Connecticut Rooftop Solar PV Permitting Guide

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[1] http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/sunshot-rooftop-solar-challenge.html

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INTRODUCTION

As Connecticut moves toward its clean energy goals, demand for solar energy systems in our communities will continue to increase. Clean energy systems have many local benefits including cheaper electricity, economic growth, a healthier environment and increased energy security. This Guide provides information and tools your municipality could consider using to attract more clean energy business and reap these benefits.

Though the purpose of this Guide is to provide resources to help make solar PV permitting easier, the ideas and tools presented here can help make permitting easier in other areas as well! Our team is happy to discuss these ideas and resources with your municipality further to see what you may be interested in exploring.

Some potential benefits of adopting the suggestions in this Guide:

- Help make the work of municipal staff easier and less time-consuming.
- Help contractor's get it right the first time by clarifying what information contractors should provide when they apply for a solar PV permit, reducing everyone's guesswork and frustration.
- Make it easier for your municipality to identify what to look for so that solar PV systems are being installed properly and safely in your community.
- Access inexpensive training for your municipal staff that also counts for continuing education credits.
- Earn Clean Energy Community points for your municipality which could result in a free, municipal clean energy project.
- Encouraging more solar PV as well as other projects to be installed in your community, increasing business and money spent in your community.

"NEW HAVEN LIGHTHOUSE" INSTALLED BY ROSS SOLAR GROUP

- More business in your community means more money being spent in the state, more jobs created in the state, and a better economic climate for all of us in Connecticut.
- Affordable, user-friendly tools provided in this Guide can help you explore ways to bring more of your information and processes online. This is a great opportunity to "test drive" tools with little risk, and help your municipality identify its needs.
- Allowing your staff to access the latest ideas and tools being offered by state initiatives can help your community to grow and prosper.

To create this Guide, we conducted research in Connecticut and consulted "best practices" nationwide on how to streamline solar PV permitting. We sought input from municipal leaders and staff, solar PV installers and industry leaders, university researchers, utility company experts, property owners and other stakeholders to identify practices that will help municipalities develop effective processes for solar PV and make solar more affordable and accessible in all of Connecticut's 169 jurisdictions. Though this Guide focuses primarily on rooftop solar PV, inclusion of considerations for free-standing solar PV are provided where possible.

This Guide provides recommendations and resources for possible improvements in the following areas, specifically for solar PV, though many ideas could be applied to permitting in general:

- Information availability
- Permit application forms and instructions
- Review and inspection requirements
- Permit fees
- Formalizing solar-friendly practices

This Guide offers the following tools:

- Standard Solar PV Permit Application Package
- Information on Simply Civic, an online permitting system available to CT municipalities to try out for free through 2014, as well as other online permitting system options
- Solar PV Code Compliance Reference
- Model ordinances to help improve permitting and planning and zoning for solar PV
- A form you can submit to receive Clean Energy Communities points for permitting improvements
- Training and information resources for municipal staff and others

The Connecticut Rooftop Solar PV Permitting Guide was inspired by California's Solar Permitting Guidebook. While our Guide does not cover the same material as California's June 2012 publication, it does provide recommendations and tools to achieve the same objective - improving solar PV permitting processes to allow for more clean energy and its benefits in your community.

This Guide is available for download on our project website, www.energizect.com/sunrisene, under the Permitting Guide tab where you will also find stand-alone forms and templates featured in this Guide. Each template can be downloaded, modified and implemented to fit the needs of your community.

You may also want to refer to the Sun Rise New England – Open for Business Final Project Report provided on the project website for more detailed information on the findings of our research and strategies for improving processes and reducing costs in Connecticut.

We will now provide some background information about developments around solar and clean energy in Connecticut before diving in to detailed suggestions and ideas for improving solar PV (and other) permitting processes.

CURRENT LAWS, REGULATIONS AND CODES THAT IMPACT SOLAR PV

The development of rooftop solar PV systems in Connecticut is impacted by several state statutes and building code requirements. These laws provide the framework for municipal regulations that impact solar development, including structural/electrical requirements for solar PV systems and solar PV permit fees. This section outlines the major rules and regulations that affect solar PV in Connecticut.

ROOFTOP SOLAR PV INSTALLATION IN FAIRFIELD, CT
COURTESY OF ASTRUM SOLAR

Connecticut Renewable Portfolio Standard

Connecticut established its Renewable Portfolio Standard (RPS) in 1998 and revised it several times thereafter. In its current iteration each electric supplier in the state must obtain at least 23% of its retail electricity load from renewable sources by January 1, 2020.

Connecticut has three classifications for renewable energy resources:[2]

Class I resources include electricity derived from solar power, wind power, fuel cells (using renewable or non-renewable fuels), geothermal, landfill methane gas, anaerobic digestion or other biogas derived from biological sources, ocean thermal power, wave or tidal power, low-emission advanced renewable energy conversion technologies, certain run-of-the-river hydropower facilities not exceeding 30 megawatts (MW) in capacity, and biomass facilities that use sustainable biomass fuel and meet certain emissions requirements. Electricity produced by end-user distributed generation (DG) systems using Class I resources also qualify under the RPS.

Class II resources include trash-to-energy facilities, certain biomass facilities not included in Class I, and certain older run-of-the-river hydropower facilities.

Class III resources include: (1) customer-sited Combined Heat and Power (CHP) systems, with a minimum operating efficiency of 50%, installed at commercial or industrial facilities in Connecticut on or after January 1, 2006; (2) electricity savings from conservation and load management programs that started on or after January 1, 2006, provided that on or after January 1, 2014, no such programs supported by ratepayers shall be eligible; and (3) systems that recover waste heat or pressure from commercial and industrial processes installed on or after April 1, 2007.

To fulfill the 2020 requirements of the RPS electric suppliers must obtain 20% of their retail load from Class I sources and 3% of their retail load from Class I or II sources. Additionally, electric suppliers were required to obtain 4% of their retail load from combined heat and power systems and energy efficiency improvements by 2010 and must maintain this load percentage through 2020 and beyond.[3]

[2] http://www.cga.ct.gov/current/pub/chap_277.htm, see Section 16-1 Definitions
[3] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CT04R&re=0&ee=0 , and Chapter 283 Section 245a http://www.cga.ct.gov/2011/pub/chap283.htm

Connecticut Public Act 11-80

Public Act 11-80,[4] passed in 2011, restructured Connecticut's state agencies and established new programs to help the state achieve its energy goals. The act created the Connecticut Department of Energy and Environmental Policy (DEEP) by merging the Department of Environmental Protection and the Department of Public Utilities Control. PA 11-80 also created the Clean Energy Finance and Investment Authority (CEFIA)[5], the successor organization to the Connecticut Clean Energy Fund (CCEF).To plan for Connecticut's energy future, PA 11-80 instructed DEEP to develop a Comprehensive Energy Plan and update the plan every three years.[6]

PA 11-80 also mandated the creation of two programs specifically designed to incentivize deployment of solar photovoltaic projects:

- **Residential Solar Investment Program (RSIP):** Section 106 of PA 11-80 required CEFIA to implement a residential solar investment program resulting in deployment of at least 30MW of new residential solar PV in Connecticut by 2022. RSIP provides incentives for customer-owned and third party owned residential solar PV systems, funded by a surcharge on ratepayers serviced by Connecticut's investor-owned utilities, Connecticut Light and Power (CL&P) and United Illuminating Company (UI). For more information on the RSIP program visit the Energize Connecticut website.
- **Zero Emission Renewable Energy Credit (ZREC) and Low Emission Renewable Energy Credit (LREC) Program:** Connecticut's investor-owned utilities, CL&P and UI, were directed to implement a 22 year program to promote, fund and expand "behind the meter" renewable generation. CL&P and UI provide 15-year revenue streams to renewable energy project developers by purchasing ZRECs and LRECs through a competitive bidding process. Solar PV projects are zero emission and are incentivized through ZRECs. For more information on the LREC/ZREC program visit CL&P's program website or United Illuminating's program website.

For more information on PA 11-80 and the programs it established, see Murtha Cullina's "Summary of Public Act No. 11-80" or read PA 11-80 itself.[7]

Connecticut Building Code Requirements

The current State Building Code of Connecticut is the building code by which the state and all municipalities must abide. Therefore, municipalities may not currently adopt codes that are stricter or more flexible than the State Building Code. The current State Building Code of Connecticut can be found on the website of the Office of the State Building Inspector[8] and includes:

- The 2005 CT Building Code which was approved in 2005
- 2009, 2011 and 2013 amendments
- Corrections to wind load data for several towns.

The 2005 CT Building Code includes the following model national and international codes:

- 2003 International Building Code (IBC)
- 2003 International Existing Building Code (IEBC)
- 2003 International Plumbing Code (IPC)
- 2003 International Mechanical Code (IMC)
- 2009 International Energy Conservation Code (IECC)

[4] http://www.cga.ct.gov/2011/act/pa/2011PA-00080-R00SB-01243-PA.htm
[5] ctcleanenergy.com, then click on "About"
[6] http://www.ct.gov/deep/cwp/view.asp?a=4120&q=500752
[7] http://www.murthalaw.com/files/summary_of_public_act_1180_bill_1243_for_72811.pdf or http://www.cga.ct.gov/2011/act/pa/2011PA-00080-R00SB-01243-PA.htm
[8] http://www.ct.gov/dcs/cwp/view.asp?a=4447&q=521446&dcsNav

The 2013 amendment, which took effect on February 28, 2014, incorporated the following codes into Connecticut's 2005 State Building Code:

- 2009 International Residential Code (IRC)[9]
- 2011 National Electrical Code (NEC) (NFPA 70)[10]

In Connecticut's 2011 amendment to its State Building Code, Connecticut adopted the 2009 International Energy Conservation Code (IECC), which increased energy efficiency requirements for new residential and commercial construction. In January 2014, Connecticut adopted the 2009 International Residential Code (IRC) and the 2011 National Electrical Code (NEC). Both took effect on February 28, 2014. The 2009 IRC contains stricter requirements for building strength and is more stringent on storm preparedness than the 2003 code. The 2011 NEC also contains updated requirements for solar PV. A Solar PV Code Compliance Reference, provided on page 42 of this Guide, summarizes the solar PV code requirements of the 2011 NEC. The state of Connecticut is planning to upgrade the entire building code to the 2012 International Building Code by 2015, including the 2014 IECC.

Planning and Zoning Laws

Connecticut has several state statutes that establish a basis for municipal land use regulations and the proactive development of solar energy systems. Based on the statutes, local governments can create solar-friendly laws via ordinances and zoning regulations as long as they do not contradict the direction of the state statutes. The following state statutes impact solar PV systems and sustainable development in Connecticut. For more detailed information about these statutes, please see CT's RSC Round I Final Project Report, accessible at www.energizect.com/sunrisene.

- **CT Gen. Statute § 8-2 (CT's zoning enabling act)** enables jurisdictions to adopt regulations that encourage energy-efficient patterns of development, the use of solar and other renewable forms of energy, and energy conservation.
- **CT Gen. Statute § 8-25 (b)** requires subdivision development regulations to encourage energy-efficient patterns of development and land use, the use of solar and other renewable forms of energy, and energy conservation.
- **CT Gen. Statutes § 8-23 (a) and (d)** require planning commissions to prepare, amend or adopt a plan of conservation and development for the municipality, and in preparing such plan, consider energy-efficient patterns of development, the use of solar and other renewable forms of energy and energy conservation.
- **CT Gen. Statute § 7-147f** limits the reasons a certificate of appropriateness can be denied to a solar energy system to features that substantially impair the historic character of the district.

Local jurisdictions could consider utilizing these statutes as a foundation for zoning regulations that make installation of solar PV easier. For example, solar-friendly regulations could exempt rooftop PV systems from zoning review and allow for flexibility with respect to zoning restrictions that impact installation of solar energy systems, whether rooftop or free-standing. Some examples of zoning elements that impact solar PV development are height restrictions, setback restrictions, lot coverage restrictions and impervious surface requirements. For more information about how to make zoning regulations in your community solar-friendly, see the sections of this Guide called "Planning and Zoning Recommendations for Municipalities" (page 48) and "Solar PV Model Zoning Ordinance for Connecticut Jurisdictions" (page 53).

[9] The following sections of the International Residential Code include relevant structural requirements for solar PV systems: Chapter 8 Section 802.2 "Design and Construction," Section 802.3 "Framing Details," 802.5 "Allowable Rafter Spans," and Section 802.6 "Bearing" (particularly Table 802.5.1 (3) Rafter Spans for Common Lumber Species (Ground snow load=30 psf, ceiling not attached to rafters, L// = 180). Additionally, Chapter 23 of the International Building Code contains wind uplift guidelines in Section 2308.10.1 "Wind Uplift."

[10] Section 690 of the National Electrical Code contains information pertinent to solar PV http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=70

CURRENT LAWS, REGULATIONS AND CODES THAT IMPACT SOLAR PV Continued

Solar Access Laws

Currently, Connecticut does not have a solar access law in place and solar rights are not clearly defined in the state. Solar rights are the rights to access and harness sunlight. Solar access laws can protect solar rights by assuring adequate access to direct sunlight for a solar energy system (including protection from physical obstructions on adjacent properties) and by protecting the ability to install solar energy systems on residential or commercial properties that are subject to restrictions (both public and private). For more information about solar access considerations, please see CT's RSC Round I Final Project Report, accessible at www.energizect.com/sunrisene.

Permit Applications & Fees

Connecticut does not have a statewide standard application or fee for obtaining a solar PV permit. Currently, each of Connecticut's 169 jurisdictions has its own permitting process, permit application and fee structure for a solar PV permit. Most CT towns use a valuation open ended permit fee structure meaning the fee is based on the cost of a project and has no upper limit. However, CT General Statute § 29-263 gives municipalities the option to exempt Class I renewable energy systems from municipal building permit fees.[11] Some municipalities have taken advantage of G.S. § 29-263 and waived the permit fee (Bridgeport, Manchester). A few jurisdictions charge a flat fee of $100 to $200.

[11] http://www.cga.ct.gov/2011/pub/chap541.htm

ROOFTOP SOLAR PV PERMITTING RECOMMENDATIONS FOR JURISDICTIONS

The following list of ideas for improving rooftop solar PV permitting results from research conducted by the **Connecticut Rooftop Solar Challenge** team. Though our team arrived at these suggestions independently from other teams across the country, these themes are consistent with the work of other teams throughout the nation that are working to help understand and improve permitting processes.

Jurisdictions are encouraged to consider these suggestions to support efficient and safe rooftop solar PV installations in their communities. Subsequent sections of this Guide provide more details as well as specific examples and templates you might use to implement recommendations that could be feasible and beneficial for your community.

Make Information Available

- **Post Permitting Information Online:** Consider making information and resources pertaining to your solar PV permitting process and fee available and easily accessible on your jurisdiction website.
- **Create a Clean Energy Webpage** on your jurisdiction's website. You could consider providing links to resources such as the **Sun Rise New England** and **EnergizeCT** websites. **EnergizeCT** is a state initiative to provide energy-related information and resources.[12] Constituents might also want to know about local clean energy projects and activities, policies and incentives, your clean energy task force (if applicable), and successes and participation in programs such as the **Rooftop Solar Challenge**, **Solarize**, the **Clean Energy Communities Program**, the **CT Solar Challenge**, and **C-PACE**.[13] See West Hartford, Greenwich, Cornwall, Coventry, Hampton and Middletown clean energy websites for examples, though all jurisdictions could review their sites for potential updates and additions.[14]
- **Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

"'GO SOLAR CHESTER!' SIGNAGE TO PROMOTE THE CT SOLAR CHALLENGE," PHOTO COURTESY OF MICHAEL PHILLIPS

Streamline Permit Application Submission

- **Simplify the Application Process:** Consider making one department responsible for the rooftop solar PV permitting process and reduce the number of steps and extra requirements asked of installers. *(Please see the "Optimizing Permit Application, Review and Inspection Processes" chapter on page 39 of this Guide.)*

[12] energizect.com/SunriseNE and more generally, energizect.com
[13] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.
[14] Cornwall: cornwallctenergy.org;
Coventry: www.coventryct.org/index.aspx?NID=175;
Greenwich: www.greenwichct.org/Government/Commissions/Conservation_Commission/Cean_Energy_Community;
Hampton: www.hamptonct.org/committee.htm?id=fhsb77u5;
Middletown: www.cityofmiddletown.com/content/81/750/1840/default.aspx;
West Hartford: www.westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

- **Adopt the Connecticut Standardized Solar PV Permit Application:** You could clarify requirements and increase consistency across jurisdictions by adopting our standardized rooftop solar PV permit application package. *(Please see the next chapter, starting on page 17, which offers the "Connecticut Standardized Solar PV Permit Application Package," also available for download as a standalone document in the Permitting Guide tab on the Sun Rise New England webpage.)*[15]
- **Adopt Online Permitting:** Consider trying out online permitting system[16], a great way to make permitting easier for your municipality and for applicants. Online permitting enables applicants to obtain and submit solar PV permit application materials online and can make it easier for your municipality to process and keep track of permits. You could also allow installers to obtain and submit permit application materials through your existing website, by email or by regular mail. Offering these options for application submission will save applicants time and money, encouraging them to do more business with your community. *(Please see the "Online Permitting" chapter on page 34 of this Guide.)*

Waive or Reduce Permit Fees

- **Consider Reducing or Waiving Fees:** Towns can encourage solar installations by reducing or waiving solar PV permit fees.[17] If a full waiver is tough to do, consider a low or flat fee based on the cost to your town instead of a value-based fee structure that may not accurately reflect the cost of review and inspection. Research in Connecticut indicates that it may cost less than $200 for a town to permit a small-scale, rooftop solar PV installation. Bridgeport and Manchester are two communities in Connecticut who have elected to waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits. *(Please see "A Permit Fee Structure that Promotes Renewable Energy" on page 47 of this Guide.)*
- **Allow for Payment Electronically or by Mail:** If you're able to allow installers to pay permit fees online, electronically, or by regular mail, this would help them save on driving time and cost, allowing them to do more business with your community.

Streamline Review and Inspection Requirements

- **Train Staff:** Your municipality could take advantage of training resources offered for jurisdiction staff who would benefit from learning more about solar PV. Your staff can participate in training offered through this project (announcements will be provided on our website, www.energizect.com/sunrisene), and also access free online training courses and resources.[18] *(Please see "Training Staff in Rooftop Solar PV Specifics," page 37 of this Guide.)*
- **Consider Streamlining Reviews.** Consider reevaluating your solar PV permitting requirements to identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, engineering reviews could potentially be streamlined or eliminated by considering criteria and a methodology for determining when these reviews are needed. *(Please see "Optimizing Permit Application, Review and Inspection Processes," on page 39 of this Guide and the "Structural Worksheet for Roof Mounted Solar Energy Systems" on page 30)*

[15] energizect.com/SunriseNE
[16] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.
[17] http://www.cga.ct.gov/2012/sup/chap541.htm, see Section 29-263"(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."
[18] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

- **Simplify the Inspection Process.** This Guide offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, consider conducting a single, comprehensive inspection instead of requiring multiple appointments. (2) Where possible, consider scheduling narrower windows of time or specific appointment times for inspections. This saves everyone—and ultimately town residents and business owners—time, money and frustration. *(Please see "Optimizing Permit Application, Review and Inspection Processes," page 39 of this Guide.)*
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[19] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in this Guide. Consider adopting the suggested elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions to remove barriers to solar energy installation and make solar PV permitting easier and less costly in your community. *(Please see "Solar PV Model Permitting Ordinance for Connecticut Jurisdictions," on page 52 of this Guide and "Solar PV Model Zoning Ordinance for Connecticut Jurisdictions" on page 53.)*

Join the Clean Energy Community

- **Get credit for your improvements by becoming a member of Connecticut's Clean Energy Communities (CEC).** *(Please see "Become an Award Winning Member of the Clean Energy Community" starting on page 60 of this Guide.)*
  - Your municipality can win CEC points for making improvements based on the recommendations in this Guide. These points can help you earn a solar PV system for your community.
- **Improve your community's score on Project Permit**
  - Project Permit[20] is a website that rates communities around the country on their solar PV permit process. Log on to see how you stack up and submit your permitting improvements to boost your score![21]
- **Try out a Roadmap for Solar Success:**
  - Optony's American Solar Transformation Initiative Roadmap[22] is a free service that develops individual strategic plans, or "roadmaps," for municipalities. Each roadmap consists of actionable steps a municipality can take to increase cost-effective installation of solar energy systems. By joining Optony's community, your municipality will gain access to:
    - A customized collection of resources to help your municipality accomplish its action steps, as well as access to a comprehensive, searchable resource library that offers sample solar contracts, policies, programs and best practices
    - Free technical assistance to help your community understand and address solar issues
    - Coordination with other jurisdictions working on similar solar-related issues to facilitate resource sharing and program development

Access Other Resources for Local Governments

In addition to the recommendations provided above, see "Additional Resources for Municipalities," on page 38 for more information that can assist your municipality in working to improve permitting, as well as other guidance on solar energy.

[19] http://www.ct.gov/dcs/cwp/view.asp?a=4447&q=521446&dcsNav.The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.
[20] http://projectpermit.org/about/
[21] Project Permit is funded by a U.S. SunShot Initiative grant as part of the Vote Solar Initiative.
[22] http://www.solarroadmap.com/

CONNECTICUT STANDARDIZED SOLAR PV PERMIT APPLICATION PACKAGE

One of the best practices for achieving efficient, streamlined permitting in Connecticut is the use of a standard solar PV permit application package. A standard form would eliminate guesswork for municipal staff and installers; clarify and simplify review and inspection; save everyone time and cost; and help make clean energy more affordable for our residents and businesses.

Experienced solar PV installer and current CEFIA solar PV system inspector Richard Dziadul, with support from the **Connecticut Rooftop Solar Challenge** team, developed Connecticut's Standardized Solar PV Permit Application.[23]

While this permit application is primarily for residential and small commercial applications, there is no size limit to use this application. For larger (typically commercial) systems a jurisdiction may require more information through additional attachments.

Connecticut's complete solar PV permit application package consists of:

- A two-page permit application form
- A two-page instruction document including a list of information to be provided on the application attachments/drawings
- Three sample drawings—electrical diagram, site plan and attachment details
- Sample PV panel and inverter manufacturers' specification sheets
- A Structural Review Worksheet that can be used to evaluate the adequacy of a roof structure for solar PV

"FAIRFIELD WOODS MIDDLE SCHOOL" INSTALLED BY PV SQUARED

Use of the Structural Review Worksheet

While rooftop solar PV systems typically weigh less than a second layer of roof shingles and a majority homes are designed to support this weight, there are some circumstances when a roof structure needs to be improved upon or reinforced to safely support a solar PV system. Many Connecticut towns require a review and wet stamp from a registered design professional (RDP)[24] to verify that an existing home or building can support solar PV without reinforcement. The employment of a RDP can significantly add to project costs. To find alternatives to the employment of an RDP on every project without sacrificing safety, the Connecticut Rooftop Solar Challenge team worked with professional structural engineers to develop the Connecticut Structural Review Worksheet for Roof-Mounted Solar Energy Systems. This Structural Review Worksheet is an optional attachment that can be used by qualified reviewers to evaluate the adequacy of a roof framing structure for solar PV.

[23] While this application package is designed for permitting rooftop solar PV systems, the application form collects some information relevant to ground or pole mount systems. Jurisdictions could thus choose to use the application package for all solar PV systems, though systems other than rooftop may require more approvals, such as zoning or wetlands. A key project recommendation is for one municipal department to handle *rooftop* solar PV permitting and therefore one department to receive the solar PV permit application. See the permitting recommendations summary in this Guide in the section titled "Rooftop Solar PV Permitting Recommendations for Jurisdictions."

[24] An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed. Typically an architect or engineer. http://www.hansenpolebuildings.com/glossary/r.htm

The Structural Review Worksheet can only be used on homes with standard structural features, and where it is possible to see enough of the framing to identify:

- Rafter size and spacing.
- Ridge board vs. ridge beam.
- Configuration of framing, including:
  - Cross ties at eave vs. collar ties;
  - Collar tie locations, if present (spacing and height);
  - Collar tie connections, if present.
- Whether any framing irregularities (e.g. skylights, dormers) occur in the vicinity of the proposed PV panels.
- Type of roof sheathing (e.g. plywood, OSB, straight board sheathing)

If too much of the framing is concealed by finishes, such as in spaces with cathedral ceilings, it may be necessary to have a registered design professional investigate the framing and review the proposed installation, especially if openings need to be made in the finishes to observe the framing and document the construction details listed above.

Did you know?
A solar PV system typically weighs less than a second layer of roof shingles

The Structural Review Worksheet requires the reviewer to collect detailed roof framing information to assess whether the roof structure meets all the Worksheet's criteria. If the structure meets all of the criteria and no indications of structural flaws are present, the installer is asked to perform roof load calculations to evaluate whether the roof can support a solar PV system.

The Structural Review Worksheet addresses the most common structural concerns that arise with solar PV (e.g., dead load, wind load), and flags any aspects of the structure that could necessitate further professional review. Specifically, the worksheet addresses dead load and wind load concerns by ensuring the proposed solar installation meets the following criteria:

1) The distributed load (i.e., weight of PV system on roof) is less than five (5) pounds (lbs) per square foot (ft^2), and
2) The point load (i.e., weight of PV system at each attachment/mounting point) is less than 45 lbs.
3) The roof's maximum rafter span can support the weight of the PV system with a 30 lb. snow load.
4) The solar panels are flush mounted, with a maximum angle of 5 degrees and a maximum gap of 6" between the roof surface and the solar panels, to ensure wind uplift is minimized.

We recommend that the reviewer completing the Worksheet have experience identifying structural features. Some suggested qualifications and uses of the worksheet are provided below, however, final decision on who can use the worksheet and how it is used is left up to the municipality.

- **The following are suggested ways to use the Structural Review Worksheet, all requiring authorization by the municipality:** A municipality could allow an approved reviewer, with a specific certification, to submit this form in lieu of a structural review by a registered design professional. This would need to be authorized by a municipality. Therefore, installers should not use the worksheet to replace evaluation by a registered design professional unless specifically authorized to do so by the municipality. Potential, acceptable certifications a jurisdiction could consider authorizing are:
  - North American Board of Certified Energy Practitioners (NABCEP) PV Installation Professional certification.
  - Licensed Home Inspector
  - Registered Professional Engineer.
  - Engineer-in-Training (EIT).
  - Other approved certification that requires training in the structural inspection of residential framing systems.
- If a municipality requires a structural review by a registered design professional on every rooftop solar PV project, the Structural Review Worksheet or information provided on portions of the Worksheet could be submitted as supplemental information along with a letter from a registered design professional.

CONNECTICUT STANDARDIZED SOLAR PV PERMIT APPLICATION PACKAGE Continued

- An installer could use the Structural Review Worksheet to help him/her identify "red flags" and provide other information that would be useful to share directly with a registered design professional. This preliminary or extra information could help the design professional find issues more easily, potentially reducing the amount of time needed by the professional.
- A registered design professional may choose to utilize the Worksheet as part of his/her evaluation process.

How to Use and Access CT's Standardized Solar PV Permit Application

Stand-alone documents, including a fillable permit application form (.doc or PDF), are provided on Connecticut's Sun Rise New England - Open for Business website[25] under the "Permitting Guide" tab.

Municipalities are encouraged to partner with solar PV installers and the Rooftop Solar Challenge II team to pilot use of the solar PV permit application. Our team is happy to support you in exploring this opportunity.

The CT Standardized Solar PV Permit Application can be used to replace a municipality's permit form(s), while a shorter version is also available for use as a supplement. Both forms are available at: http://www.energizect.com/sunrisene

[25] www.energizect.com/sunrisene

Permit # [For Jurisdiction Use]: _____

energize CONNECTICUT℠

Connecticut Standardized Solar Photovoltaic (PV) Permit Application

Date: _____

Property Type: ☐ **Residential (R)** ☐ **Commercial (C)** ☐ **Other (specify):** _____

General Description of Solar PV Array: _____

_____ **System Size** (kW DC): _____

Property Owner: _____

Street Address: _____ Parcel ID #: _____

Town: _____ State: _____ Zip: _____

Phone: _____ Cell: _____

Email: _____ Fax: _____

Additional Information: _____

Contractor: _____

Street Address: _____

Town: _____ State: _____ Zip: _____

Contact Name: _____ Title: _____

Phone: _____ Cell: _____

Email: _____ Fax: _____

License Type: _____ State: _____

License Number: _____ Exp. Date: _____

Scope of Work: _____

Subcontractor or Professional Engineer: _____

Street Address: _____

Town: _____ State: _____ Zip: _____

Contact Name: _____ Title: _____

Phone: _____ Cell: _____

Email Address: _____ Fax: _____

License Type: _____ State: _____

License Number: _____ Exp. Date: _____

Scope of Work: _____

Please list on a separate sheet, included as attachment I, all of the above subcontractor information for any additional subcontractors employed on the project.

SOLAR PV SYSTEM INFORMATION

Mounting Description

Mounting Type (roof, pole, ground, other-specify): _____

Mounting System Manufacturer: _____ Product Name and Model #: _____

(Continued)

energize CONNECTICUT℠

CT Standardized Solar PV Permit Application

Building Information (For Roof-Mounted Systems Only)

Building Type (e.g. house, shed, barn, slab): _____

Building Height (in feet):_____

Is the building permitted? ☐ Yes ☐ No ☐ NA

If no, reason: _____

Are there other permits associated with this application? ☐ Yes ☐ No

Describe: _____

Electrical Description

Size (amps) and type (phase, voltage) of electrical service: _____

Amperage of main breaker:_____ Will the value of main breaker change? ☐ Yes ☐ No To:_____

Rated amperage of the bus bar in the main panel:_____

Type of interconnection (e.g. breaker-load side, supply-side interconnect):_____

Electrical panel location: _____

If load side interconnect, will solar intertie into a subpanel? ☐ Yes ☐ No

If yes, rated amperage of the subpanel bus bar? _____ Value of breaker protecting subpanel bus bar? _____

Attachments for application (See Instructions on the next page, followed by Example Attachments)

☐ 1. Additional Subcontractors and Information

☐ 2. One-Line Electrical Drawing

☐ 3. One-Line Site Plan Drawing

☐ 4. Attachment Details (Line Drawing)*

☐ 5. Solar PV Module Specification Sheets From Manufacturer

☐ 6. Inverter Specification Sheets From Manufacturer

☐ 7. Pole or Ground Mount Information (if applicable)*

☐ 8. Structural Review Worksheet (if applicable)

☐ 9. Additional Information for Large Solar PV Systems (as Specified by the Municipality)

***NOTE:** Applicants should submit either Attachment 4 for roof-mounted systems OR Attachment 7 for pole/ground-mounted systems, not both.

Certification

I hereby certify that ☐ I am the owner of record of the named property or; ☐ the proposed work is authorized by the owner of record and/or I have been authorized to make this application as an authorized agent, and we agree to conform to all applicable codes, laws, regulations and ordinances. All information contained within is true and accurate to the best of my knowledge and belief. No work shall start until the Jurisdiction has approved the permit or until the Contractor has received approval from_____.

(Jurisdiction Name)

Signature of Property Owner or Authorized Agent: _____

Typed or Printed Name of Signatory: _____Date:_____

Instructions for ATTACHMENTS to the Connecticut Standardized Solar PV Permit Application

Please Complete the Application Form (pages 1-2) and provide ALL applicable Attachments based on the below instructions and examples for Attachments 2-7. Attachment 8 is a Structural Review Worksheet to be used if applicable, provided as a separate form. Additional information required by a municipality for large solar PV systems can be submitted as a 9th Attachment.

Each Attachment—Subcontractor List, Drawings and Calculations—Must Include:

- Date
- Property Owner
  - Name
  - Address
  - Contact phone number
- Installation Company
  - Name of company and contact person
  - Address
  - Contact phone number
- Drawing number and Revision number or other control method
- Drawing designer

Attachment 1. Additional Subcontractor List
(If Needed, as per Permit Application)

Attachment 2. One-Line Electrical Drawing Must Show:

- Size of electrical service
  - Size of Main Breaker
  - Size of Bus Bar (If Known)
- Type of electrical service
- If interconnection point is a subpanel
  - Size of Subpanel Main Breaker
  - Size of Subpanel Bus Bar (If Known)
- Nominal power of solar system (Watts)
  - DC Capacity: Nameplate "STC" Value of all panels, watts
  - AC Capacity: Total AC capacity of Inverters, watts
- Batteries (If Present): Type, Quantity, Nominal Voltage, Capacity kWh
  - H_2 mitigation methods (If Necessary)

(Attachment 2 continued)

- Interconnection method
  - Size of overcurrent protection
- Number, type and electrical configuration of solar panels
- Number and type of Inverters
- Values for source stickers: NEC 690.53; NEC 690.54 (Encouraged, Not Required)
- Wiring methods
  - Wire Type(s), Size
  - Conduit Type(s), Size
- Solar metering (If Appropriate)
- Electrical current contribution from all PV sources
- Electrical grounding details: Wire Type, Size, GEC

Attachment 3. One-Line Site Plan Drawing Must Show:

- Location of solar panels
- Location of Inverters and major equipment
- Location of roof obstructions (Vents, Chimneys, etc.)
- Location of Main Breaker Panel
- Location of Utility Meter
- Location of AC disconnect
- Location of batteries and/or charge controllers (If Appropriate)
- Location of solar metering (If Appropriate)
- Planned conduit path (Encouraged, Not Required)
- Gross dimensions of structure (If Appropriate)
- Approximate layout of building or other structure (If Appropriate)
- Property lines, zoning, and setback considerations (If Appropriate)
- Trenching details: Location, Depth and Length of Trench (If Appropriate)
- A notation indicating scale —or not to scale (Both are Acceptable)

Instructions for ATTACHMENTS to the Connecticut Standardized Solar PV Permit Application

Attachment 4. Attachment Details for Roof-Mounted Systems (Line Drawing) Must Show:*

- Racking System
  - – Manufacturer of racking structure
  - – Model
  - – Type
- Flashing description
- Fastener detail
  - – Type of fasteners, e.g. Lag Screws, Seam Clamps, Ballast
    - ○ If Lag Screws include:
      (1) Type (e.g. Zinc, Stainless steel)
      (2) Size of Lag
      (3) Depth of Thread Penetration
      (4) Type of Sealant (e.g. caulk)
- Mitigation of Dissimilar Metals
  - – Describe how any dissimilar metals will be isolated

Attachment 5. Solar PV Module Specification Sheets
(provide PDF from manufacturer)

Attachment 6. Inverter Specification Sheets
(provide PDF from manufacturer)

Attachment 7. Pole Mount or Ground Mount Information (if applicable):*

- Racking system
- Mounting specification sheets and details from manufacturer (PDFs)
- Manufacturer's Pre-Engineered Document or PE Stamp
- Code Compliance Manual (If Requested by Municipality)
- One-way distance from the Solar PV system to the interconnection point
- Electrical grounding details
- Height of solar PV system at maximum design tilt
- Applicable zoning information if not shown on site plan (e.g. setback from property line)

Attachment 8. Structural Review Worksheet (if applicable, see separate form)

- **NOTE:** This worksheet can be used by an installer to meet the requirements of a municipal building department if the department specifically authorizes its use for that purpose. It may also be used to supplement a structural review certification letter from a Professional Engineer, or for independent project purposes.

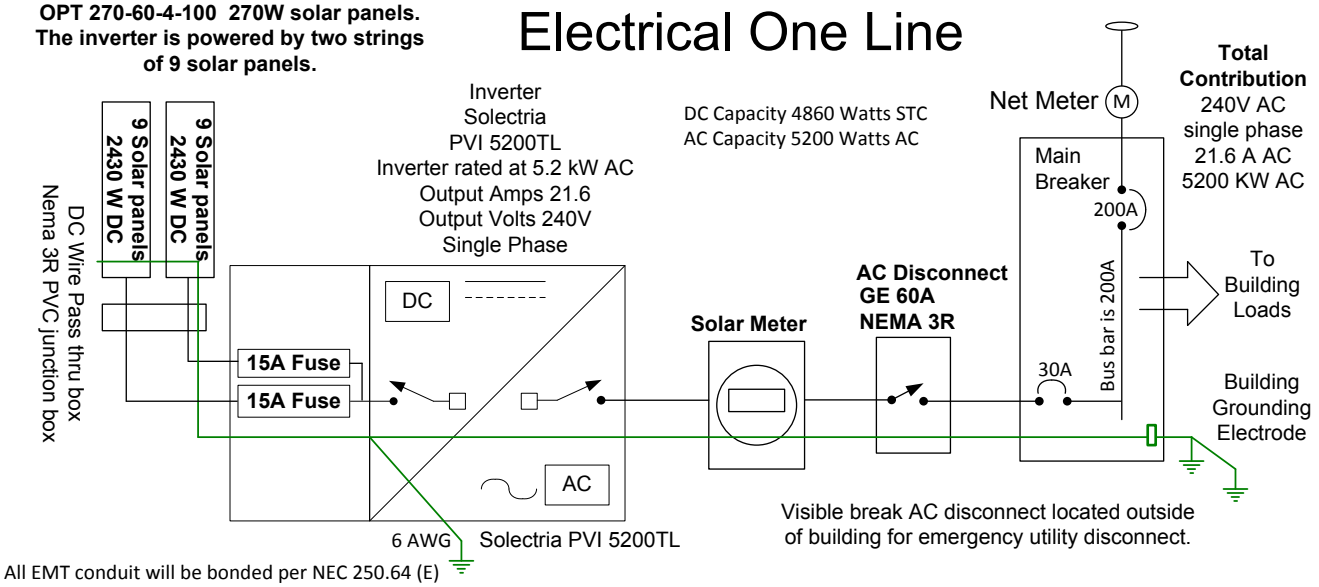
Attachment 9. Additional information required for larger solar PV systems

- This Standardized Solar PV Permit Application can also be used to permit larger systems. If your municipality requires additional information to permit larger systems, specify the information needed as a 9th attachment to the application.

***NOTE:** Applicants should submit either Attachment 4 for roof-mounted systems OR Attachment 7 for pole/ground-mounted systems, not both.

Sample Solar PV Electrical One Line

Design includes a total of 18 Suniva OPT 270-60-4-100 270W solar panels. The inverter is powered by two strings of 9 solar panels.



All EMT conduit will be bonded per NEC 250.64 (E)

Point of Interconnection Sticker 690.54	
AC Operating Volts	**240 V**
Max Operating Current	**21.6 A**

AC Wire Type
THWN-2 6 AWG 90°wire
¾ inch EMT Conduit

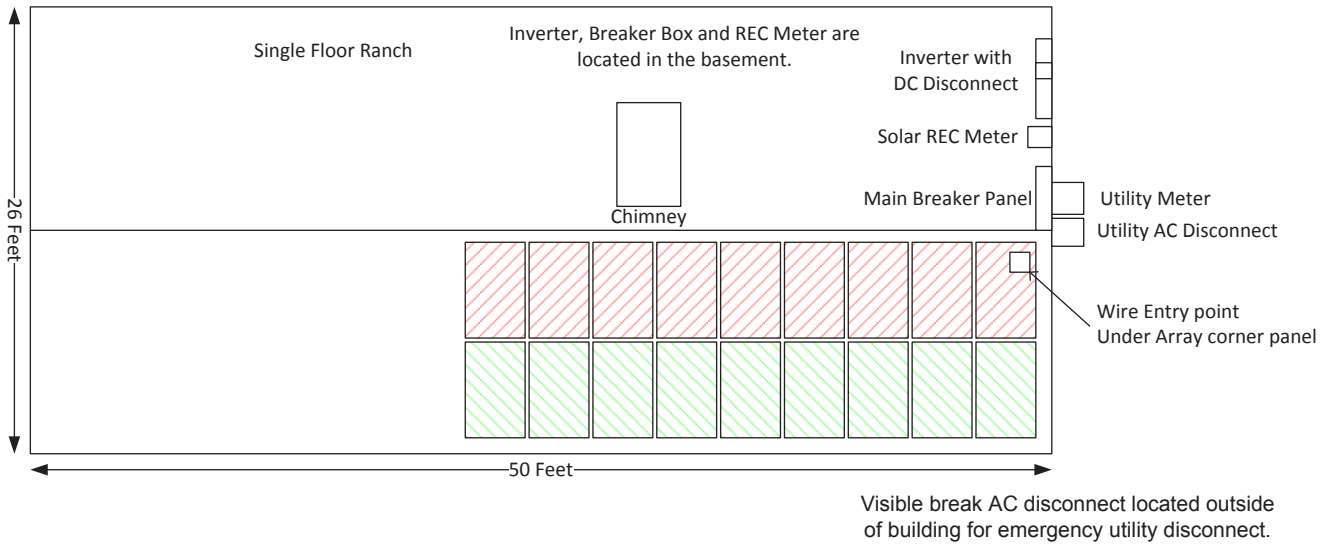
DC Wire Types
PV Wire – 10 AWG 90° C on roof
In conduit THWN-2 10 AWG 90°wire
Rails grounded with bare 8 AWG
Grounding Electrode Conductor 6 AWG bare or green
¾ inch EMT Conduit

Source Sticker NEC 690.53	
Operating Current	**17.4 A**
Operating Voltage	**281 V**
Maximum System Voltage	**412 V**
Short Circuit Current	**28.6 A**

Note: Grounding Electrode Conductor will be 6 AWG bare or green and connect to building grounding electrode.

Installion Company Name	Property Owner Street Address Town, CT
Contact Name **Phone** **860 123-4567**	Drawing Number 101 Revision 1
Installer Address **Town, CT**	Month Day, Year Drawn By Name of Designer

Sample Solar PV
One Line Site Plan



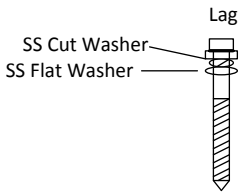
Visible break AC disconnect located outside of building for emergency utility disconnect.

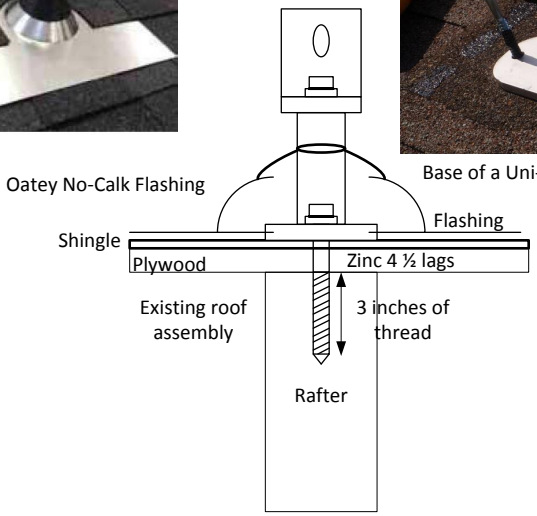
S

Installion Company Name **Contact Name** **Phone** **860 123-4567** **Installer Address** **Town, CT**	Property Owner Street Address Town, CT
	Drawing Number 101 Revision 1
	Month Day, Year Drawn By Name of Designer

Sample Solar PV Attachment Details

Base of a Uni-rac two piece foot





Racking system is Uni-Rac, Solarmount with standard size rail.

Uni-rac supplies the lag screws and SS hardware necessary to ensure dissimilar metal compliance. Nowhere does the aluminum touch steel directly.

Type of sealant

All penetrations are sealed with an appropriate roofing sealant.

OSI RF-140 Black Magic Roofing & Flashing Sealant or equivalent.

An Oatey No-Calk Flashing will be installed to cover the mounting.

Installion Company Name **Contact Name** **Phone** **860 123-4567** **Installer Address** **Town, CT**	Property Owner Street Address Town, CT
	Drawing Number 101 Revision 1
	Month Day, Year Drawn By Name of Designer

SAMPLE SOLAR PV MODULE SPECIFICATION SHEET

ENGINEERING EXCELLENCE

- Built exclusively with **Suniva's premium ARTisun Select cells**, providing one of the highest power outputs per square meter at an affordable price
- **Suniva is a U.S. based company** spun out from the Georgia Tech University Center of Excellence in Photovoltaics; one of only two such research centers in the U.S.
- Suniva's state-of-the art manufacturing and module lab facilities feature the most advanced equipment and technology

QUALITY & RELIABILITY

- Suniva Optimus modules are manufactured and warranted to our specifications assuring consistent high performance and high quality.
- Rigorous in-house quality management tests beyond standard UL and IEC standards
- Produced in an ISO 9001: 2008 certified facility
- Performance longevity with advanced polymer backsheet
- Passed the most stringent salt spray tests based on IEC 61701
- Passed enhanced stress tests[1] based on IEC 61215 conducted at Fraunhofer ISE
- Certified PID free by PV Evolution Labs (PVEL)
- PAN files are independently validated

Suniva

SUNIVA OPTIMUS® SERIES MONOCRYSTALLINE SOLAR MODULES

OPT SERIES: OPT 60 CELL MODULES (SILVER FRAME)

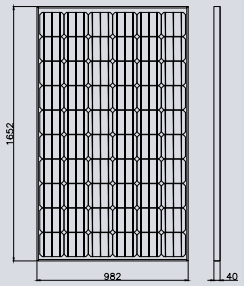
Optimus® modules are known for their superior quality and long-term reliability. These high-powered modules consist of Suniva's premium ARTisun® Select cell technology and are designed and manufactured in the U.S.A. using our pioneering ion implantation technology. Suniva's high power-density Optimus modules provide excellent performance and value.

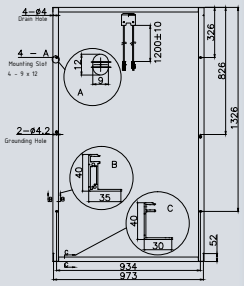
FEATURES

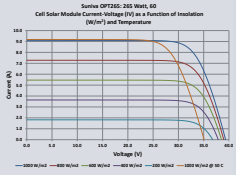
- Contains premium ARTisun Select cell technology - over 19%
- Extensive materials testing and certifications safeguard reliability
- Positive only tolerance ensures predictable output
- Marine grade aluminum frame with hard anodized coating
- Buy America-compliant upon request
- Qualifies for U.S. EXIM financing
- System and design services available
- Industry leading linear warranty: 10 year warranty on workmanship and materials; 25 year linear performance warranty delivering 80% power at STC

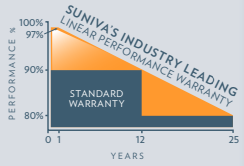
CERTIFICATIONS

AS5033 Compliant









PLEASE RECYCLE

JANUARY 17, 2014 (REV. 19) [SAMD_0010]

OPTIMUS SERIES: OPT 60 CELL MODULES

ELECTRICAL DATA (NOMINAL)

The rated power may only vary by -0/+3% and all other electrical parameters by ± 5%

Model Number	OPT 260-60-4-100	OPT 265-60-4-100	OPT 270-60-4-100
Power Classification (Pmax)	260 W	265 W	270 W
Module Efficiency (%)	16.02%	16.33%	16.60%
Voltage at Max. Power Point (Vmp)	30.20 V	30.70 V	31.20 V
Current at Max. Power Point (Imp)	8.60 A	8.64 A	8.68 A
Open Circuit Voltage (Voc)	38.10 V	38.30 V	38.50 V
Short Circuit Current (Isc)	9.08 A	9.12 A	9.15 A

The electrical data apply to standard test conditions (STC): Irradiance of 1000 W/m² with AM 1.5 spectra at 25°C.

CHARACTERISTIC DATA

Type of Solar Cell	High-efficiency ARTisun Select cells of 156 x 156 mm (6 in.)
Frame	Silver anodized aluminum alloy
Glass	Tempered (low-iron), anti-reflective coating
Junction Box	NEMA IP67 rated; 3 internal bypass diodes
Cable & Connectors	12 AWG (4 mm²) PV Wire cable with multiple connector options available; cable length 1200 mm

MECHANICALS

Cells / Module	60 (6 x 10)
Module Dimensions	1652 x 982 mm (65.04 x 38.66 in.)
Module Thickness (Depth)	40 mm (1.57 in.)
Approximate Weight	17.9 +/- 0.25 kg. (39.5 +/- 0.5 lb.)

TEMPERATURE COEFFICIENTS

Voltage	ß, Voc (%/°C)	-0.335
Current	α, Isc (%/°C)	+0.047
Power	γ, Pmax (%/°C)	-0.420
NOCT Avg	(+/- 2 °C)	46.0

LIMITS

Max. System Voltage	1000 VDC for IEC, 1000 VDC for UL
Max Series Fuse Rating	15 Amps
Operating Module Temperature	-40°C to +85°C (-40°F to +185°F)
Storm Resistance/Static Load	Tested to IEC 61215 for loads of 5400 Pa (113 psf); hail and wind resistant

Suniva® reserves the right to change the data at any time. View manual at suniva.com.
[1]UV 90 kWh, TC 400, DH 2000.

Please read installation manual before installing or working with module.

Product	Modules per pallet	Pallets per Container	Total Modules
OPT - 60 cell (silver and black)	25	28	700

HEADQUARTERS
5765 Peachtree Industrial Blvd.,
Norcross, Georgia 30092 USA
Tel: +1 404 477 2700
www.suniva.com

Suniva® The Brilliance of Solar Made Sensible®

SOLECTRIA RENEWABLES

TRANSFORMERLESS
STRING INVERTERS

PVI **3800TL**
PVI **5200TL**
PVI **6600TL**
PVI **7600TL**

FEATURES

- 600 VDC
- Highest industry peak and CEC efficiencies
- Lightweight, compact design - smallest in the industry
- Quick and easy installation
- Wide operating voltage range
- DC disconnect

OPTIONS

- Web-based monitoring
- Revenue grade monitoring
- DC arc-fault detection and interrupt

TRANSFORMERLESS STRING INVERTERS

Solectria Renewables' PVI 3800TL, 5200TL, 6600TL and 7600TL are compact, transformerless, single-phase inverters with the highest peak and CEC efficiencies in the industry. These inverters come standard with an integrated DC disconnect, optional DC arc-fault detection and interrupt, 1 or 2 MPP tracker(s), and a user-interactive LCD and keypad. Its small and lightweight design make for quick and easy installation and maintenance. These inverters include an enhanced DSP control, comprehensive protection functions, and advanced thermal design enabling highest reliability and uptime. They also come with a standard 10 year warranty with options for 15 and 20 years.

Built for the real world

COMING SOON

SPECIFICATIONS		PVI 3800TL	PVI 5200TL	PVI 6600TL	PVI 7600TL
DC Input					
Absolute Maximum Open Circuit Voltage			600 VDC		
Operating Voltage Range			120-550 VDC		
MPPT Input Voltage Range			200-500 VDC		
MPP Trackers		1	2		
Maximum Operating Input Current		20 A	15 A per MPP tracker	18 A per MPP tracker	20 A per MPP tracker
AC Output					
Nominal Output Voltage			208 or 240 VAC, 1-Ph		
AC Voltage Range			-12%/+10%		
Continuous Output Power	208 VAC	3300 W	5200 W	6600 W	6600 W
	240 VAC	3800 W	5200 W	6600 W	7600 W
Continuous Output Current	208 VAC	15.8 A	25 A	31.7 A	31.7 A
	240 VAC	15.8 A	21.6 A	27.5 A	31.7 A
Maximum Backfeed Current			0 A		
Nominal Output Frequency			60 Hz		
Output Frequency Range			59.3-60.5 Hz		
Power Factor			Unity, > 0.99		
Total Harmonic Distortion (THD)			< 3%		
Efficiency					
Peak Efficiency			98%		
CEC Efficiency			97.5%		
Tare Loss			<1 W		
Temperature					
Ambient Temperature Range (full power)			-13°F to +122°F (-25°C to +50°C)		
Storage Temperature Range			-40°F to +185°F (-40°C to +85°C)		
Relative Humidity (non-condensing)			0-100%		
Data Monitoring					
Optional SolrenView Web-based Monitoring			External		
Optional Revenue Grade Monitoring			External		
External Communication Interface			RS485		
Testing & Certifications					
Safety Listings & Certifications			UL 1741/IEEE 1547, UL1699B, CSA C22.2#107.1, FCC part 15 A&B		
Testing Agency		ETL	CSA		
Warranty					
Standard			10 year		
Optional			15, 20; extended service agreement		
Enclosure					
DC Disconnect			Standard, fully-integrated		
Dimensions (H x W x D)		17.5 x 15.8 x 8.5 in. (445 x 401 x 216 mm)	26.8 x 15.8 x 8.5 in. (680 x 401 x 216 mm)		
Weight		43 lbs (19.5 kg)	65 lbs (29.5 kg)		
Enclosure Rating			Type 4		
Enclosure Finish			Aluminum		

SOLECTRIA RENEWABLES www.solectria.com | inverters@solectria.com | 978.683.9700

USAGE GUIDE FOR STRUCTURAL REVIEW WORKSHEET

This Structural Review Worksheet can be used to evaluate the integrity of a roof's framing for a proposed solar PV system. To use this Worksheet in an official capacity, you will need permission from the municipal building department. The Worksheet identifies structural conditions in a home's roof framing that may raise concerns with the installation of solar PV, including increased dead load and wind uplift.

This worksheet only applies to installations that meet the following basic criteria, as well as the more detailed criteria below and elsewhere in the Worksheet:

- Installation on one or two family home built after 1900
- Installation on home with regular, stick-built framing (not home with trusses)
- Installation on home with asphalt shingle or standing metal seam roof
- Solar PV panels are flush mounted (i.e., installed parallel to the roof)

User Qualifications for the Structural Review Worksheet

Users of this worksheet should have demonstrable knowledge of typical residential roof framing systems. A number of certification programs may be acceptable evidence of qualifications, if approved by the local jurisdiction, for example:

- Registered Design Professional (Professional Engineer or Architect)
- Licensed Home Inspector
- Engineer-in-Training (EIT)
- North American Board of Certified Energy Practitioners (NABCEP) PV Installation Professional certification
- Other approved certifications that require training in structural inspection of residential framing systems.

Visibility Requirements

Worksheet users must be able to view the roof framing to evaluate its strength. Enough of the framing must be exposed to be able to determine at a minimum:

- Rafter size and spacing
- Ridge board versus ridge beam
- Configuration of rafter cross-ties (e.g. attic floor, collar ties), including size and spacing
- Existence of framing irregularities (e.g. skylights, dormers) in the vicinity of the proposed PV panels
- Type of roof sheathing (e.g. plywood, oriented strand board (OSB), straight board sheathing)

If the framing is concealed by finishes, such as in spaces with cathedral ceilings, a Registered Design Professional should investigate the framing and review the proposed installation. Openings may be required in the finishes to observe the framing and document the construction details listed above.

Anchorage to Structure

Use of this worksheet is contingent upon fastening the PV system directly to the rafters. If the installer wishes to attach to the sheathing between the rafters, a registered design professional should evaluate the proposed design and confirm the available sheathing capacity. If the sheathing alone is not adequate to resist downward gravity and wind uplift forces, the addition of blocking between the rafters at the attachment locations may be a possible solution.

Structural Information

(To be used as a standalone supplemental form or in conjunction with the Structural Evaluation portion of this Worksheet on the following pages, 3-4)

Please fill in the following Roof Description Information

ROOF DESCRIPTION:

Wind Exposure Category (B / C / D):[1] _____

Roofing Type (e.g. asphalt shingle, slate, clay tile, cedar shake, metal seam, single-ply membrane, built-up): _____

_____

Age of roof:_____Number of Layers: _____

Roof Type (e.g. gable, hipped, flat):_____

Framing Type (e.g. stick-built, trusses): _____

If trusses, list manufacturer, if known:_____

Rafter Material (wood, steel, etc.; if wood, specify rafter species[2]): _____

Rafter Size (e.g. 2x6): _____Rafter Spacing (e.g. 16"): _____

Maximum unsupported rafter span: _____ Feet _____ Inches

Ceiling joist or rafter tie size and spacing (e.g. 2x6@16"):_____

Ceiling joist or rafter tie orientation (relative to rafters): ☐ parallel ☐ perpendicular

Height of ceiling joist or rafter tie measured vertically above top of rafter support walls (enter "0" if ceiling joists are located at the top of the support walls): _____

Height of roof ridge measured vertically above top of rafter support walls:_____

Ridge type (beam or board): _____

Framing Irregularities in vicinity of proposed panel installation (e.g. modifications, skylights, dormers that interrupt rafter spans): _____

Heavy equipment or unusual loads suspended from rafters in the vicinity of proposed panel installation:_____

_____

Other information/Comments: _____

_____

[1] http://publicecodes.cyberregs.com/icod/irc/2009/icod_irc_2009_3_par010.htm

[2] Obtain species from grade stamps on the rafters. If no grade stamps, assume Spruce-Pine-Fir #2.

Please perform the following Roof Load Calculations

ROOF LOAD CALCULATIONS:

a. Total weight of PV modules, rails, mountings, hardware and wiring	_____	Lbs
b. Total number of attachments (mountings)	_____	Mountings
c. Weight per attachment point (mounting) a÷b	_____	**Lbs/Attachment**
d. Maximum spacing between adjacent attachment (mounting) points	_____	Feet-Inches
e. Total surface area of PV modules (square feet)	_____	Ft^2
f. Distributed weight of PV modules a÷e	_____	**Lbs/ft^2**

Structural Evaluation

Please answer the questions in the Maximum Rafter Span Table Qualifier

MAXIMUM RAFTER SPAN TABLE QUALIFIER:

1. Was the house built after 1900?	☐ Yes	☐ No
2. Does the roof have only one layer of asphalt roofing shingles or standing metal seam?	☐ Yes	☐ No
3. Does the roof have a slope of 4:12 or greater?	☐ Yes	☐ No
4. Is roof framing stick-built wood framing?	☐ Yes	☐ No
5. Are rafters continuously tied with ceiling framing from one supporting wall to the other at the eave level, noting that the ceiling framing must match the rafter spacing and direction?	☐ Yes	☐ No
6. Is the framing in the vicinity of the solar array free of irregularities (see Roof Description for examples)?	☐ Yes	☐ No
7. Is the framing in the vicinity of the solar array free of heavy equipment or unusual loads?	☐ Yes	☐ No
8. Is the roof framing free of visible indications of distress (e.g. ridge sagging, walls out of plumb, significant ceiling cracks, split rafters)?	☐ Yes	☐ No
9. Is the roof framing free of signs or knowledge of previous damage (e.g. water incursion, fire damage, impact from an object, termite damage, etc.)?	☐ Yes	☐ No
10. Is the new PV system flush mounted, with a maximum angle of 5 degrees relative to the roof line and a maximum gap of 6" between the roof surface and the solar panels?	☐ Yes	☐ No
11. Is the maximum weight of PV modules less than or equal to 4 lbs/ft^2 (see "Roof Load Calculations" p. 2)?	☐ Yes	☐ No
12. Is the "weight per attachment point" less than 45 lbs (see "Roof Load Calculations" p. 2)?	☐ Yes	☐ No

If all answers are "Yes," proceed to Rafter Span Verification. If any answer is "No," enter "NA" for your answer to Question 13 on the next page and employ a Registered Design Professional to evaluate the roof structure.

Structural Evaluation

RAFTER SPAN VERIFICATION

Refer to the Rafter Span Table below to determine whether the "Maximum Unsupported Span" (provided in the "Roof Description" on page 2) is less than the maximum allowed rafter span. *(Consider wood species, rafter size, and rafter spacing in your assessment)*

MAXIMUM RAFTER SPANS

Ground snow load = 30 psf

Maximum Dead Load Including PV Panels = 14 psf

Ceiling not attached to rafters (deflection ≤ L/180)

		Rafter Size				
		2x4	2x6	2x8	2x10	2x12
Rafter Spacing	Species and Grade	Maximum Rafter Spans (ft-in)				
12"	Spruce-Pine-Fir #2	8'-4"	12'-4"	15'-8"	19'-1"	22'-2"
	Douglas Fir-Larch #2	8'-10"	12'-11"	16'-5"	20'-0"	23'-3"
	Hem-Fir #2	8'-10"	12'-11"	16'-5"	20'-0"	23'-3"
16"	Spruce-Pine-Fir #2	7'-4"	10'-8"	13'-7"	16'-7"	19'-2"
	Douglas Fir-Larch #2	7'-8"	11'-2"	14'-2"	17'-4"	20'-1"
	Hem-Fir #2	7'-8"	11'-2"	14'-2"	17'-4"	20'-1"
19.2"	Spruce-Pine-Fir #2	6'-8"	9'-9"	12'-4"	15'-1"	17'-6"
	Douglas Fir-Larch #2	7'-0"	10'-3"	12'-11"	15'-10"	18'-4"
	Hem-Fir #2	7'-0"	10'-3"	12'-11"	15'-10"	18'-4"
24"	Spruce-Pine-Fir #2	6'-0"	8'-9"	11'-1"	13'-6"	15'-8"
	Douglas Fir-Larch #2	6'-3"	9'-2"	11'-7"	14'-2"	16'-5"
	Hem-Fir #2	6'-3"	9'-2"	11'-7"	14'-2"	16'-5"

13. According to the Rafter Span Table, is the observed "Maximum Unsupported Span" less than the "Maximum Rafter Span" listed in the table? ☐ Yes ☐ No ☐ NA

STRUCTURAL REVIEW WORKSHEET CONCLUSION:

If your answer to Question 13 is "*Yes*," you do not need to employ a Registered Design Professional to evaluate the roof structure unless required to do so by the local jurisdiction.

Disclaimer:
This worksheet should not be used to replace a Jurisdiction's requirement that a registered design professional perform a structural analysis for a roof-mounted solar PV installation, unless a municipal building department specifically authorizes its use for that purpose.

ONLINE PERMITTING

An online permitting system can save your municipality, as well as contractors resources, time and money. There are many options to choose from for online permitting and there is a wide range in the functionality offered. Ideally, online permitting software should be able to do most or all of the following:

- Handle rooftop solar PV permitting as well as other types of permitting.
- Provide download options for needed forms such as the **Connecticut Standardized Solar PV Permit Application Package.**
- Include an upload option for completed permit applications.
- Offer an interactive workflow for inspections, notifications and next steps.
- Display approval-status information.
- Provide downloadable approval documents.
- Help your municipality store and track permit application information and documents.
- Be user friendly, with clear instructions on how to use the system.
- Ideally, allow for online payments to jurisdictions when a permit fee is required.

Online permitting systems can bring efficiency to permitting processes across jurisdictions. Clearer, easier processes allow installers and municipalities to handle higher volumes of permit requests, and allow for more residents and businesses to benefit from clean energy. More generally, online permitting can allow a municipality to increase business and help its community prosper.

The following examples of online permitting systems are in place or are being developed for use in Connecticut and across the country:

Connecticut's Rooftop Solar Challenge Partner:

Simply Civic is a U.S. Department of Energy SunShot Incubator Program Round 6 and Round 8 awardee. The company has developed a software solution designed to reduce solar PV soft costs arising from administrative processes at the municipal level.

Simply Civic provides jurisdictions with a simple, fast and affordable online permitting solution for solar PV (and other types of permitting). The online platform allows permit applicants and building department staff to seamlessly collaborate during the permit application, review and approval processes. Benefits to municipal staff and installers include reduction or elimination of phone calls, emails and the travelling expenses incurred when in-person visits are required to submit, review, and sometimes resubmit paperwork. Additionally, Simply Civic stores and tracks permit applications, easing staff workloads. New features continue to be developed and implemented to enhance the functionality of the platform.

Simply Civic, a Rooftop Solar Challenge partner, has developed an online permitting software system available to CT municipalities to pilot for free through 2014

Simply Civic is contributing to the CT Rooftop Solar Challenge goal of making online permitting an option for any of Connecticut's 169 municipalities, including those with limited resources. Connecticut is encouraging municipalities to consider adoption of the system by first piloting the system free of charge through the end of calendar year 2014. To learn more about Simply Civic or if you are ready to "test drive" online permitting, contact the Connecticut Rooftop Solar Challenge team at sunshot@ctcleanenergy.com or info@simplycivic.com. You can also view Simply Civic's website, http://simplycivic.com.

Permitting systems currently in use by Connecticut municipalities:

ViewPermit 3.0
GIS-centric. Online and desktop.
Innovative Permit and Licensing management.

ViewPermit serves as the online permitting platform for a number of Connecticut jurisdictions.[26] The Capitol Region Council of Governments (CRCOG) acquired state support for a group of Connecticut towns to work with the company ViewPoint and help develop the ViewPermit system to meet each town's specific needs. Other Connecticut towns have since purchased the ViewPermit platform.

ViewPoint provides an enterprise-level, customized permitting solution called ViewPermit. As explained on its website:

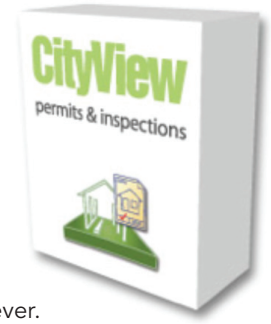
Incorporated in 1995, ViewPoint is a highly trained group of professionals with extensive experience solving the complex problems facing communities and government agencies today. We utilize Geographic Information Systems (GIS), enterprise databases, graphic design, and state of-the-art computer hardware and software to provide practical, cost-effective solutions for daily operations, as well as the most challenging projects.

ViewPoint offers the following process solutions to local governments:

- Cost-effective, time-saving solutions
- Reliable, easy-to-use software
- Creative problem solving
- Responsive approach to clients
- Prompt, comprehensive support
- Thorough on-site training

A few Connecticut towns use CityView's online permitting system. MSGovern web designers provide an informative website with a free demo. They describe CityView's key points this way:

The Power of CityView Permits & Inspections:

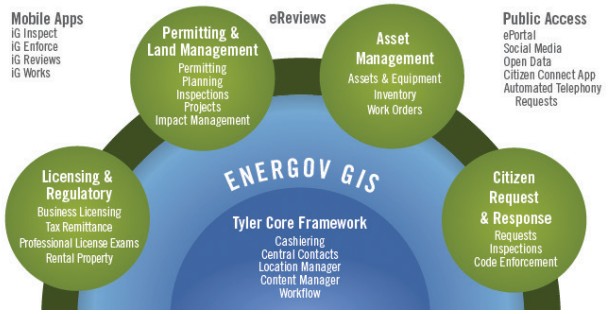


- Improve customer service with real-time status reports that can be accessed by staff or online by applicants via the CityView Portal.
- Automatically assign and schedule inspections and abolish time-consuming manual scheduling forever.
- Manage and track your permits in a central location. Everything you need to know about a permit from owner and contractor information to related sub permits, utility releases to expiration dates, is instantly available and readily accessible by all departments.
- Streamline your business processes with your tailored workflows that allow you to define deadlines and automatically create next steps like plan checks and inspections ensuring that all components of a permit application are completed in the correct order and the complete status information is available at any point in time.
- Eliminate inaccurate fee collection with an integrated fees module that allows you to configure, calculate and collect fees using even the most complex fee structure.
- Easily manage drawdown of deposits, bonds and escrows and receive notifications when specified limits are reached.
- Make informed decisions with intuitive reports that allow you to quickly and easily assess the status of all permits and inspections, their related fees and the length of time they have existed in the system.

If your jurisdiction already uses an online permitting system, consider adopting the CT Standardized Solar PV Permit Application for use through your online portal

[26] Towns using ViewPermit are listed on the permitting portal's homepage https://www.viewmypermitct.org/TownSelection.aspx

EnerGov is a planning, permitting and licensing software platform developed by Tyler Technologies.



Energov uses GIS technology to facilitate municipal processes. The company describes the benefits of its software as follows:

From planning, permitting and licensing to asset management and citizen requests, our industry-leading EnerGov platform uses GIS to automate and centrally connect critical processes, streamline workflow, improve communication and increase productivity from desk to field.

EnerGov is specifically designed to automate and centrally connect critical processes, including land use planning and project review, regulatory management, inspections, code enforcement, citizen requests, asset management, work order management and more.

EnerGov empowers public sector jurisdictions across the country by:

- Harnessing the power of GIS
- Integrating departments and agencies
- Actively engaging citizens
- Improving operations desk to field
- Creating efficient workflow
- Creating powerful reports

Other Permitting software systems in use nationwide:

Listed in "Tucson's Rooftop Solar Challenge, Best Practices to Develop Solar Energy Study," and used in many cities across the country, CRW Systems Trakit offers another choice for an online permitting system. CRW describes their products and services as Community Development Software & Service Solutions including code enforcement, permitting, planning, and expert services.

MIXNET's efilePX is a cloud-based permit manager software system with no upfront hardware or software costs. The system is transaction based which means municipal payments are based on the number of permits the system processes.

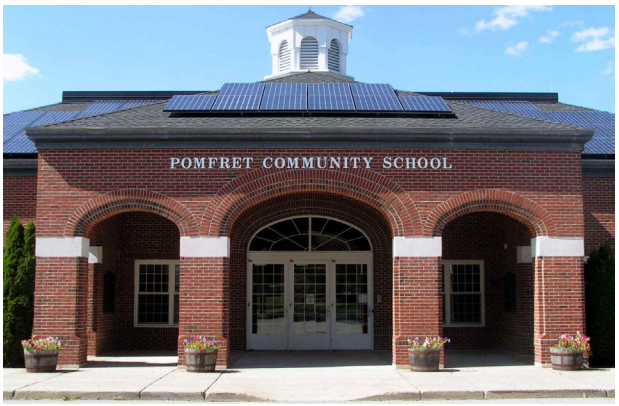
Mygov offers modular software programs that handle a variety of municipal processes including permitting. Mygov's permitting module facilitates permit administration from initial submission to final inspection.

TRAINING STAFF IN ROOFTOP SOLAR PV SPECIFICS

It can be helpful for jurisdiction staff involved in solar PV permit review and inspection to participate in relevant solar PV training. Trained personnel know what to look for, and can help alleviate frustration and excessive work for municipalities, installers and property owners.

The following list provides examples of resources available to building inspectors wanting to better understand solar PV:

- CEFIA-hosted training specifically for inspectors—check our website, www.energizect.com/sunrisene, for updates.
- "Photovoltaic Online Training for Code Officials" developed by IREC and conceived in partnership with DOE, offered on the National Training & Education Resource (NTER) website. Inspectors can apply for Continuing Education credits after completing this program.
- Solar Energy International offers workshops on solar PV as well as a variety of textbooks in eBook format and print editions.
- Sandia National Laboratories has put together "photovoltaic guide post," multimedia tutorials for code inspectors.
- "Understanding National Electrical Code (NEC) Requirements for Solar Photovoltaic Systems, Based on the 2011 NEC," Mike Holt, available at Mike Holt Solar PV Products.
- Brooks Solar offers training and workshops. Visit their site to download their "recommended reading," and "training materials" including "Expedited permit Process," and "A Guide to PV System Design and Installation."
- Solar America Board for Codes and Standards (Solar ABC's) "Expedited Permit Process for PV Systems. A Standardized Process for the Review of Small-Scale PV Systems," prepared by Bill Brooks, P.E., Brooks Engineering.



"POMFRET COMMUNITY SCHOOL"[27]

- "NABCEP Photovoltaic (PV) Installation Professional Resource Guide," version 6, authored by William Brooks and James Dunlop, published 2013 by the North American Board of Certified Energy Practitioners (NABCEP), is available as a PDF download free of charge on the NABCEP website.
- IREC's Solar Instructor Training Network

In addition to these resources, CEFIA will be hosting training opportunities for municipal building officials. For more information on these trainings please check the project website, or contact: sunshot@ctcleanenergy.com for the latest updates.

CEFIA will be hosting training opportunities for municipal building officials!

Check our website for updates: wwww.energizect.com/sunrisene

[27] http://www.pomfret.ctschool.net/

ADDITIONAL RESOURCES FOR MUNICIPALITIES

The following list provides additional resources for municipalities who want to improve their permitting processes or learn more about solar energy:

- IREC's May 2012 report "Sharing Success. Emerging Approaches to Efficient Rooftop Solar Permitting," is a summary of best permitting practices across the country.
- IREC's Permitting home page
- The U.S. Department of Energy developed an updated version of their comprehensive resource: "Solar Powering Your Community: A Guide For Local Governments."
- ICLEI, Local Governments for Sustainability USA, has posted the slides and recordings from presentations from their 2012-2013 webinar series, "Reducing Barriers to Solar for Local Governments." A few examples are:
  - Commercial PACE: Program Development and Implementation
  - Solar Powering Your Community
  - Addressing Solar Myths and Misconceptions
  - Improving the Efficiency of the Rooftop Solar Permitting Process
  - Firefighter Safety and Photovoltaic (PV) Systems

"ROOFTOP SOLAR PV INSTALLATION," MIDDLETOWN, CT, INSTALLED BY RGS ENERGY

- Resources for Firefighter Safety – As solar PV deployment increases, firefighters will be more likely to encounter a home or business with a solar PV system installed. Training and notification that a PV system is located at a home are two great ways to reduce risk to firefighters. More information about firefighter safety and solar PV is available at the following website.
  - Solar Energy Industries Association (SEIA), "Fire Safety and Solar," http://www.seia.org/policy/health-safety/fire-safety-solar

OPTIMIZING PERMIT APPLICATION, REVIEW AND INSPECTION PROCESSES

Municipal permitting staff and inspectors make sure standards and codes are met to protect people, property, homes and businesses. Nevertheless, municipal staff could consider ways to make rooftop solar PV permit application, review and inspection processes easier without compromising safety.

The following measures and strategies are suggestions for adding efficiency to permit application, review and system inspection processes for rooftop solar PV:

- It is helpful to make requirements and processes as transparent and clear as possible. When installers and property owners know what to expect, they are more likely to get it right the first time.
  - You could post a summary of your rooftop solar PV permitting process on your clean-energy permitting webpage.
    - If you don't have a clean energy webpage for your permitting department, there are many tools available to help with creation of a simple web presence, and you could link it to your jurisdiction's homepage.
    - Another great option is to provide information about your permitting requirements through an online permitting system, for example as a downloadable, informational document. You could provide a link to your online permitting system from your jurisdiction homepage and/or permitting webpage.
  - You could publicize your permit application and inspection requirements and procedures online:
    - Clearly explaining how to apply and what information is required would be very helpful to installers. You could also choose to use the Connecticut Standardized Solar PV Permit Application, which takes the guesswork out of the application process for both municipal staff and installers.

"ROOFTOP SOLAR PV INSTALLATION" MANCHESTER, CT
PHOTO COURTESY OF RGS ENERGY

    - You could let installers know what inspection(s) may be required and clarify the inspection procedure. You could also provide a reference document such as the Solar PV Code Compliance Reference provided in this Guide, which helps installers understand what codes are applicable.
- Try to simplify processes and steps wherever possible.
  - Having one department responsible for permitting rooftop solar PV can make the process easier for everyone. Asking an installer to visit or obtain signatures from multiple departments can cause confusion, cost extra time and money, and can discourage installers from doing business in your jurisdiction. A single responsible department can also simplify the process for your municipality and reduce overall workload for staff.
  - Consider ways your municipality could organize and combine necessary inspections. Most rooftop solar PV systems can be evaluated with a single comprehensive inspection. Multiple inspections and scheduling appointments with large windows-of-time can be difficult for installers and property owners seeking to install solar PV. If scheduling specific appointment times is not feasible for your town, you could consider narrowing the window of time your town specifies for inspections.

- Consider developing criteria and a methodology for determining when professional engineering reviews are not necessary, without compromising safety.
  - You could consider using the Structural Review Worksheet provided on page 30 of this Guide, to create a standard process for evaluating structures with regular roof framing.
  - New construction can be designed and built to be solar-ready, and this may become more prevalent as new laws and building codes are adopted. Example characteristics of solar-ready, new construction are:
    - The roof is capable of carrying the load of solar PV equipment up to a specified amount such as five (5) pounds (lbs) per square foot, as well as be designed to withstand local wind and snow loads.
    - The roof is free from obstructions such as plumbing vents.
    - Building plans include a chase, or a means to connect the solar PV system to the building's electrical system.
    - There is space around the electrical panel for inverter and disconnect boxes.
    - NREL has published a useful report on this topic called "Solar Ready Buildings Planning Guide."
- Providing resources to municipal staff conducting review and inspection can make it easier for officials to know what the building code specifically requires for solar PV.
  - Building inspectors, along with other staff could access the latest resources and documentation about how to inspect solar PV systems efficiently and effectively. The following resources pertain specifically to inspections:
    - "Photovoltaic Online Training for Code Officials" developed by IREC and conceived in partnership with DOE, offered on the National Training & Education Resource (NTER) website.
    - "Field Inspection Guidelines for PV Systems" from IREC, or Brooks Solar.
    - John Wiles' Installer/Inspector Checklist, which outlines the general requirements found in the 2005, 2008, 2011 National Electrical Codes (NEC) — Article 690 for Photovoltaic (PV) Power System Installations, published 6/30/2011. (The checklist is listed on the left side of NMSU's Codes & Standards webpage).

Top Inspection Considerations

- Supply Side Interconnection
- Grounding
- Wire Management
- Load Side Interconnection
- Safety Labeling
- Homeowner Information Packet

  - The Solar PV Code Compliance Reference, provided on page 42, is a version of John Wiles' Installer/Inspector Checklist. This document can be used as a reference by installers, municipal staff and inspectors to better understand the applicable code requirements. Users should note the following about the Reference:
    - The Reference provides a very comprehensive list of aspects of a solar PV installation that could be reviewed, clarifying what the codes do and do not require. In practice, inspectors or reviewers can use their discretion to focus on key areas for which issues are more likely to occur or which issues have the highest consequences (see the call out box, "Top Inspection Considerations").

Note: Connecticut adopted the 2011 NEC in February 2014. This Reference provides code requirements for the 2005, 2008 and 2011 NEC so that reviewers can keep track of updates to the code, but reviewers should follow the requirements of the 2011 NEC.

- The Reference is an outline of the general requirements found in the *2005, 2008, 2011 National Electrical Codes (NEC)* — Article 690 for Photovoltaic (PV) Power Systems installations. The Reference is only a guide and applies to components used or installed in a PV system (aside from those inside a listed, factory-assembled component).
- The local authority having jurisdiction (AHJ) or inspector or reviewer has the final say on what is or is not acceptable, within the context of the Connecticut state building codes. This list should be used in conjunction with Article 690 and other applicable articles of the NEC and includes inspection requirements for both stand-alone PV systems (with and without batteries) and utility-interactive PV systems. Where Article 690 differs from other articles of the NEC, Article 690 takes precedence.
- References in brackets [ ] are to the 2005 and 2008 NEC and other relevant documents. Changes related to 2008 NEC requirements are noted in {brackets}. 2011 differences are in (parenthesis).

2011/2008/2005 NATIONAL ELECTRICAL CODE SOLAR PV CODE COMPLIANCE REFERENCE

This Reference provides a very comprehensive list of aspects of a solar PV installation that could be reviewed, clarifying what the codes do and do not require. In practice, inspectors or reviewers can use their discretion to focus on key areas for which issues are more likely to occur or which issues have the highest consequences. **Users should note the following:**

1. This Reference is an outline of the general requirements found in the 2005, 2008, 2011 National Electrical Codes (NEC) — Article 690 for Photovoltaic (PV) Power Systems installations. This Reference is only a guide and applies to components used or installed in a PV system (aside from those inside a listed, factory-assembled component). ***As of February 2014, Connecticut abides by the 2011 NEC; other years are provided as reference.***
2. The local authority having jurisdiction (AHJ) or inspector or reviewer has the final say on what is or is not acceptable, within the context of the Connecticut state building codes. This list should be used in conjunction with Article 690 and other applicable articles of the NEC and includes inspection requirements for both stand-alone PV systems (with and without batteries) and utility-interactive PV systems. Where Article 690 differs from other articles of the NEC, Article 690 takes precedence.
3. References in brackets [ ] are to the 2005 and 2008 NEC and other relevant documents. Changes related to 2008 NEC requirements are noted in {brackets}. 2011 differences are in (parenthesis).
4. Access to the 2011 NEC is provided online, for free, by the National Fire Protection Association (NFPA): http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=70

This reference was created by John Wiles, modified only slightly. To access the original reference along with other information about solar PV codes and standards, see the Southwest Technology Development Institute, New Mexico State University, Codes & Standards website: http://www.nmsu.edu/~tdi/Photovoltaics/Codes-Stds/C-S-Resources.html.

1. PV ARRAYS

- PV modules listed to UL Standard 1703 [110.3] {690.4(D)}

a. Mechanical Attachment

- Modules attached to the mounting structure according to the manufacturer's instructions [110.3(B)]
- Roof penetrations secure and weather tight

b. Grounding

- Each module grounded using the appropriate hardware, the grounding point identified on the module and the manufacturer's instructions.
  - **Note:** Bolting the module to a "grounded" structure usually will not meet NEC requirements [110.3(B)]. Array PV mounting racks are usually not identified as equipment-grounding conductors (Note 690.43(C) and (D) in 2011 have additional provisions and allowances for grounding with mounting structure).
- Properly sized equipment-grounding conductors routed with the circuit conductors [690.45] Note differences between 2005, 2008 and 2011 NEC.

c. Conductors

- Conductor type- If exposed: USE-2, UF (usually inadequate at 60°C), or SE, 90°C, wet-rated and sunlight resistant. [690.30(B)] {2008 NEC restricts exposed single-conductor wiring to USE-2 and listed PV/Photovoltaic wire/cable} – If in conduit: RHW-2, THWN-2, or XHHW-2 90°C, wet-rated conductors are required [310.15]
- Conductor insulation rated at 90°C [UL – 1703] to allow for operation at 70°C+ near modules and in conduit exposed to sunlight (add 17-20°C to ambient temperature – 2005 NEC) {see Table 310.15(B)(2) in the 2008 NEC}

- Temperature-derated ampacity calculations based on 156% of short-circuit current (Isc), and the derated ampacity greater than 156% Isc rating of overcurrent device [690.8,9].
  - **Note:** Suggest temperature derating factors of 65°C in installations where the backs of the module receive cooling air (6" or more from surface) and 75°C where no cooling air can get to the backs of the modules. Ambient temperatures in excess of 40°C may require different derating factors.

    (2011 NEC 690.8 substantially updates ampacity calculations to parallel calculations in other sections of the NEC)
- Portable power cords allowed only for tracker connections [690.31 (C), 400.3,7,8]
- Strain reliefs/cable clamps or conduit used on all cables and cords [300.4,400.10]
- Listed for the application and the environment? Fine stranded, flexible conductor cables properly terminated with terminals listed for such conductors (690.31(E))
- Cables and flexible conduits installed and properly marked (690.31(E))
- Exposed conductors in readily accessible areas in a raceway if over 30 volts {690.31(A)}
  - **Note:** Raceways cannot be installed on modules. Make conductors not readily accessible.

2. OVERCURRENT PROTECTION

- Overcurrent devices in the dc circuits listed for dc operation – if device not marked dc, verify dc listing with manufacturer. Auto, marine and telecom devices are not acceptable.
- Rated at 1.25 x 1.25 = 1.56 times short-circuit current from modules [UL – 17093, 690.8, module instructions]
  - **Note:** Both 125% factors are now in the NEC, *but a duplicate 125% remains in the module instructions and should be removed in 2011*. Supplementary listed devices are allowed in PV source circuits only, but branch-circuit rated devices preferred [690.9(C)].
- Each module or series string of modules have an overcurrent device protecting the module [UL-1703/NEC 110.3(B)]
  - **Note:** Frequently, installers ignore this requirement marked on the back of the modules. Listed combiner PV combiner boxes meeting this requirement are available. One or two strings of modules do not require overcurrent devices, but three strings or more in parallel will usually require an overcurrent device. The module maximum series fuse must be at least 1.56 Isc.
- Located in a position in the circuit to protect the module conductors from backfed currents from parallel module circuits or from the charge controller or battery [690-9(A) FPN]
- Smallest conductor used to wire modules protected – sources of overcurrent are parallel-connected modules, batteries, and ac backfeed through inverters [690-9(A)]
- User-accessible fuses in "touch-safe" holders or capable of being changed without touching live contacts [690.16] Strengthened for 2011 to include distance between overcurrent device and disconnect.
- Fuses must be able to be de-energized for service per NEC 690.16(B)

3. ELECTRICAL CONNECTIONS

- Pressure terminals tightened to the recommended torque specification
- Crimp-on terminals listed and installed with listed crimping tools by the same manufacturer [110.3(B)]
- Twist-on wire connectors listed for the environment (e.g. dry, damp, wet or direct burial) and installed per the manufacturer's instructions
- Pressure lugs or other terminals listed for the environment (e.g. inside, outside, wet, direct burial)
- Power distribution blocks listed and not just UL recognized
- Terminals containing more than one conductor listed for multiple conductors
- Connectors or terminals using flexible, fine-stranded conductors listed for use with such conductors? {690.31(F), 690.74}
- Locking (tool-required) on readily accessible PV conductors operating over 30 volts {690.33 (C)}

4. CHARGE CONTROLLERS

- Charge controller listed to UL Standard 1741 [110.3] {690.4(D)}
- Exposed energized terminals not readily accessible
- Diversion controller has an independent backup control method [690.72(B)(1)]

5. DISCONNECTS

- Disconnects listed for dc operation in dc circuits. Automotive, marine and telecom devices are not acceptable
- PV disconnect readily accessible and located at first point of penetration of PV conductors
- PV conductors outside structure until reaching first readily accessible disconnect unless in a metallic raceway [690.14, 690.31(F)]
- Disconnects for all current-carrying conductors of PV source [690.13]
- Disconnects for equipment [690.17]
- Grounded conductors not fused or switched – Bolted disconnects OK.
  - **Note:** Listed PV Centers by Xamtrex, Outback, and others for 12, 24 and 48-volt systems contain charge controllers, disconnects and overcurrent penetration for entire dc system with possible exception of source circuit or module protective fuses.

6. INVERTERS (Stand-alone systems)

- Inverter listed to UL Standard 1741 [110.3] {690.4(D)}
  - **Note:** Inverters listed to telecommunications or other standards do not meet NEC requirements
- DC input currents calculated for cable and fuse requirements. Input current = rated ac output in watts divided by lowest battery voltage divided by inverter efficiency at that power level [690.8(B)(4)]
- Cables to batteries sized 125% of calculated inverter input currents [690.8(A)]
- Overcurrent/Disconnects mounted near batteries and external to PV load centers if cables are longer than 4-5 feet to batteries or inverter
- High interrupt, listed, dc-rated fuses or circuit breakers used in batter circuits. AIR/AIC at least 20,000 amps [690.71(C), 110.9]
- No multiwire branch circuits where single 120-volt inverters connected to 120/240-volt load centers [100-Branch Circuit, Multiwire], [690.10(C)]

7. BATTERIES

- None are listed
- Building-wire type cables used [Chapter 3]
  - **Note:** Welding, cables, marine, locomotive (DLO) and auto battery cables don't meet NEC. Flexible, listed RHW or THW cables are available. Article 400 flexible cables larger than 2/0 AWG are OK for batter cell connections, but not in conduit or through walls. [690.74, 400.8] Flexible, fine stranded cables require very limited specially listed terminals. See stand-alone inverters for ampacity calculations.
- Access limited [690.71 (B)]
- Installed in well-vented areas (garages, basements, outbuildings, and not living areas)
  - **Note:** Manifolds, power venting and single exterior vents to the outside are not required and should be avoided.
- Cables to inverters, dc load centers and/or charge controllers in conduit
- Conduit enters the battery enclosure below the tops of the batteries [300.4]
  - **Note:** There are no listed battery boxes. Lockable heavy-duty plastic polyethylene tool boxes are usually acceptable.

8. INVERTERS (Utility-interactive Systems)

- Inverter listed to UL Standard 1741 and identified for use in interactive photovoltaic power systems [690.4(D), 690.60]
  - **Note:** Inverters listed to telecommunications and other standards do not meet NEC requirements
- Back up charge controller to regulate the batteries when the grid fails [690.72(B)(1)]
- Connected to dedicated branch circuit with back-fed overcurrent protection [690.64]
- Listed dc and ac disconnects and overcurrent protection [690.15, 17]
- Total rating of overcurrent devices supplying power to ac load center (main breaker plus backfed PV breaker) less than load-center rating (120% of rating in residences) [690.64(B)(2)] The 2008 NEC allows the 120% breaker total on commercial installations if the PV breaker is at the opposite end of the busbar from the main utility breaker

9. GROUNDING

- Only one bonding conductor (grounded conductor to ground) for dc circuits and one bonding conductor for ac circuits (neutral to ground) for system grounding [250]
  - **Note:** The dc bonds will generally be located inside inverters as part of the ground-fault protection devices. ON stand-alone systems, the dc bonding jumper may be in separate ground fault detection and interruption device or may be built into the charge controller
- AC and dc grounding electrode conductors connected properly. They may be connected to the same grounding electrode system (ground rod). Separate electrodes, if used, must be bonded together [690.41,47]
  - **Note:** The 2008 NEC in 690.47 allows a combined dc grounding electrode conductor and an ac equipment-grounding conductor, but the conditions and requirements are numerous {690.47} (2011 NEC clarified and combines 2005 and 2008 690.47(C) requirements)
- Equipment grounding conductors properly sized (even on ungrounded, low-voltage systems) [690.43]
- Disconnects and overcurrent in both of the ungrounded conductors in each circuit on 12-volt, ungrounded systems or on ungrounded systems at any voltage [240.20(A)], [690.41]
- Bonding/grounding fittings used with metal conduits when dc system voltage is more than 250V dc [250.97]

10. CONDUCTORS (General)

- Standard building-wire cables and wiring methods uses [300.1(A)]
- Wet-rated conductors used in conduits in exposed locations [100 Definition of Location, Wet]
- Insulations other than black in color will not be as durable as black in the outdoor UV-rich environment
- DC color codes correct – they are the same as ac color codes – grounded conductors are white and equipment-grounded conductors are green, green/yellow or bare. [200.6(A)] Ungrounded PV array conductors on ungrounded PV arrays will *not* be white in color.

A PERMIT FEE STRUCTURE THAT PROMOTES RENEWABLE ENERGY

Section 29-263 (c)[28] of the Connecticut General Statutes states, "Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality." This means that municipalities have the option to waive or reduce permit fees for solar PV systems.

Most jurisdictions use a value-based permit fee structure to determine permit fees for projects including for rooftop solar PV systems. However, this fee structure is not necessarily "fair" for solar PV or similar types of installations. For example, a more expensive solar PV system would incur a higher permit fee than a less expensive installation even though the cost to a jurisdiction to permit two such systems is about the same. Research data collected in Connecticut during this project estimates that permitting a small-scale rooftop solar PV system generally costs a municipality $200 or less.

Cities and towns can demonstrate support for clean energy in their community and across Connecticut by choosing to reduce or waive their building permit fees for clean energy projects. Jurisdictions are encouraged to waive building permit fees for Class 1 renewable energy systems, as some jurisdictions such as Bridgeport and Manchester have already done. If your municipality is not able to waive the fee at this time, you could consider establishing a low, flat fee for rooftop solar PV permitting, such as $100 - $200 as several Connecticut municipalities have done.

"ROOFTOP SOLAR PV INSTALLATION" KILLINGLY, CT
INSTALLATION BY SUNLIGHT SOLAR ENERGY INC.

Additionally we recommend that permit fees for zoning review be waived for residential rooftop systems. Residential rooftop solar PV systems are typically not impacted by zoning regulations and require no or very little review. By waiving the permit fee for zoning review you can help homeowners affordably install rooftop solar PV systems.

[28] http://www.cga.ct.gov/2011/pub/chap541.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

PLANNING AND ZONING RECOMMENDATIONS FOR MUNICIPALITIES

Municipal planning and zoning regulations can impact a homeowner's ability to install a solar PV system. Solar PV systems (both ground and roof mount) are typically classified as "accessory structures" and are subject to the same regulations as any other structure in that category (e.g. a garage or shed). Often these regulations can be overly restrictive and prevent a solar PV system from being located in a way that would be most efficient (in terms of maximizing the energy production of the PV system) or even prevent a PV system from being installed altogether.

The following recommendations, if adopted, could help make municipal planning and zoning regulations more solar-friendly:

Exempt rooftop installations from zoning review – Consider exempting all rooftop solar PV installations (or those meeting certain criteria) from zoning review. If your jurisdiction's planning & zoning department does conduct an administrative review for solar PV systems, consider waiving any fee associated with this review. Solar PV projects usually pay a building and/or electrical permit fee in addition to fees charged by other departments; the sum of these permit fees can significantly add to solar PV project costs.

Exempt or allow increased flexibility from zoning requirements for solar energy systems – Consider creating exemptions or increasing flexibility for solar energy systems with respect to height, setback, lot coverage and impervious surface limitations. Solar energy systems are usually categorized as accessory structures, and if so, then the jurisdictions' limitations for accessory structures should be reviewed to determine which limitations make sense for solar PV and which are unnecessarily restrictive.

"GROUND-MOUNTED SOLAR PV INSTALLATION"
CORNWALL, CT INSTALLED BY SUNLIGHT SOLAR ENERGY, INC.

The following are examples of types of restrictions that solar could be exempted from or restrictions that could be made more flexible:

- Height – Exemptions from height limitations for rooftop solar energy systems, similar to the exemptions given for rooftop appurtenances such as a chimney, television antennae, rooftop mechanical equipment, or spire.[29] Exemptions from accessory structure height restrictions for free-standing solar energy systems (e.g., ground and pole-mounted systems) could also be implemented.
- Setback – Free-standing solar energy systems could be exempt from lot setback requirements (e.g., side and rear yard setbacks) or the setback requirements could be reduced for solar. Lot setback considerations can also impact rooftop solar PV if the structure on which the solar PV is built or will be built to have access to sunlight.
- Lot coverage – Free-standing solar energy systems could be excluded from counting towards lot coverage, as the contact with the ground is limited only to footings.

[29] Integrating Solar Energy into Local Development Regulations, www.planning.org/research/solar/briefingpapers/localdevelopmentregulations.htm

PLANNING AND ZONING RECOMMENDATIONS FOR MUNICIPALITIES Continued

- Impervious surface[30] – Free-standing solar energy systems could be excluded from impervious surface calculations, or the impervious surface calculation could be limited to the system's footings (the parts of the system that make contact with the ground). This is significant as local zoning laws typically set maximum impervious surface or coverage percentages and municipal and state agencies have been inconsistent in determining whether solar panels should constitute an impervious surface. Free-standing solar energy systems do not completely cap the ground and thereby do not prevent water absorption. Exemption for solar energy systems allows for installation in areas otherwise protected by municipal land use laws that pose strict limitations on impervious surface coverage (e.g., coastal and waterfront areas, forest and conservation areas). New Jersey passed a state law in 2010 excluding solar energy systems from being counted as impervious surface.[31]
- Establish requirements for historic and village district installations – CT General Statute 7-147f states, "No application for a certificate of appropriateness for an exterior architectural feature, such as a solar energy system, designed for the utilization of renewable resources shall be denied unless the commission finds that the feature cannot be installed without substantially impairing the historic character and appearance of the district."

  A municipality could enforce CT Gen. Statute Section 7-147f by developing clear prescriptive standards for when solar PV is allowed in a historic district. For example, consider allowing flush mounted solar panels on all existing roofs, installation of roof-mounted solar panels not visible from the street, and permitting rear yard ground mounted solar systems of limited height to be approved with only a no-cost administrative review. Though prescriptive standards can help streamline approval for projects meeting specific criteria, the standards should not be used to exclude projects that meet the state requirement of "do not substantially impair the historic character of the district." For examples of prescriptive standards for solar PV in historic districts see the National Trust for Historic Preservation's Design Guidelines for Solar Installations[32], the National Alliance of Preservation Commission's Sample Guidelines for Solar Systems in Historic Districts[33], or NREL's Implementing Solar PV Projects on Historic Buildings and in Historic Districts.[34]

Adopt zoning regulations that protect future solar access as well as access to sunlight after investment in a solar energy system (these recommendations require the adoption of solar access laws in CT to provide a legal framework for these types of improvements to local zoning regulations).

- A municipality could encourage the state to adopt a statute that allows for creation of solar easements to protect solar PV system access to sunlight across property lines. An easement applies to properties whose owners have signed a voluntary agreement and typically protects a solar system from obstructions on adjacent properties only.

[30] "Impervious surface" means any structure, surface, or improvement that reduces or prevents absorption of stormwater into land, and includes porous paving, paver blocks, gravel, crushed stone, decks, patios, elevated structures, and other similar structures, surfaces, or improvements. Increases in impervious surface area are often used to characterize and measure land use changes in the process of property development.
[31] "Solar Panels Do Not Constitute Impervious Cover Under New Law," April 2010, njzoningwatch.com/category/highlands.
[32] http://www.preservationnation.org/information-center/sustainable-communities/buildings/solar-panels/design-guidelines-for-solar.html#.UvpXqFKUP4Y
[33] http://www.preservationnation.org/information-center/sustainable-communities/buildings/solar-panels/additional-resources/NAPC-Solar-Panel-Guidelines.pdf
[34] http://www.nrel.gov/docs/fy11osti/51297.pdf

PLANNING AND ZONING RECOMMENDATIONS FOR MUNICIPALITIES Continued

- Consider adopting a regulation/ordinance that protects solar access such as one of the following four examples, each suited to addressing different development patterns. For more details on this topic please see Appendix VI in the SunShot Initiative Solar Challenge Round I Final Report.
  - First, an ordinance may create a **permitting and recording procedure** by which a home owner who installs a solar system may obtain a permit that prevents their solar access from being impeded by later construction or vegetation growth. Such a permit can then be recorded in the local land records.
  - Second, an ordinance may create a **solar envelope** around each property. Solar envelope ordinances are a more comprehensive form of solar access protection, and preserve a property's access to sunlight even if the property owner has not yet installed a solar collector.
  - Third, an ordinance may create new zones that **coordinate solar access with topography and population density**. Boulder, Colorado created three solar access areas based on planned densities, topography, and lot configurations. The level of protection varies based on the impact of solar access regulations of existing and future development - in some zones solar access is protect by right and in other zones solar access protection requires a permit. The American Planning Association's Essential Info Packet Planning and Zoning for Solar Energy has a chapter on Solar Access Ordinances where you can review Boulder's regulations as well as examples from other communities.
  - Fourth, **Consider implementing incentive-based green building ordinances or ordinance provisions** to award points, incentives, or bonuses (such as density bonuses) to developers who include energy efficiency features such as solar systems and solar access in their projects.

More information and resources on the planning and zoning aspects of solar PV can be found in the American Planning Association's (APA) "Solar Briefing Papers,"[35] specifically "Integrating Solar Energy into Local Development Regulations," as well as the APA's Info Packet "Planning and Zoning for Solar Energy,"[36] a compilation of ordinances from around the country that provide examples of zoning regulations for solar. Additionally, Massachusetts' "Model Zoning for the Regulation of Solar Energy Systems,"[37] includes information on commercial and utility-scale installations as well.

[35] http://www.planning.org/research/solar/briefingpapers
[36] http://www.planning.org/pas/infopackets/open/eip30.htm
[37] http://www.mass.gov/eea/docs/doer/green-communities/grant-program/model-solar-zoning.pdf

FORMALIZE YOUR JURISDICTION'S COMMITMENT TO CLEAN ENERGY

If you are working to promote clean energy in your jurisdiction by improving administrative processes and reducing non-hardware costs associated with rooftop solar PV, you can formalize this commitment by adopting a solar-friendly ordinance or incorporating elements of the following model ordinances into your jurisdiction's municipal codes and regulations.

The model ordinances provided in this Guide are separated into two documents. The first ordinance pertains to PERMITTING for solar PV, usually handled by a building department, and the second ordinance pertains to PLANNING AND ZONING aspects, often handled by a separate, zoning department. These two ordinances incorporate recommended standards for solar PV so that a municipality may facilitate the clear and efficient installation of solar PV systems.

These model ordinances are available for download as stand-alone documents under the Permitting Guide tab on Energize CT's Sun Rise New England - Open For Business website.

If you are an installer or constituent and would like to suggest to a municipality that they utilize the Connecticut Rooftop Solar PV Permitting Guide and/or any of the recommended practices or tools provided in the Guide, a template letter is provided in Appendix I to suggest this to municipal leaders. You can also download the "Template Letter to Municipality Suggesting Use of Permitting Guide" as a standalone document from the project website.

"TALCOTT MOUNTAIN HDR 4" SIMSBURY, CT BY WISSOTZKY[38]

[38] http://www.flickr.com/photos/wissotzky/4963494005/

SOLAR PV MODEL PERMITTING ORDINANCE for CONNECTICUT JURISDICTIONS

PERMITTING ORDINANCE OR ORDINANCE ELEMENTS

Applicability and Scope

This model ordinance is applicable to residential and commercial solar photovoltaic (PV) systems. The purpose is to reduce or eliminate permit fees associated with the installation of solar PV systems in order to facilitate affordable deployment of renewable energy.

The reach of this Ordinance does not currently include but could be expanded to include permitting of solar thermal systems and other types of clean energy systems.

[Text included in square brackets is a note to the municipality rather than text that should be included in the formal ordinance]

ORDINANCE

Section 1. Purpose.

It is the purpose of this regulation to reduce the cost of solar PV system installations and promote the use of renewable energy. This Ordinance seeks to:

1) Provide property owners and business owners with flexibility in satisfying their on-site energy needs.

2) Reduce overall energy demands within the Municipality and promote energy efficiency.

3) Streamline the permitting process for rooftop solar PV systems by updating regulations and administrative procedures related to rooftop solar PV permitting and fees.

4) [As applicable] Support [alternately, further] the Municipality's conservation, energy and development plan [alternately, comprehensive plan, energy, economic development or sustainability goals].

Section 2. Applicability.

1) This Ordinance applies to solar photovoltaic (PV) systems modified, upgraded or installed after the effective date of the Ordinance.

2) This Ordinance is effective as of date of adoption unless another date is otherwise specified

Section 3. Permit Fee

For building-mounted solar PV systems [alternately
"For all Class I renewable energy systems as defined in the Connecticut General Statutes"][39], the building permit fee shall be waived [alternately "shall be a flat fee of $_____"].[40]

Section 4. Licensing

For solar energy work, our Municipality does not require any community-specific licenses over and above current state of Connecticut licensing requirements defined by the Connecticut Department of Consumer Protection.

[39] [Class I Renewable Energy Systems are defined by Conn. Gen. Stat. §16-1(a)(26), as "(A) energy derived from solar power, wind power, a fuel cell, methane gas from landfills, ocean thermal power, wave or tidal power, low emission advanced renewable energy conversion technologies, a run-of-the-river hydropower facility provided such facility has a generating capacity of not more than five megawatts, does not cause an appreciable change in the river flow, and began operation after July 1, 2003, or a sustainable biomass facility with an average emission rate of equal to or less than .075 pounds of nitrogen oxides per million BTU of heat input for the previous calendar quarter, except that energy derived from a sustainable biomass facility with a capacity of less than five hundred kilowatts that began construction before July 1, 2003, may be considered a Class I renewable energy source, or (B) any electrical generation, including distributed generation, generated from a Class I renewable energy source."]

[40] [If a flat fee is to be imposed by a municipality it is recommended that the fee reflects the cost of permitting the solar PV system and that it should be no more than $200. Research conducted for the SunShot Initiative Rooftop Solar Challenge has shown that the cost of permitting for solar energy systems typically does not exceed $200.]

SOLAR PV MODEL ZONING ORDINANCE for CONNECTICUT JURISDICTIONS

ZONING ORDINANCE OR ORDINANCE ELEMENTS

Applicability and Scope

This model ordinance provides guidance on establishing zoning regulations that accommodate the functional requirements of solar photovoltaic (PV) systems. The ordinance incorporates standards for solar PV systems that enable them to maximize their efficiency. These standards can be implemented as written in the model ordinance, or adapted to fit the goals and character of your community. In addition to the ordinance text, footnotes and examples in the introduction to this ordinance can help you explore options for addressing solar energy systems in your jurisdiction. Ideally a solar ordinance should be a stand-alone local regulation or a separate section within a land use ordinance that than being integrated into existing Ordinance language.

With respect to municipal zoning regulations, small-scale residential and commercial solar PV systems that primarily deliver electricity to an onsite building are usually categorized as accessory structures. Larger systems, such as ground-mounted solar "farms", that generate electricity primarily for offsite use are typically categorized as principal structures, although some electricity may be used by an onsite building.

This ordinance focuses on accessory structure restrictions and suggests example language to provide exemptions from or flexibility with respect to these regulations. Accessory structure restrictions could apply to rooftop or free-standing systems. The following are examples of the types of restrictions could be made more flexible for solar, or where solar could be exempted:

- Height – Height restrictions could prevent a solar energy system from being installed if a structure is already at the maximum allowed height (e.g. a flat roof that is currently at the maximum height). Height restrictions can also reduce a solar energy systems ability to collect sunlight and put the system at risk of obstruction from neighboring objects (e.g. trees, buildings). Exemptions from building height limitations are needed for rooftop solar energy systems, (similar to the exemptions given for rooftop appurtenances such as a chimney, television antennae, rooftop mechanical equipment, or spire[41]) and from accessory structure height restrictions for free-standing solar energy systems.

  Model Height Towns:

  – Westport, CT exempts rooftop solar PV systems from building height restrictions, provided that the solar system does not extend above the ridge line of the roof[42]

  – Milwaukee allows ground-mounted solar energy systems greater than 20 feet in height if they meet the setback requirements of the principle structure[43]

  – Rock Hill, SC restricts ground-mounted solar energy systems to the height of the principle structure[44], allowing for more leeway than accessory height restrictions

- Setback – free-standing solar energy systems should be exempt from lot setback requirements (e.g., side and rear yard setbacks) or the setback requirements should be reduced for solar. Lot setback considerations can also impact rooftop solar PV if the structure on which the system is built is not compliant with setback requirements. For example, if a building was constructed before the development of setback regulations, a new rooftop solar PV installation could be forced to comply with the municipality's setback requirement. Complying with the setback requirement could reduce the performance of the solar PV system. It is recommended that setback variances granted to structures, should also apply to solar PV systems on the structure.

  Model Setback Towns:

  – Maricopa County, AZ requires a minimum 3 foot setback from rear and side yards for solar energy systems as compared to up to 20 feet for other accessory structures[45]

  – Rock Hill, SC bases its setback requirement on the height of the solar energy system.[46] Rather than a blanket setback, this type of regulation allows greater flexibility when locating a solar PV system.

[41] Integrating Solar Energy into Local Development Regulations, www.planning.org/research/solar/briefingpapers/localdevelopmentregulations.htm
[42] http://westportct.gov/modules/showdocument.aspx?documentid=497
[43] http://www.growsolar.org/wp-content/uploads/2013/02/MKEshines_ZoningBrief.docx
[44] http://www.cityofrockhill.com/departments/planning-and-development/zoning. See "Zoning Ordinance"
[45] http://www.maricopa.gov/planning/Resources/Ordinances/pdf/reform_ordinance/mczo1.pdf
[46] http://www.cityofrockhill.com/departments/planning-and-development/zoning. See "Zoning Ordinance"

SOLAR PV MODEL ZONING ORDINANCE CONNECTICUT JURISDICTIONS Continued

- Lot Coverage – Free-standing solar energy systems should be excluded from counting towards lot coverage, as contact with the ground is limited only to footings.

  Model Lot Coverage Towns:

  – Maricopa County, AZ exempts accessory solar energy systems from lot coverage calculations as long as the system and its supporting structure do not constitute a building[47]

  – Larimer County, CO limits the total area of a ground-mounted system to 50% of the lot's net area[48]

- Impervious Surface[49] – Free-standing solar energy systems should be excluded from impervious surface calculations. This is significant as local zoning laws typically set maximum impervious surface or coverage percentages and municipal and state agencies have been inconsistent in determining whether solar panels should constitute an impervious surface. Free-standing solar energy systems do not completely cap the ground and thereby do not prevent water absorption. Exemption for solar energy systems allows for installation in appropriate areas otherwise protected by municipal land use laws that pose strict limitations on impervious surface coverage (e.g., coastal and waterfront areas, forest and conservation areas).

  Model Impervious Surface State:

  – New Jersey passed a state law in 2010 excluding solar energy systems from being considered an impervious surface.[50]

Section 7 of this ordinance incorporates the requirements of General Statute Section 7-147f[51] into your municipality's zoning regulations. G.S. § 7-147f mandates that a municipality cannot deny a "certificate of appropriateness" to a solar energy system unless it significantly impairs the historic character of the district. In addition to adding this provision to your town's ordinance, consider developing prescriptive standards to make the process of installing solar in your community's historic districts efficient and clear. The National Trust for Historic Preservation[52] and the North Carolina Solar Center[53] have some helpful resources that can Guide you in developing your own prescriptive standards for solar PV in historic districts.

Section 12 of the ordinance includes a provision for the verification of compliance with Connecticut General Statute 8-25 (b).[54] G.S. § 8-25(b) requires subdivision development regulations to "encourage energy-efficient patterns of development and land use, the use of solar and other renewable forms of energy, and energy conservation" and "requires any person submitting a plan for a subdivision to… demonstrate to the commission that such person has considered, in developing the plan, using passive solar energy techniques." One way to ensure adherence to this statute is to require developers to submit to a Municipality a completed Solar Site Design Worksheet for a Proposed Subdivision. See the addendum to this ordinance for a sample worksheet, which is also available for download and modification as a stand-alone document in the Permitting Guide tab on Energize CT's Sun Rise New England - Open for Business website.[55]

[47] http://www.maricopa.gov/planning/Resources/Ordinances/pdf/reform_ordinance/mczo1.pdf
[48] http://www.larimer.org/building/Accessory_Solar_Facilities.pdf
[49] "Impervious surface" means any structure, surface, or improvement that reduces or prevents absorption of stormwater into land, and includes porous paving, paver blocks, gravel, crushed stone, decks, patios, elevated structures, and other similar structures, surfaces, or improvements. Increases in impervious surface area are often used to characterize and measure land use changes in the process of property development.
[50] "Solar Panels Do Not Constitute Impervious Cover Under New Law," April 2010, njzoningwatch.com/category/highlands/.
[51] http://www.cga.ct.gov/2011/pub/chap097a.htm#Sec7-147f.htm
[52] http://www.preservationnation.org/information-center/sustainable-communities/buildings/solar-panels/design-guidelines-for-solar.html#.UvpXqFKUP4Y
[53] http://ncsc.ncsu.edu/index.php/2012/09/04/installing-solar-panels-on-historic-buildings/
[54] http://www.cga.ct.gov/2011/pub/chap126.htm#Sec8-25b.htm
[55] http://www.energizect.com//communities/programs/Sun%20Rise%20New%20England

SOLAR PV MODEL ZONING ORDINANCE CONNECTICUT JURISDICTIONS Continued

The reach of this Ordinance does not currently include but could be expanded in the future to include:

- Solar access protections which can be implemented once appropriate enabling solar access laws are adopted by the State of Connecticut legislature:
  - Recordation of solar easements by the municipality to protect access to sunlight for solar energy systems. Note than an agreement can be made between two neighbors that could address solar access considerations similarly to a solar easement; however, the existence of a solar access law provides a legal framework for addressing such considerations more broadly.
  - Protection of the right to install rooftop solar PV with respect to private and local government restrictions such as covenants, conditions and restrictions in deeds and local ordinances that pose barriers to installation of solar energy systems. This right would pertain to individually owned standalone buildings as well as those in communities regulated by homeowner or condominium associations or other governing boards.
- Zoning considerations for principal solar energy systems and solar thermal systems.

Zoning considerations for other types of clean energy systems.

[Text included in square brackets is a note to the municipality rather than text that should be included in the formal ordinance]

SOLAR PV MODEL ZONING ORDINANCE CONNECTICUT JURISDICTIONS

ORDINANCE

Section 1. Purpose.

It is the purpose of this regulation to provide a clear regulatory system to promote the safe, effective and efficient installation and operation of solar photovoltaic (PV) systems. This Ordinance seeks to:

1) Provide property owners and business owners with flexibility in satisfying their on-site energy needs.

2) Reduce overall energy demands within the Municipality and promote clean, local energy sources.

3) Streamline the permitting process for solar PV systems by updating zoning regulations to explicitly address solar PV systems.

4) [As applicable] Support [alternately, further] the Municipality's conservation and development plan, [alternately, comprehensive plan, energy, economic development or sustainability goals].

Section 2. Definitions.

Accessory Building-Mounted Solar Photovoltaic System: A solar photovoltaic system attached to any part or type of roof on a building or structure that is either the principal structure or an accessory structure on a recorded [lot/parcel/property]. This system also includes any solar photovoltaic-based architectural elements.

Accessory Free-Standing Solar Photovoltaic System:
A free-standing solar photovoltaic system that delivers electricity primarily to a building or structure that is either the principal structure or an accessory structure on a recorded [lot/parcel/property]. This system also includes any solar photovoltaic-based architectural elements.

Accessory Structure: A structure, the use of which is customarily incidental and subordinate to that of the principal building, and is located on the same lot or premises as the principal building. [Note: Your municipality could use your existing definition of "Accessory Structure"]

Building-Integrated Solar Photovoltaic System: A solar energy system that consists of integrating photovoltaic modules into the building structure, such as the roof or the façade and which does not alter the relief of the roof.

Passive Solar Energy Techniques: As defined in Connecticut General Statute 8-25 (b), these are site design techniques which maximize solar heat gain, minimize heat loss and provide thermal storage within a building during the heating season and minimize heat gain and provide for natural ventilation during the cooling season. The site design techniques shall include, but not be limited to: (1) House orientation; (2) street and lot layout; (3) vegetation; (4) natural and man-made topographical features; and (5) protection of solar access within the development.

Photovoltaic (PV): A semiconductor based device that converts light directly into electricity.

Principal Solar Photovoltaic System: A solar photovoltaic system that captures solar energy and converts it to electrical energy primarily for offsite use and is the primary land use of the property on which it is located. Some electricity may be used by an onsite building.

Solar Photovoltaic (PV)-based Architectural Element: Structural/architectural element that provides protection from weather that includes awnings, canopies, porches or sunshades and that is constructed with the primary covering consisting of solar PV modules, and may or may not include additional solar PV related equipment.

Solar Photovoltaic (PV) Related Equipment: Items including a solar photovoltaic cell, panel or array, lines, mounting brackets, framing and foundations used for or intended to be used for collection of solar energy.

SOLAR PV MODEL ZONING ORDINANCE
CONNECTICUT JURISDICTIONS Continued

Section 2. Definitions. (continued)

Solar Photovoltaic (PV) System: A solar collection system consisting of one or more building systems, solar photovoltaic cells, panels or arrays and solar related equipment that rely upon solar radiation as an energy source for collection, inversion, storage and distribution of solar energy for electricity generation.

Solar Thermal System: A solar collection system that directly heats water or other liquid using sunlight. The heated liquid is used for such purposes as space heating and cooling, domestic hot water, and heating pool water.

Section 3. Applicability.

1) This Ordinance applies to Accessory Building-Mounted Solar Photovoltaic (PV) and Accessory Free-Standing Solar PV Systems modified, upgraded or installed after the effective date of the Ordinance. This Ordinance does not apply to Solar Thermal Systems or Principal Solar Photovoltaic Systems, as defined by this Ordinance.
2) Solar Photovoltaic systems installed before the effective date of this Ordinance are not required to meet the requirements of this Ordinance.
3) Elements of this Ordinance are effective as of the effective date of this Ordinance unless another date is otherwise specified.
4) Any upgrades, modifications or changes to an existing solar energy system that significantly alter the size or placement of the structure must comply with the requirements of this ordinance.

Section 4. Permissible Zoning Districts.

Accessory Building-Mounted and Free-Standing Solar PV Systems are permissible in all zoning districts as an accessory use to any lawfully permitted principal use on the same [lot/parcel/property] upon issuance of the proper permit pursuant to [Section/Article] and upon compliance with all requirements of this section and as elsewhere specified in this Ordinance. Building-Integrated Solar Photovoltaic Systems that are integrated into the roof or the façade of a structure, and which do not alter the relief of the roof, are permitted outright in all zoning districts.

Section 5. Location Within a Lot/Parcel/Property.

Accessory Building-Mounted Solar PV Systems are permitted to face any rear, side or front yard. Accessory Building-Mounted Systems may only be mounted on lawfully constructed principal or accessory structures. Free-Standing Solar Photovoltaic Systems are permitted within the lot's buildable area as determined by the solar PV specific setbacks defined in Section 9 of this ordinance.

Section 6. Design and Installation Standards.

1) Solar PV Systems must be installed to comply with all State of Connecticut codes and regulations.
2) The installation of all solar PV systems must comply with the National Electrical Code, most recent edition, as adopted and amended by the State of Connecticut.
3) The installation of any solar PV system is subject to local electric public utility requirements for interconnection to the electrical distribution system. All interconnections shall comply with the applicable regulations established by the agency having jurisdiction.

Section 7. Village or Historic Districts.

In the case of an installation in a village or historic district, no application for a certificate of appropriateness for an exterior architectural feature, such as a solar energy system, designed for the utilization of renewable resources shall be denied unless the commission finds that the feature cannot be installed without substantially impairing the historic character and appearance of the district. [56]

[56] http://www.cga.ct.gov/2011/pub/chap097a.htm#Sec7-147f.htm

Section 8. Height Restrictions.

Accessory Building-Mounted Solar PV Systems shall be exempt from height restrictions pertaining to the principal structure so that the height of the rooftop solar PV system does not contribute to the total height of the principal structure [Alternatively, rooftop solar PV systems will not extend more than "X" feet from the highest point above the roof surface.[57]]

Accessory Free-Standing Solar PV Systems will not exceed 35' in height.[58]

Section 9. Setback Requirements

Accessory Building-Mounted Solar PV Systems are exempt from zoning setbacks. Accessory Roof-Mounted Solar PV Systems will not extend beyond the edges of the roof on which they are mounted.

Accessory Free-Standing Solar PV Systems are exempt from front, rear and side lot setbacks. [Alternatively, standalone solar PV systems will maintain a 1-3 foot setback from the property line at minimum design tilt.]

Section 10. Lot Coverage

The surface area of Accessory Free-Standing Solar PV Systems will be exempt from contributing to the calculation of overall lot coverage.

Section 11. Impervious Surface

The surface area of Accessory Free-Standing Solar PV Systems will be exempt from contributing to the calculation of overall impervious surface coverage. [Alternatively, only the footings[59] of Accessory Free-Standing Solar PV Systems will contribute to the calculation of overall impervious surface coverage.]

Section 12. Subdivision developments

Developers proposing new subdivisions must demonstrate to the municipality that the use of Passive Solar Energy Techniques was considered in the development of the subdivision plan.[60] To fulfill this requirement, developers are required to submit to the Municipality the completed "Solar Site Design Worksheet for a Proposed Subdivision" which is provided as a stand-alone document in the CT Rooftop Solar PV Permitting Guide tab on the Sun Rise New England website, www.energizect.com/sunriseNE [Alternatively, the relevant form can be obtained from the municipality — the municipality should specify how to access it.]

[57] While most residential rooftop solar PV systems do not extend more than 18' above the roof, systems can often extend higher on flat roofs. Suggested restrictions are six feet above the highest point of roof surface for residential rooftop systems and 15 feet for commercial rooftop systems.

[58] Ideally, there would be no height restrictions placed on standalone solar PV systems. If a municipality is set on having a height restriction, the higher the better, so as not to prevent the installation of solar PV. However, a municipality could include different height restrictions depending on the density of the zone, or overlay district. Suggested height limits are 30-35' for pole-mounted and 20-25' for ground-mounted systems. Limiting the height of a standalone system may reduce a system's efficiency and its ability to collect sunlight. In some cases these type of limitations can make a proposed PV system not economically viable.

[59] "Footings" refers to the structural components of the solar energy system that make contact with the ground, as opposed to the entire extent of the above ground surface.

[60] Connecticut General Statute 8-25 (b) requires subdivision development regulations to "encourage energy-efficient patterns of development and land use, the use of solar and other renewable forms of energy, and energy conservation" and "requires any person submitting a plan for a subdivision to… demonstrate to the commission that such person has considered, in developing the plan, using passive solar energy techniques." http://www.cga.ct.gov/2011/pub/chap126.htm#Sec8-25b.htm

SOLAR SITE DESIGN WORKSHEET FOR A PROPOSED SUBDIVISION

HAVE YOU INCLUDED ANY OF THE FOLLOWING SOLAR-FRIENDLY DESIGN PRINCIPLES IN YOUR SUBDIVISION PLAN? (Check all below elements that apply)

Note that solar-friendly design is not required for subdivisions; however, developers are strongly encouraged to include solar-friendly design elements in their subdivision plans.

Street and Lot Layout

☐ Home lots are arranged on streets that run within 20 degrees of east/west to maximize solar exposure

House Orientation

☐ Homes are designed in a manner so that the longer axis of the house is aligned within 20 degrees of east/west in order to maximize solar exposure

☐ Homes are designed so that south-facing roof surfaces (and more generally, sections of the roof ideal for placement of solar energy systems) receive unobstructed sun between 9 am and 3 pm

☐ Homes are designed so that primary living spaces include a southern exposure

☐ Homes are designed so that at least 50% of window area contributes to passive heating during the heating season and are shaded in the cooling season

☐ Roof structures that might create shading and block PV arrays are installed on the north slope of the roof to minimize impacts

Vegetation

☐ Plantings support passive heating and cooling techniques and do not shade roof surfaces ideal for solar energy systems

Protection of solar access within the development

☐ Subdivision regulations protect the homeowners' right to install solar and eliminate potential obstructions from neighboring structures or vegetation

For any of the above design principles that were not included in your subdivision plan, please explain why:

_____

_____

_____

_____

_____

_____

_____

This document is available for download and modification under the Permitting Guide tab on Energize CT's Sun Rise New England - Open for Business website.

BECOME A MEMBER OF THE CLEAN ENERGY COMMUNITY AND WIN A SOLAR ENERGY SYSTEM FOR YOUR MUNICIPALITY!

If you have done the work to make permitting improvements for solar PV or adopted some of the tools offered in this Guide, you may qualify for points that would help earn a clean energy system for your municipality.

The Clean Energy Communities Program (CEC) is designed to help community leaders, households and local businesses work together to achieve clean energy goals. By joining the Clean Energy Communities program your municipality pledges to reduce energy consumption by 20% and voluntarily support 20% of municipal building electricity from clean energy resources by 2018. Municipalities can opt to take "action steps" (such as taking actions to reduce solar PV soft-costs and making improvements to their permitting practices) that support clean energy deployment to meet their CEC targets. Municipalities can meet up to 5% of their CEC commitment with improvements that help streamline the permitting process for solar PV.

Communities receive CEC points that can be redeemed for clean energy systems or "Bright Ideas Grants" for energy-saving projects, and early-adopters of best practices for permitting improvements may be eligible to earn bonus points. Please see the Clean Energy Communities[61] website for more information on this exciting program and to learn about the ways your community can earn rewards for supporting clean energy. You can also email us at sunshot@ctcleanenergy.com.

"SOLAR PV INSTALLATION AT BEARDSLEY ZOO IN BRIDGEPORT, CT, EARNED THROUGH THE CLEAN ENERGY COMMUNITIES PROGRAM"
COURTESY OF ROSS SOLAR GROUP

For more information on which improvements can result in CEC credit, please see the CEFIA Staff Scoring Sheet on page 64 of this Guide.

To get CEC credit for your improvements, your municipality is encouraged to download and complete CEFIA's Solar-Ready Clean Energy Community Checklist. The Checklist is included in this Guide (starting on the next page) and is also provided as a stand-alone form on the Permitting Guide tab of the Sun Rise New England - Open for Business website. You can submit this checklist to sunshot@ctcleanenergy.com.

[61] http://www.energizect.com/communities/programs/clean-energy-communities

SOLAR-READY CLEAN ENERGY COMMUNITY CHECKLIST

(Also found on the Permitting Guide tab of Energize CT's Sun Rise New England – Open for Business website.)

Your answers to the questions below will enable CEFIA to better understand your jurisdiction's solar-readiness, eligibility to receive Clean Energy Communities Points, and opportunities for improvement. Note that this information may be used on a publicly-accessible website to provide constituents and solar PV installers information about your jurisdiction's solar-friendly practices. To begin earning CEC points, you must first become a member.[62]

Please provide the requested information below. For Yes/No questions, indicate Y or N. If Y, please include details. You may contact sunshot@ctcleanenergy.com with questions. If a question requires further elaboration please attach the relevant documents/references to this form.

MUNICIPALITY NAME: _____

Name of person(s) completing this form: _____

Title: _____

Department: _____

Phone number: _____

Email address: _____

Jurisdiction Websites	
Jurisdiction website	
Building department or permit information website	
Planning and Zoning department website	
Jurisdiction's clean energy or energy-related website(s) (if applicable)	
Program Participation	
CT Solarize Program? (specify Round#, program type)	
Current CT Clean Energy Communities Member?	
Adopted Commercial Property Assessed Clean Energy (C-PACE)?	
Jurisdiction Clean Energy Task Force? (If Yes, provide contact information, website address, etc.)	
Other clean energy programs or initiatives?	

[62] http://www.energizect.com/communities/programs/clean-energy-communities

SOLAR-READY CLEAN ENERGY COMMUNITY CHECKLIST Continued

Permitting Information	
What permits are required for a solar PV installation (e.g., building, zoning)? What other departments review the application?	Permits: Other Departments:
Is one department responsible for receiving and approving the solar PV permit? Have unnecessary steps and approvals been eliminated?	
Have you adopted the CT Standard Solar PV Permit Application or do you have a solar PV specific permit application?	
Do you have a solar friendly permitting fee (e.g., fee waiver or flat fee)? Does it apply to residential or commercial systems, or both?	
Permit fee structure (e.g., $X for first $1,000, $X for each additional $1,000). Indicate fee structure for Residential and Commercial systems.	
Do you provide information or forms pertaining to your permit process online?	
Do you have an online permitting system? If yes, what is the name of the system? Is it used for solar PV permit submission and processing?	
Any other electronic process/system used for permitting (email, back-end system)?	
Is your town interested in online permitting?	
Has your permitting staff received solar-specific training resulting in improved solar PV permitting?	
Are structural/professional engineering stamps required on every rooftop installation or do you have a method to identify when a structural review is necessary?	
When inspection is required, do you conduct a single comprehensive inspection? Do you set a specific inspection appt. time or a window of time?	
What other aspects of your permitting process do you consider to be solar-friendly or a best practice?	

SOLAR-READY CLEAN ENERGY COMMUNITY CHECKLIST Continued

Permitting Information (continued)	
Jurisdiction contact person and contact information for follow-up on permitting questions	
Any other comments/notes pertaining to your jurisdiction's permitting processes/needs?	
Other Information about your town's solar-readiness	
Does your town require any community-specific licenses, over and above the state requirements for solar-energy workers?	
Electric utility serving municipality (CL&P, UI, etc.):	
Does your town offer any local financial incentives such as tax incentives, rebates, or loans for solar?	
Does your town have a plan of conservation and development that encourages clean energy adoption?	
Does your town have any zoning, permitting or other ordinances that support or encourage adoption of clean energy?	
Does your town specifically address solar energy systems in its zoning regulations? If yes, please provide an attachment with the regulations or specify the sections of the zoning regulations that address solar PV (include considerations for height, setback, lot coverage, impervious surface and whether the installation is permitted by-right)	
Do you have any municipal solar PV installations? If yes, indicate location/address and size/capacity for each system.	
Do you have any other municipal renewable energy systems such as fuel cells, biomass facilities, wind turbines, etc.? If yes, provide location and other details.	
What other practices make your town solar-friendly?	
Other comments/description of attached documents	

Printed name of person signing this form: _____
(must be authorized to sign for jurisdiction)

Signature: _____ Signature Date: _____

[CEFIA will use the next table to determine how improvements to your solar PV permitting processes and your encouragement of solar PV deployment count toward Clean Energy Communities Program points. CEFIA has final discretion as to whether criteria for adoption of tools/measures are sufficiently met.]

CEFIA STAFF SCORING SHEET (to be left blank by municipalities)

Final decision as to whether improvements qualify for CEC points is at CEFIA staff discretion. Contact CEFIA staff in advance of an improvement to be sure it will qualify for CEC points.

Tool/Measure Adopted (# Points Possible)	# Pts	Staff Notes
Town is a Clean Energy Community member		
CT Standardized Solar PV Permit Application adopted. (1 pt)		
Online permitting system adopted including solar PV permit submission and processing. Note system name. (1 pt)		
Solar-friendly permitting fee or structure (e.g., fee waiver or flat fee ≤$200). Applies to residential and/or commercial systems. (1 pt if waiver or flat fee <=$200 for residential solar PV)		
Have an effective method and criteria to identify if and when a structural review and stamp by a professional engineer is needed. (1 pt)		
Permitting staff has received solar PV-specific training relevant to improving staff processing and review of solar PV permits. (1 pt)		
Permit Application Requirements, Review and System Inspection (1 pt, if *all* of the following met) • No community-specific licenses are required over and above state requirements for solar energy workers. • One department is responsible for receiving and approving the solar PV permit. Unnecessary steps and approvals have been eliminated. • When an inspection is required, a single comprehensive inspection is conducted, and efforts have been made to provide a more specific inspection time.		
Town has amended its zoning regulations to make them significantly more flexible for and friendly to solar PV. (1 pt) *Final decision as to whether improvements qualify for CEC points is at the discretion of CEFIA staff.*		
Other significant measure/tool adopted for which CEFIA might consider substitution for above points. Specify. (1pt)		
TOTAL SCORE (up to 5 points maximum)		
TOTAL CEC POINTS AWARDED		

A copy of this completed scoring table was provided to the municipality. Note CEFIA staff person and/or supporting contractor (as applicable) and the dates that this scoring sheet was finalized and provided to municipality.	CEFIA Staff Person:
	Supporting Contractor:
	Date Finalized:
	Date Provided to Muni:
	Notes:

OTHER PROGRAMS AND PRODUCTS THAT CAN HELP YOU PROMOTE AND ADOPT SOLAR ENERGY

Solarize Connecticut

Solarize Connecticut (Solarize CT[63]) is a program designed to encourage adoption of residential solar PV through a group purchasing structure that lowers costs through volume, economy of scale, peer and other effects. The Solarize CT program offers a coordinated education, marketing and outreach effort, combined with a tiered pricing structure that provides increased savings to homeowners as more people in a community go solar. The more residents sign up to install solar, the more the price decreases for everyone who participates. **To learn more about Solarize, please visit www.solarizeCT.com.**

Incentives for Clean Energy in Connecticut

- **Residential Solar Investment Program (RSIP)**

  CEFIA distributes incentives for customer and third-party owned solar PV systems on owner-occupied one to four family homes through RSIP. RSIP incentives can be applied to the first 10kW of a solar PV system, with other applicable restrictions. **To learn more about RSIP, please visit the EnergizeCT website.**[64]

- **Zero Emission Renewable Energy Credits (ZREC)**

  Incentives for solar PV systems of any size are available through the ZREC program. ZRECs are distributed through an auction process run by Connecticut's two investor-owned utilities, Connecticut Light and Power and United Illuminating. **To learn more about ZRECs, please visit CL&P or UI's website.**

Connecticut's Innovative Financing Products

CEFIA offers numerous innovative financing products to increase affordability and accessibility of rooftop solar PV installations and other clean energy technologies and measures for residents and businesses.

- **Energize Connecticut Solar Lease version 2.0**

  The CT Solar Lease™ Program provides a great opportunity to install a solar energy system with no money down and an option to purchase the system after year five. The product is available to homeowners with lower credit scores than most products in the market, making it accessible to a wider range of customers. Both a solar PV and a solar hot water lease product are available.

"ROOFTOP SOLAR PV INSTALLATION" CORNWALL, CT COURTESY OF CHRIS LENZELEC

- **Energize Connecticut Smart-E Loan**

  The Smart-E Loan Program offers long-term, low-interest financing through participating lenders to help Connecticut residents make home energy upgrades, including implementation of energy efficiency measures and installation of rooftop solar PV.

- **Energize Connecticut Solar Loan powered by Sungage**

  The Energize Connecticut Solar Loan allows homeowners to affordably purchase solar PV by spreading out the cost of the system over the term of the loan. The CT Solar Loan is administered by Sungage, Inc., a financial services company committed to helping more people own solar PV

- **Cozy Home Loan**

  The Cozy Home Loan makes energy improvements affordable for CT residents with low to moderate incomes. It is an easy-to-access, low-interest payment plan for eligible residents in Fairfield, New Haven and Litchfield counties. The Cozy Home Loan is administered by the Housing Development Fund.

For more information about the above as well as other financing programs available to homeowners in Connecticut, visit www.energizect.com/gosolar

[63] http://solarizect.com
[64] http://www.energizect.com/residents/programs/residential-solar-investment-program

OTHER PROGRAMS AND PRODUCTS THAT CAN HELP YOU PROMOTE AND ADOPT SOLAR ENERGY Continued

- **C-PACE**

  Connecticut Property Assessed Clean Energy (C-PACE) is a finance program/product that allows commercial, industrial and multifamily property owners to access up to 100% low-cost, fixed rate, long-term financing for energy efficiency and renewable energy improvements and repay the loan through a voluntary assessment on their property tax bill, similar to a water/sewer tax assessment. Property owners pay for the improvements over time (up to a period of 20 years) through this additional charge on their property tax bill, and the repayment obligation transfers automatically to the next owner if the property is sold. The state of Connecticut passed legislation enabling CEFIA to offer C-PACE financing. However, each city or town must still opt into the C-PACE program and agree to assess, collect, remit and assign benefit assessments to CEFIA.

For more information about the C-PACE program, visit www.c-pace.com.

For a comprehensive listing of programs and products that support clean energy adoption in Connecticut, see: http://www.energizect.com

APPENDIX I – TEMPLATE LETTER TO MUNICIPALITY SUGGESTING USE OF PERMITTING GUIDE

YOUR NAME
ADDRESS
CITY, CT, ZIP CODE

DATE

MAYOR'S OR TOWN CEO'S NAME
ADDRESS
CITY, CT, ZIP CODE

Dear MAYOR'S OR TOWN CEO'S NAME,

Thanks to a U.S. Department of Energy SunShot Initiative Rooftop Solar Challenge award, our Connecticut project team has identified best practices and developed tools to help make rooftop solar PV more affordable and more accessible to property owners in all of Connecticut's 169 jurisdictions.

Recommendations and tools for improving solar PV permitting are provided in the **CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE**. I encourage you to access or download the Guide from Energize CT's Sun Rise New England - Open for Business website[65] and consider adopting the helpful recommendations and tools including:

- The **Connecticut Standardized Rooftop Solar PV Permit Application**
- Affordable, user-friendly options for online permitting
- A solar-friendly permit fee
- Model solar PV ordinances
- A solar PV code compliance reference
- Training resources for municipal staff
- A checklist you can submit to CEFIA to claim your Clean Energy Community Program points for making solar friendly improvements to municipal processes and regulations

Adopting recommendations and tools for streamlining the solar PV permitting process demonstrates TOWN's commitment to clean, local sources of energy. A more efficient permitting process will lower installation costs for property owners, reduce TOWN's administrative costs, support the solar industry, create jobs and strengthen our local and state economy.

Thank you for your time and consideration.

Sincerely,

NAME, AFFILIATION AND CONTACT INFORMATION

[65] www.energizect.com/sunrisene

Thank You!

U.S. Department of Energy SunShot Initiative Rooftop Solar Challenge

energize CONNECTICUT℠

Powered by SunShot U.S. Department of Energy

www.energizect.com/sunrisene

sunshot@ctcleanenergy.com

energize CONNECTICUT

Empowering you to make smart energy choices

Energize Connecticut—programs to help you save money and use clean, affordable energy. Brought to you by the Energy Efficiency Fund, the Clean Energy Finance and Investment Authority, and your local electric and gas utilities, and funded by a charge on customer energy bills.