not located together \_\_\_\_\_
2. If all terminals of a disconnect are energized when open, a label "WARNING ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION. \_\_\_\_\_

# Solarstruc

SolarStruc is an easy-to-use analytical software package designed to simplify the ; calculation of rooftop solar loads for solar professionals. When used properly, SolarStruc allows the user to determine rooftop loads for solar installations. Solar professionals can also use the calculator included for checking the structural adequacy of the top chord of a truss. SolarStruc is based on the design criteria of ASCE 7.05 which is considered an acceptable method of structural analysis by the State of Wisconsin.

- A free copy of SolarStruc can be downloaded at  
<http://www.growsolar.org/wp-content/uploads/2012/06/Solarstruc-2.2.xls>
- A SolarStruc tutorial is available to view online:  
<http://media.cityofmadison.com/mediasite/Viewer/?peid=baf0c2eb2ea24e03a74976755185c16b1d>  
We strongly recommend that you view the entire tutorial before submitting a permit package using SolarStruc calculations.
- Questions and comments about SolarStruc can be emailed to [aharper@cityofmadison.com](mailto:aharper@cityofmadison.com)

**Solarstruc V2.1  
Load Generator**  
(Input data in all yellow spaces)

Horizontal projection: 9.5 feet

Vertical projection: 3.2 feet

Project address:  
Number and street: 14 S. 39th Street  
City and state: Madison, WI  
Date and time: 2/14/2011 13:26

Solar array

Tilt angle (degrees): 18.43

1.1 = C<sub>g</sub> of roof

Horizontal

Height of one panel = 60 inches  
Width of one panel = 39.5 inches  
Number of panels in a row = 4  
Number of panels in a column = 2  
Weight of one panel = 44 pounds

Tributary length for support = 28.5 inches  
Tributary width for support = 48 inches

Spacing of roof structural members = 24 inches

Height from ground to midpoint of roof = 12 feet  
Width of building = 48 feet  
Height of midpoint of array above ground = 12.5 feet  
Horizontal distance from top of array to roof edge = 13.4 feet

Roof slope = 4/12 = 18.4 degrees

Design wind velocity = 90 mph  
Exposure category B or C = B  
Ground snow load p<sub>g</sub> = 30 psf

**Solarstruc V2.1  
TRUSS CHORD CHECK**  
(Input data in applicable yellow spaces)

Dead load of roofing materials: 4.2 pounds per square foot

Spacing of trusses: 24 inches

Total horizontal length: 72 inches

Load a load b load c load d load e load f load g

251 251

Load offset from panel point (inches):  
a = 68.4  
b = 33.6  
c =  
d =  
e =  
f =  
g =

R<sub>1</sub> = 387 lb

R<sub>2</sub> = 165 lb

maximum moment in chord section = 469 ft-lbs

Allowable moments:  
#2 SPF 2 x 4 = 442 ft-lbs  
2100 msr SPF = 615 ft-lbs

Note: Apply loads from left to right.  
Example - If there are three point loads on this section of truss the loads should be under Load a, Load b, and Load c and the distances a, b, and c should be filled in.