



Solar Training for Designers and Code Enforcement Professionals

Presenters: Maureen Guttman, AIA & Shawn Martin

Tuesday, September 12, 2017

8:00 AM - 9:30 AM





Best Practices for Designing & Permitting Solar PV Systems

Presented by the Solar Rating and Certification Corporation (ICC-SRCC) & Building Codes Assistance Project



Instructors



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DOE SunShot Initiative Mission

On the Path
TO
SunShot

Solar Training & Education for Professionals (STEP)

Innovative training programs for the solar workforce

#SunShot

- BUILDING DESIGN PROFESSIONALS**
Incorporate solar into building designs
- VETERANS & MILITARY**
Training veterans for solar careers
- UTILITY PROVIDERS**
Operate and interconnect systems to the grid
- REAL ESTATE AGENTS**
Communicate system value to home buyers
- STATE REGULATORS & POLICYMAKERS**
Set policies, design programs
- FIRE INSPECTORS & FIRST RESPONDERS**
Provide inspection & emergency services
- CODE OFFICIALS**
Set standards, inspections

energy.gov/sunshot

Learning Objectives

Upon completion of this course, participants will be able to:

1. Identify the current codes addressing aspects of PV installations and identify resources for municipalities to learn about best practices for solar permitting.
2. Explain basic technical information and the economical, ecological and community benefits of solar PV.
3. List the submittal elements that should be required from the applicant to ensure an effective solar plan review, and cite 2-3 methods other municipalities have employed to address effective solar permitting.
4. Identify methods to act in a leadership capacity to increase solar PV deployment in your community and in your practice and increase services to clients with reliable information on solar costs, benefits and available incentives.



Part #1

Introduction to Solar Energy Systems



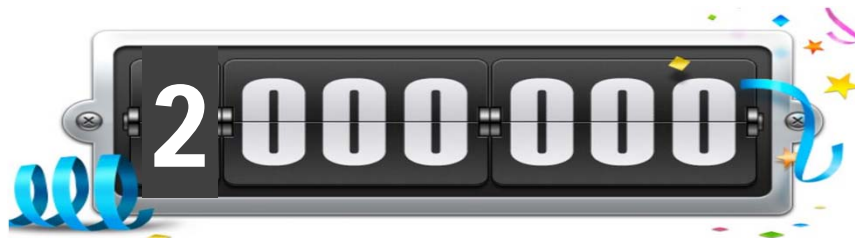
Why are we talking about solar?

As of 2016, over a million residential and commercial structures are equipped with solar PV, increasing the opportunity for professional interactions with this technology



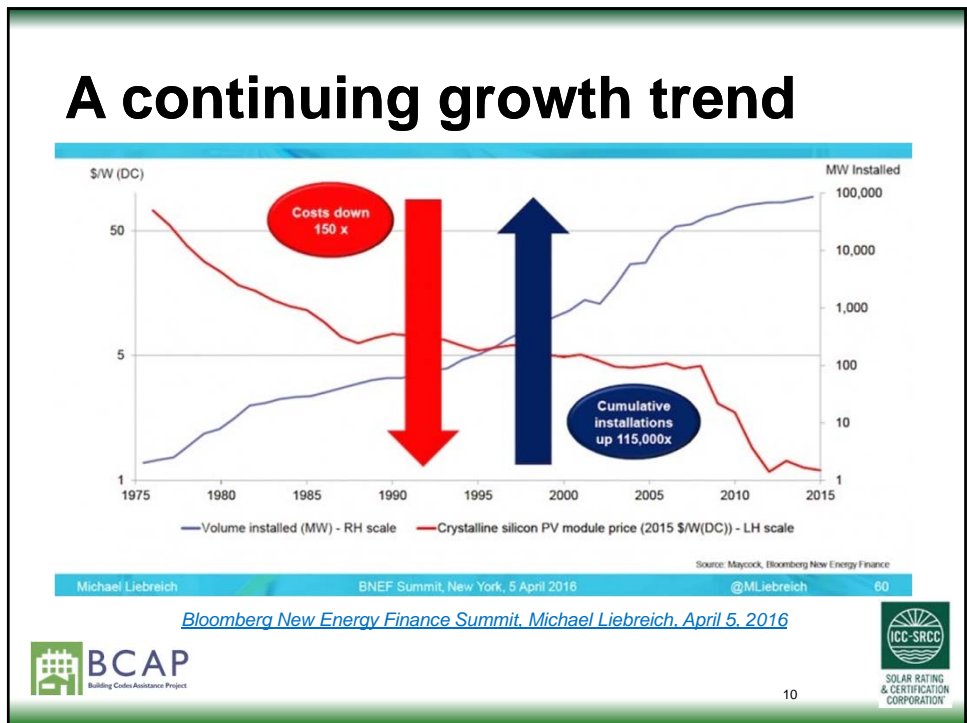
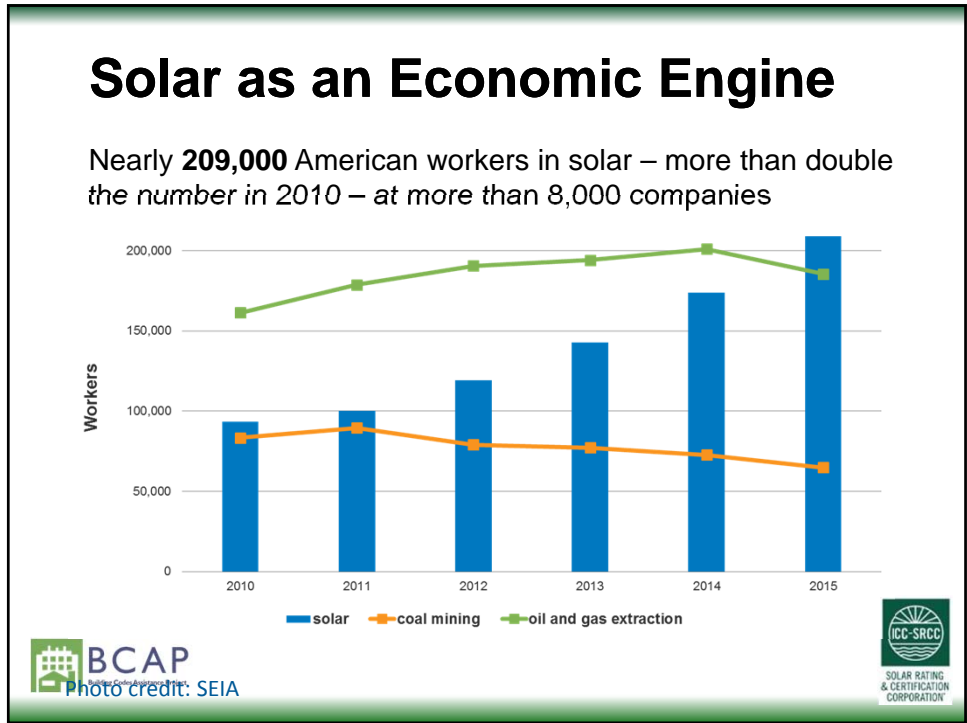
U.S. Solar Market Projection

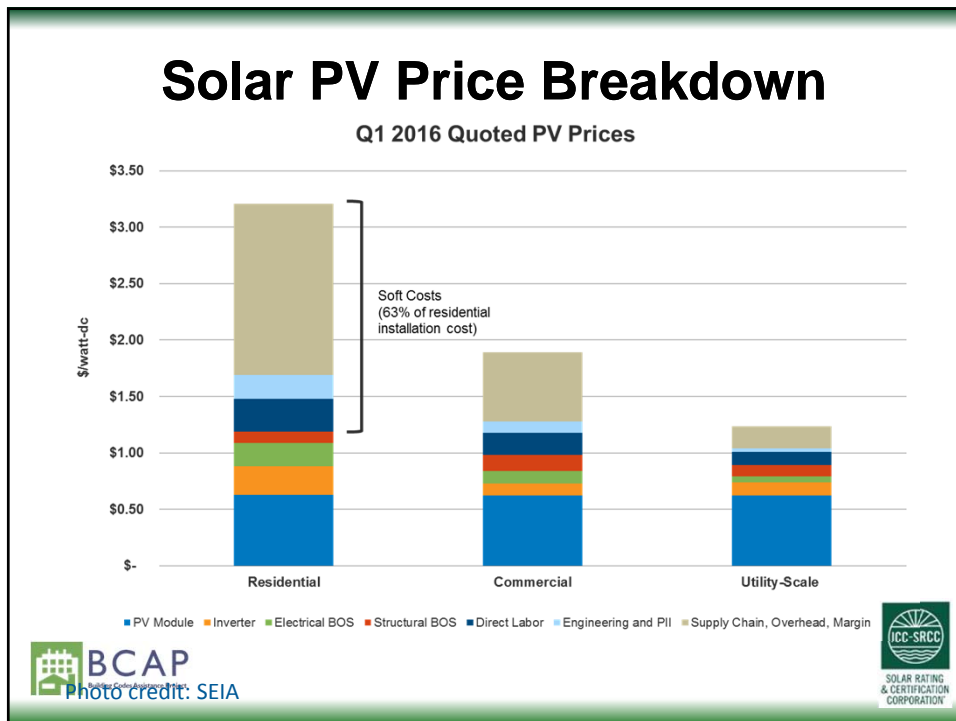
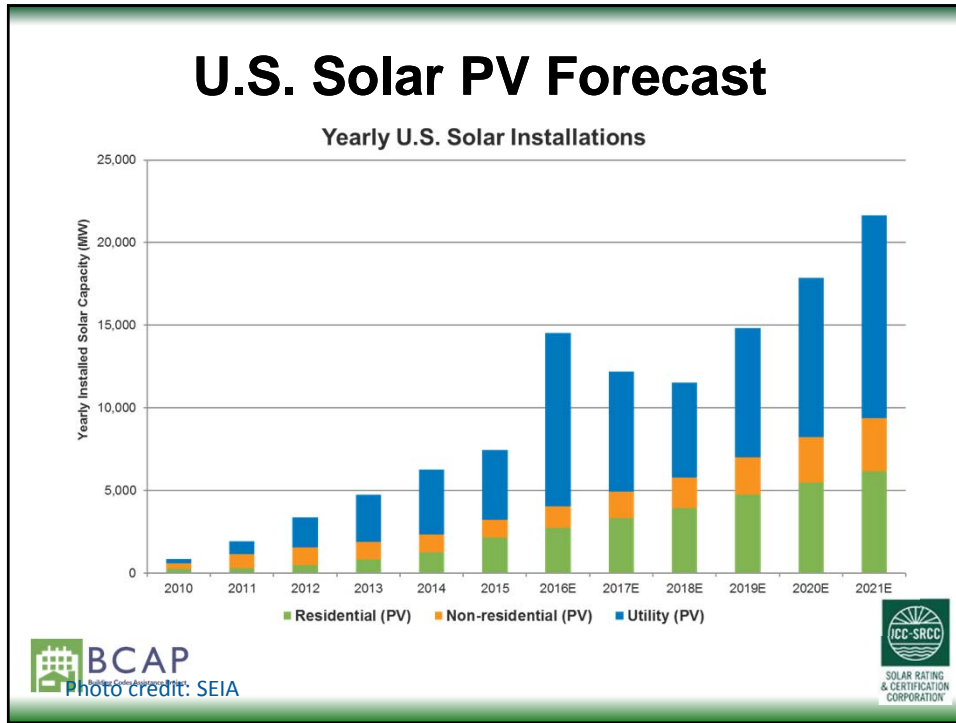
In 2017-2018

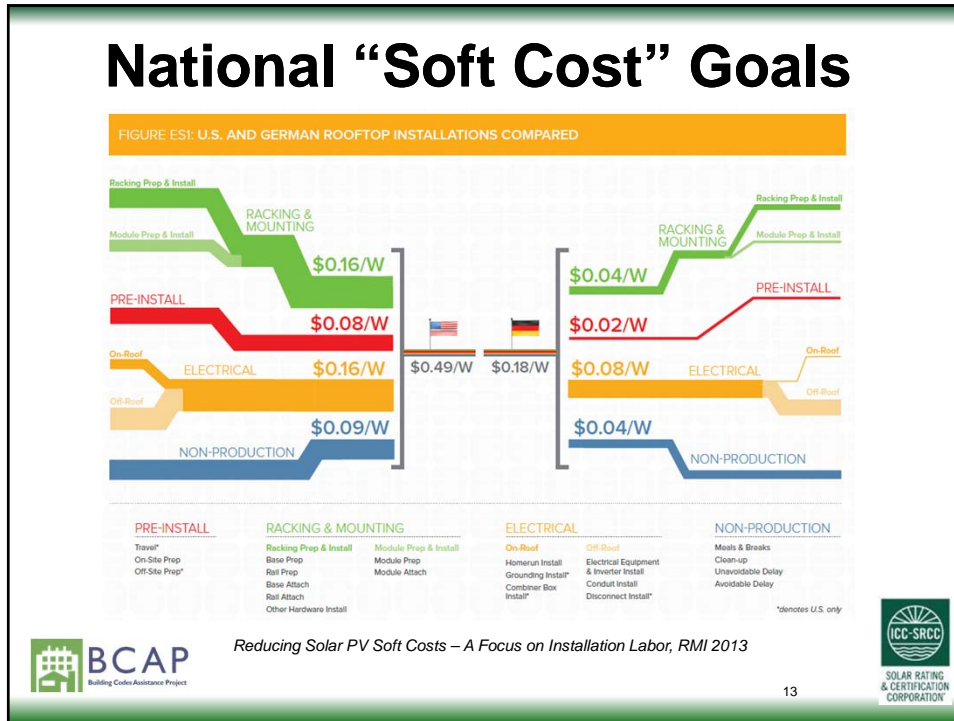


2 million solar installations









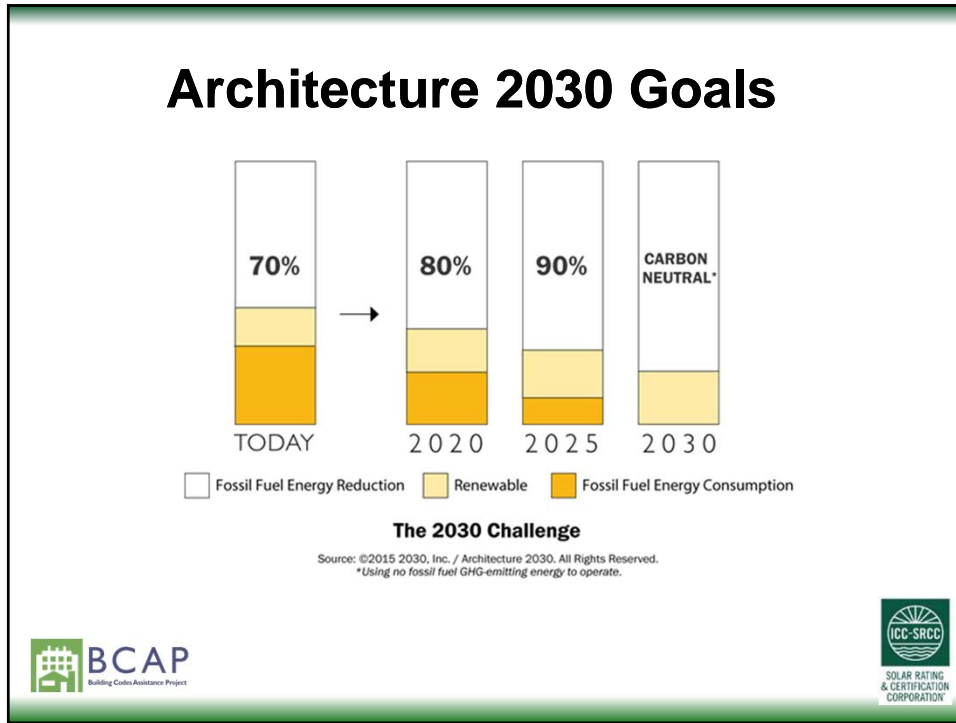
Why is PV training important?

Buildings use about **40%** of primary energy

And **70%** of the electricity

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Why is solar training important for code officials now?



- Strong growth of the solar industry is expected to continue
- Many code officials recognize the need to improve knowledge of solar.
- Focus is now on reducing non-hardware costs.

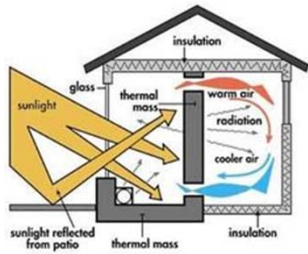


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Part #2

PV Introduction


Types of Solar Energy Systems




Passive




Photovoltaic



Solar Thermal



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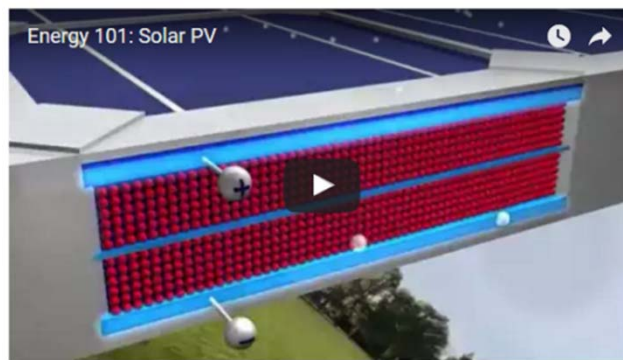
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Solar Modules & Collectors



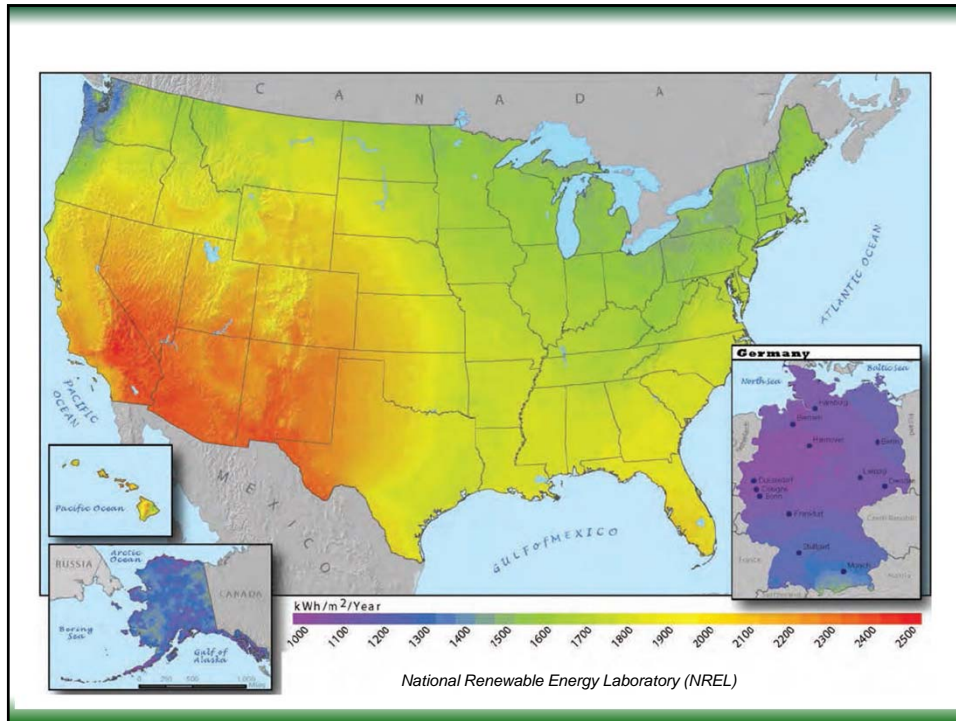
Solar Photovoltaic Basics



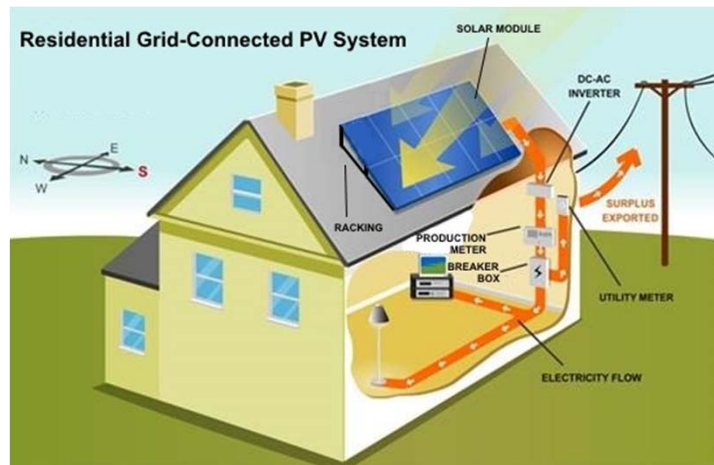
U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy





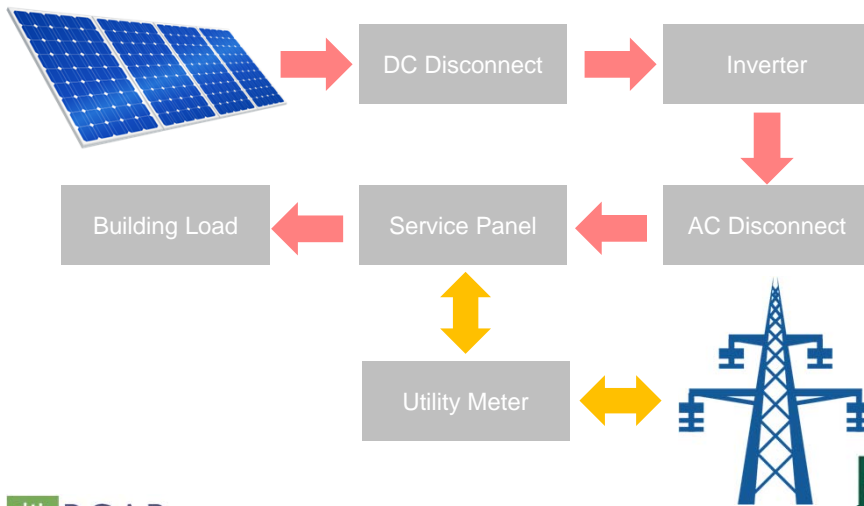
Anatomy of Grid-Tied PV

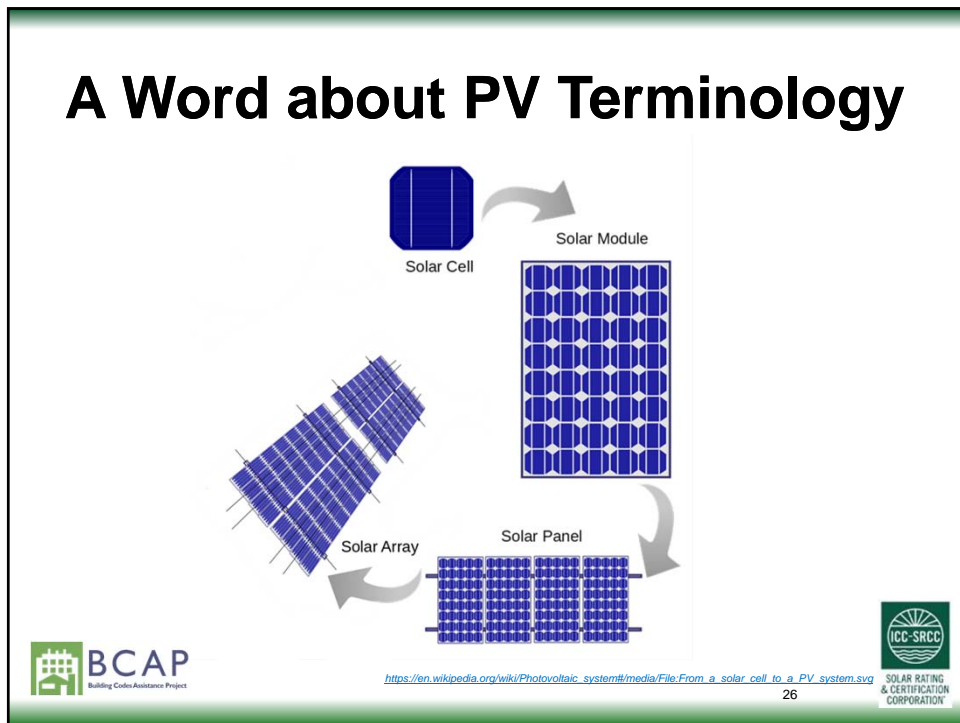
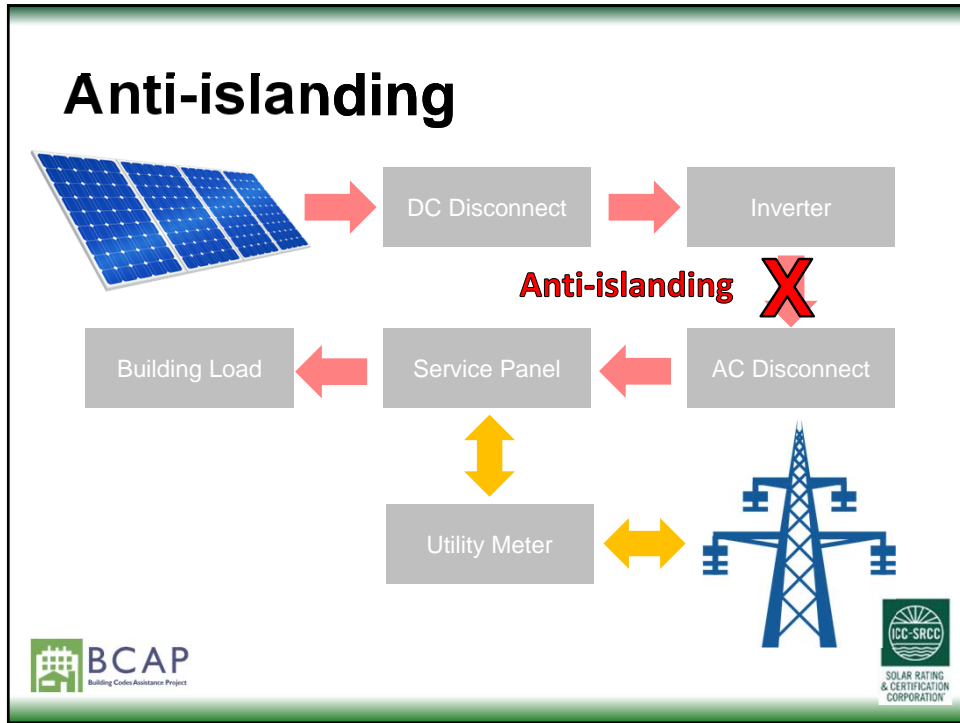


Inverter: Speaking the grid's language



Solar PV Energy Flow







Energy Efficiency (EE) FIRST

- Efficient building construction
- Efficient systems and appliances
- Operations and maintenance
- Change in user behavior
- Natural daylighting
- Natural ventilation

The greenest watt is the one that doesn't have to be produced

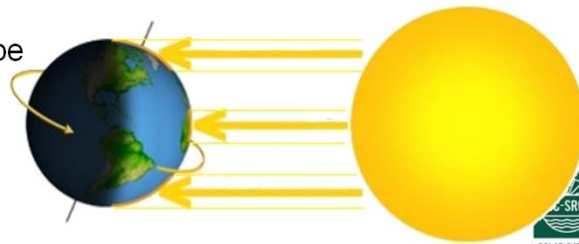
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Key Performance Variables

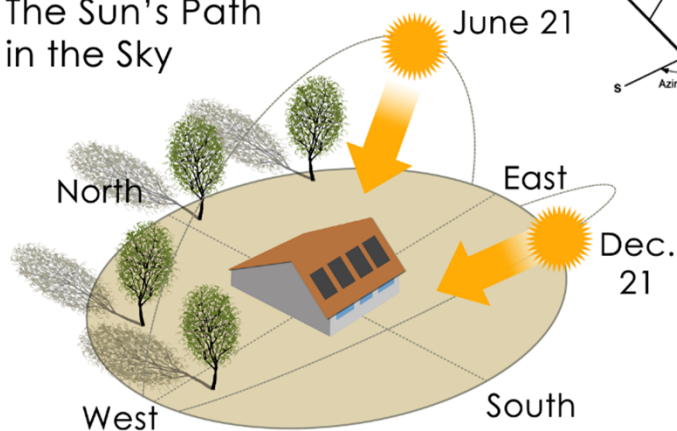
Amount of solar radiation that reaches any one spot on earth depends on:

- Geographic location
- Time of day
- Season
- Local weather
- Local landscape



Orientation

The Sun's Path in the Sky



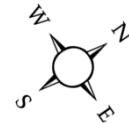
Tilt

Maximum solar production can be achieved when the PV panels are **tilted** towards the sun



Layout

System location will be dictated by the **available area** for the desired system size



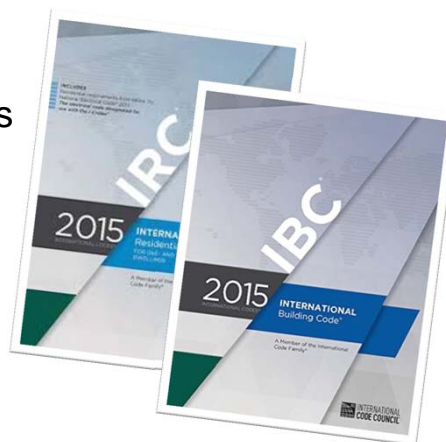
Shading

Shading greatly affects solar PV production

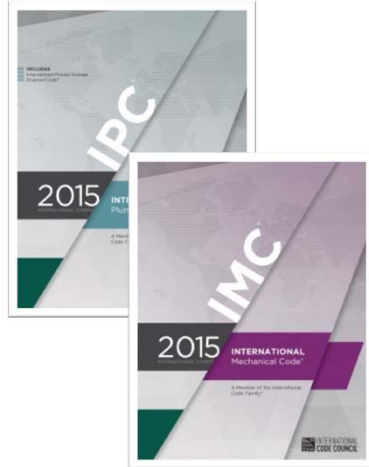


International Building Code (IBC) & International Residential Code (IRC)

- Fire Classifications
- Roof Coverings
- Structural:
 - Wind
 - Seismic
 - Gravity



International Plumbing Code (IPC) & International Mechanical Code (IMC)

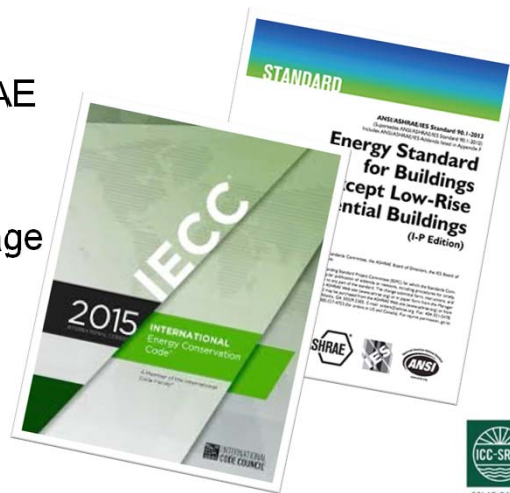


- Label information
- Building envelope penetrations
- Allowable locations
- Roof access
- Roof anchors for fall protection
- Many more provisions applicable to solar thermal



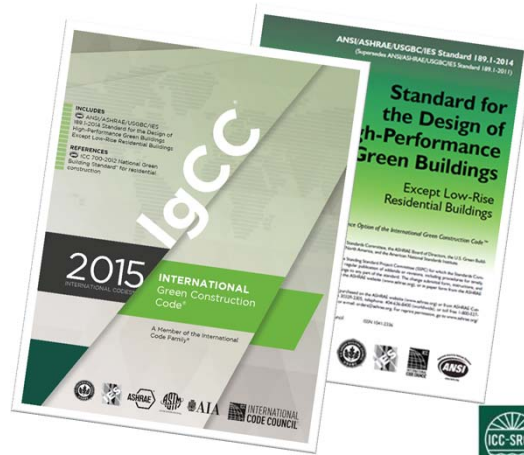
International Energy Conservation Code (IECC)

- Minimum energy considerations
- References ASHRAE Standard 90.1
- Mandatory and enforceable language
- C406.5 On-site renewable energy
- Solar-ready appendices



IgCC and ASHRAE 189.1

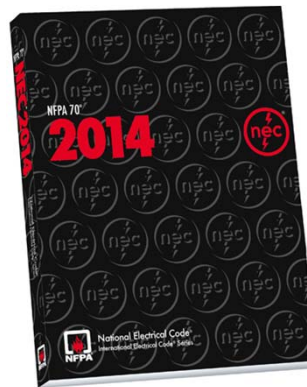
- Total building sustainability guidance
- High performance green buildings



NFPA 70: National Electrical Code

NEC & Solar PV:

- Art. 690 Solar Photovoltaic (PV) Systems
- Art. 705 Interconnection of Electric Power Production Sources
- Art. 250 Grounding and Bonding



Solar Code Resources: ISEP

2015 ISEP
INTERNATIONAL SOLAR ENERGY PROVISIONS AND COMMENTARY

INCLUDED:
• Code solar energy provisions with commentary
• After work section
• ICC-ES ESR-2888, 300 and 301
• 2015 to 2008 NEC solar energy provisions

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Part #4

Best Practices for Permitting PV Systems

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Permitting Challenges



1 in 3 solar installers avoid selling in an average of 3.5 jurisdictions because of permitting difficulties.



Resubmissions of plans occur in 24% of all installations and rework in 16% of installations



AVERAGE
8 WEEKS
INSTALLATION

An average installation requires nearly 8 weeks to be processed by all the relevant jurisdictions.

Image Source: <https://solarpermit.org/>



[Nationwide Analysis of Solar Permitting and the Implications for Soft Costs, DOE SunShot and Clean Power Finance, December 2012.](#)



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The Problem from Both Perspectives

Installer's Perspective

- Varying requirements across AHJs create confusion, rework, and frictional costs
- Requirements within the same AHJ suffer from inconsistent application.
- Requirements are not readily accessible and can be updated without notice.
- Inconsistent processing and cycle times disrupt sales and operations flows (e.g. scheduling staff time, routing crews, and site visits to customers)

"I find myself having to educate the city staff on their own requirements"

"AHJs can change their interpretations of existing codes and you only find out after you are about to submit your paperwork..."

AHJ's Perspective

- Installer errors and incomplete/inconsistent paperwork (e.g. design doesn't match documents) creates extra work and delays.
- AHJs often operate in sub-optimal conditions - strained budgets, under-resourced, staff turnover.
- No channel to communicate updates or simplification of processes to installers.
- Solar installations are uncommon; AHJs are unaware of existing best practices or that a problem even exists.

"Perhaps a fifth of submittal packages are poorly organized and may require hours of red-lining."

"This is a matter of safety, not red tape."



[Nationwide Analysis of Solar Permitting and the Implications for Soft Costs, DOE SunShot & CPF](#)



What makes permitting for solar unique?

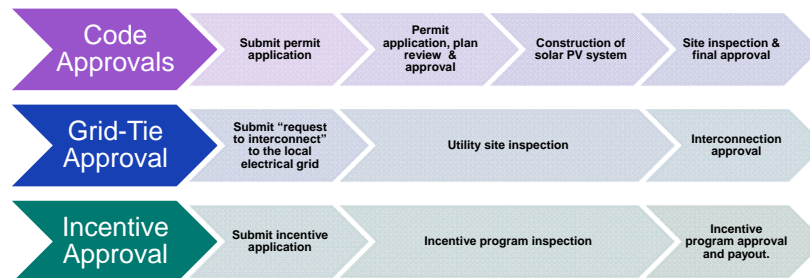
- Impacts multiple disciplines and areas of the building.
- Most frequently retrofits
- Inexperience of code officials with the technology.
- Rooftop access needed for inspection.
- Wide variation in local permitting requirements.
- Scale and pace of solar installs
- Unique financing and marketing of systems
- Many efforts to promote the spread of solar and reduce “soft costs”
- Local laws and ordinances addressing solar installations
- Multiple inspections
- Applicability nationwide, on most types of structures, new and existing construction.



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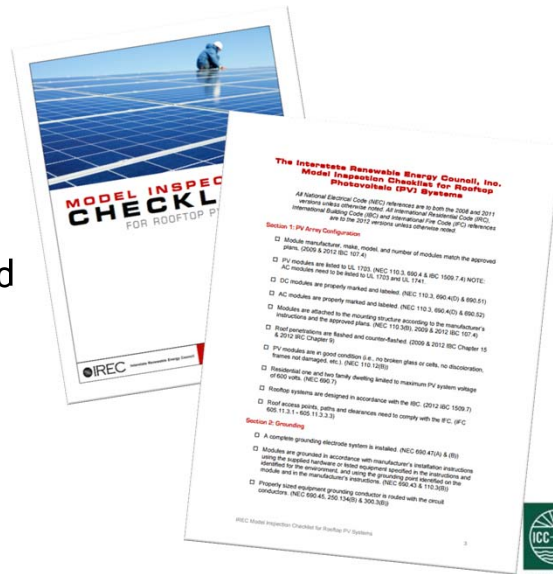


PV's Overlapping Approval Processes



Best Practices for PV Permitting: Themes

- Transparency
- Ease of Use
- Consistency
- Fast Turnaround
- Knowledge



Best Practices: Transparency

- Easy access to PV requirements, forms & fees
 - Consolidate all relevant requirements in one place, regardless of origin or department.
- Clear, consistent definitions.
 - Use terms consistent with model codes and standards.
- Clearly list submittal requirements.
- Summarize fees and anticipated processing times.



Best Practices: Ease of Use

- Create forms and guides specifically for PV permitting.
- Setup a single point of contact for PV systems
- Flat rate or simplified fees.
- Implement expedited permitting procedures for smaller, simpler systems.



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What is “expedited permitting”?

- Definition: An organized permitting process by which a majority of small PV systems can be permitted quickly and easily (Brooks).
- Simple eligibility checklist to determine eligibility.
 - 10-15 kW maximum power output
 - Simplified structural and electrical review
 - Minimize the need for detailed engineering studies
- Not intended to apply to all PV systems
- Widespread use of expedited permitting and growing.

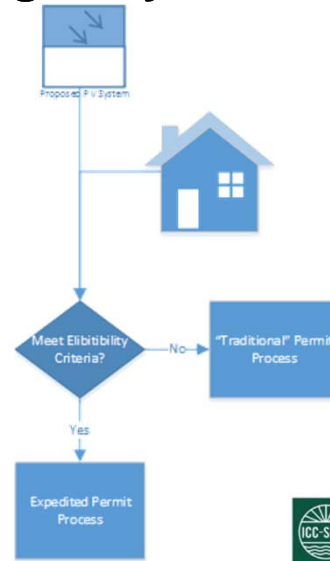


Source: Solar ABCs?: Expedited Permit Process for PV Systems



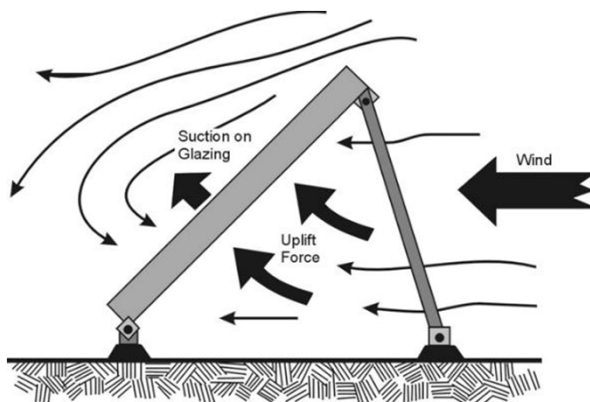
Expedited Permitting: Eligibility Criteria

- Limit system capacity and complexity.
- Simplify structural review.
- Limit applicability to certain building types.
- Installation by licensed solar contractors.
- Utilize listed/certified components.
- Exclude sites with special zoning, historical and architectural requirements.



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Example: Wind Uplift on Collectors



Examples of Expedited Permitting Solutions:

1. Mount collector parallel to the roof, and with a gap no more than 18" inches.
2. Require engineered or certified racking systems.
3. Certified PV modules.



Checklists

- Simple, easy to use format
- Tool for education
- Highlight local interpretations and changes to the codes over time.



AHJs

- Increase consistency of inspections.
- Explain points of non-compliance.
- Consolidate material from different depts/trades.

Designers & Contractors

- Advance preparation for inspection.
- Set expectations for subcontractors.



Introduction to IREC's Model Inspection Checklist for Rooftop PV Systems

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Best Practice: Consistency

- Standardization in model codes, forms and terms
- Provide sufficient detail to encourage consistent application by inspectors
- Seek commonality with requirements in other nearby jurisdictions.



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Best Practice: Fast Turnaround

Permitting

- One-stop or online permitting
- Timely responses to incomplete or inaccurate applications

Inspections

- Eliminate excessive inspections – try to roll structural, fire and electrical inspections together
- Timely response to inspection requests
- Seek opportunities to coordinate interconnect and incentive program inspections



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Best Practice: Training

- Provide solar-specific training for staff involved in plan check and inspections of solar systems.
 - Build familiarity with the technology
 - Learn local requirements, and make use of local expedited permitting material where it exists.
- Make use of solar resources designed specifically for code officials.



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Solar Training & Education for Professionals

UTILITY PROVIDERS
Operate and interconnect systems to the grid

INSURERS
Assess risks

FINANCIERS
Provide capital

REAL ESTATE AGENTS
Communicate system value to home buyers

APPRAISERS, INVESTORS
Value systems

STATE REGULATORS & POLICYMAKERS
Set policies, design programs

FIRE INSPECTORS & FIRST RESPONDERS
Provide inspection & emergency services

CODE OFFICIALS
Set standards, inspections

IREC
International Renewable Energy Council

IFEF
International Fire & Electrical Federation

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BCAP
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Source: U.S. Department of Energy, SunShot Program

PV Training for Architects & Engineers

www.bcapcodes.org

Solar Photovoltaic Training
For Architects and Engineers

Philadelphia, PA
February 27, 2017

Powered by **SunShot**
U.S. Department of Energy

Created by **Sustainable Energy**

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PV Online Training for Code Officials (PVOT)

Online training platform making use of a game-based 3D Model of a Roof-Mounted Residential PV Installation

- Instruction – View descriptions of PV components by selecting items.
- Exploration – Find and identify installed PV components
- Assessment – Identify PV components as correctly or incorrectly installed



PHOTOVOLTAIC
Online Training Course for Code Officials



www.pvonlinetraining.org



Solar PV Safety for Fire Fighters


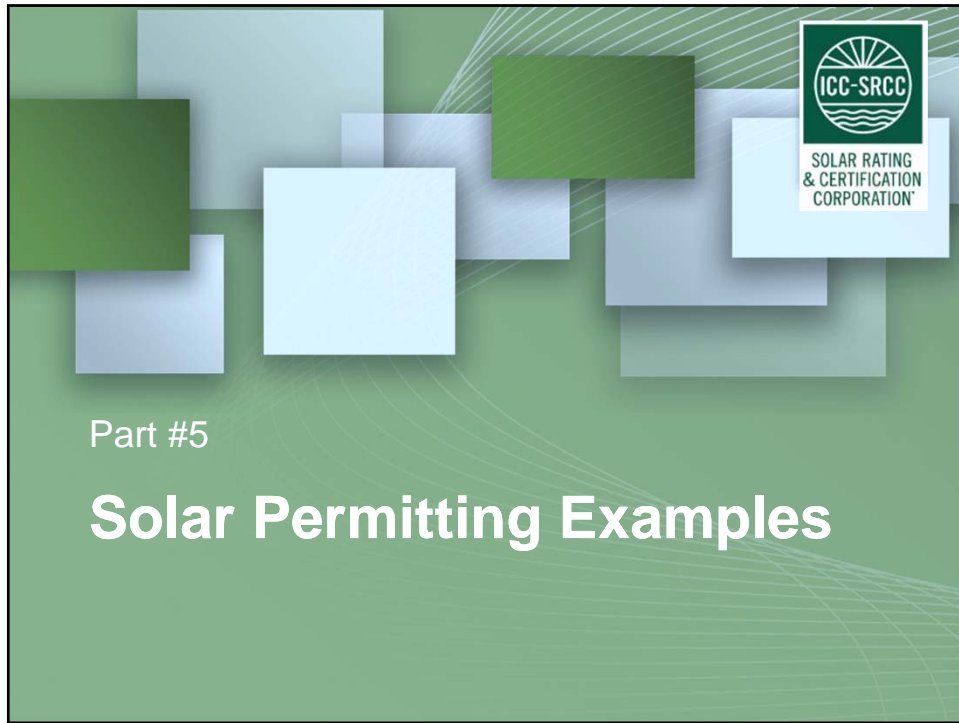
- FREE Online training
- 14 integrated videos
- Simulations to practice new skills
- Self-paced & interactive



www.iaff.org/pvsafetytraining

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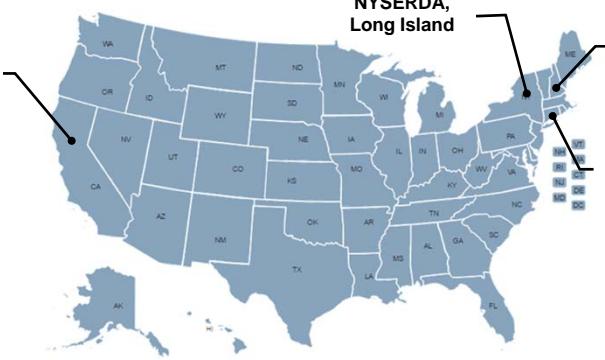




Part #5

Solar Permitting Examples

State and Local Permitting






CA Solar Permitting Guidelines

NYSERDA, Long Island

Solar Friendly Best Planning Practices for NH

CT Rooftop Solar PV Permitting Guide



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AB 2188: Expedited Solar Permitting Act

- AB2188 (Muratsuchi), signed by Governor in September 2014
- Mandates a standardized, streamlined solar permitting process statewide for $\leq 10\text{kW}$ systems
- Cities must implement ordinance by September 30, 2015

Eligibility Criteria for Expedited Permitting

Expedited Permitting Ordinance

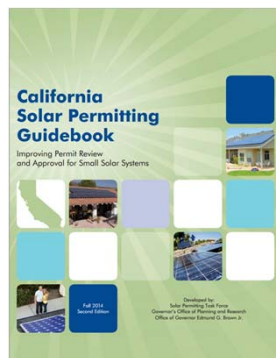
Creation of an Expedited Process

Inspection Process

Changes to HOA Approval Process



CA Solar Permitting Guidebook



- Created by Governor's office, building officials, local governments, state regulatory agencies, solar companies
- Roadmap for local governments to establish a streamlined permitting processes for small, solar rooftop systems under 10kw
- Guidance on interpretation of codes and standards
- 7 toolkit documents for cities to streamline the permit process



“The Qualifying Box”

- PV & SHW
- Less than 10 kW or 30 kWth (SHW)
- Rooftop installations
- String inverter, microinverter, or DC converter (PV)
- Complies with eligibility checklist

90% of all installed systems

- Over 10kW
- Ground mounted and large scale
- Exceed max. building height as defined by jurisdiction
- Structural exceptions – including:
 - In areas with special wind or snow load areas
 - Houses that weren't built in compliance with building structural codes

10% of all installed systems



Source: California Solar Permitting Guidebook, CSE, 3/18/2015



NH Zoning and Planning Reform Suggestions

- Exempt roof-mounted solar from zoning and site plan review regulations
- Exclude PV from impervious surface regulations
- Exempt roof-mounted PV (that doesn't extend beyond the building footprint) from building setbacks
- Exempt small systems from floor area ration and lot coverage requirements
- Exempt roof-mounted solar from zoning and site plan review regs – or classify in the same category as building HVAC equipment




Source: Solar Friendly Best Planning Practices for New Hampshire Communities, January, 2015. 64




CASE STUDY



Example: Solar Express Chicago



- Solar Express implemented in 2013 to streamline solar installations in Chicago
- [Overview Website](#)
- [Easy Permit Process](#)



- [PV Permitting Guideline Document](#)
- [Solar Zoning Policy](#)



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Part #6

Putting it Into Action

Putting it Into Action

- Take Stock - Review current local solar permitting practices. Learn about local laws and regulations for solar. Talk to local solar installers.
- Expand your Knowledge – Learn.
- Make it Better – Improve.
 - Streamline Zoning Requirements
 - Work to Consolidate Inspections
 - Make Requirements Readily Available
 - Create PV-Specific Permitting Materials
 - Consider Expedited Permitting Processes for PV



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Model Expedited Permitting Resources

- Interstate Renewable Energy Coalition (IREC)
 - Model Inspection Checklist for Rooftop PV Systems (2011 NEC, 2012 IRC/IBC/IFC)
 - Best Practices in Residential Solar Permitting
- ICC-SRCC International Solar Energy Provisions (ISEP)
 - Resource A: Checklist and Submittal Requirements for Expedited Permitting of Solar PV Systems (2015)
- Solar ABCs
 - Expedited Permit Process for PV Systems (2012)





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FINAL REFLECTION



Review Questions

1. Why is permitting and inspecting solar PV systems different than others.
2. Solar systems are really only useful in warmer regions (T/F).
3. Name the codes where provisions impacting solar systems appear.
4. Name some specific steps that can streamline solar permitting.



Thank you for participating

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To schedule a seminar, contact:
The ICC Training & Education Department
1-888-ICC-SAFE (422-7233) Ext. 33818
E-mail: icctraining@iccsafe.org



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