Solar Tech

SunShot
U.S. Department of Energy

Solar 3.0

Residential
and
Commercial Solar PV

www.Solar30.org

Initiatives

Local best practices

National impact

Partners

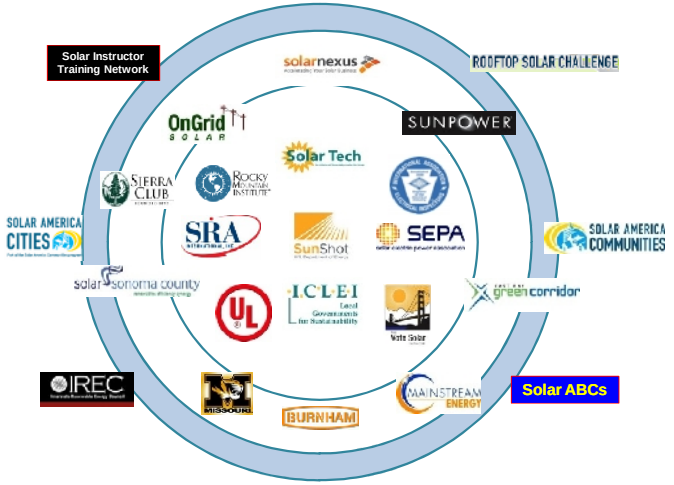
Collaborative Consortium

Solar 3.0 Team

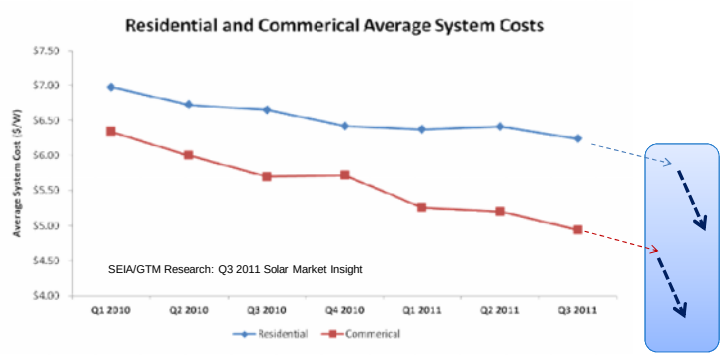
Solar 3.0 Defined

- An industry initiative to rapidly expand the market
- Earlier efforts focused on pre-requisites
  - Solar 1.0
    - 2006 – 2008
    - Policy focus
  - Solar 2.0
    - 2009 – 2010
    - Technology focus
- Solar 3.0 Outreach and Promoting best Practices
  - Identify inefficiencies and promote consistencies

Solar 3.0 Team



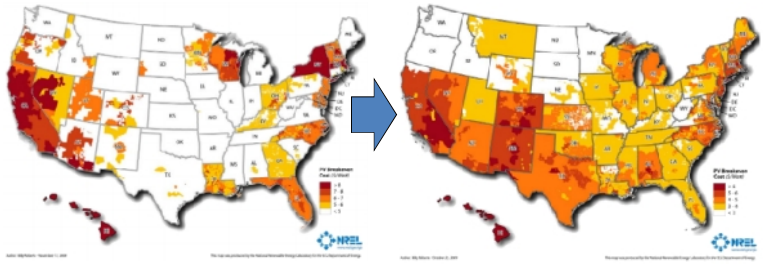
Installed System Costs Continue to Decline



Solar 3.0 = Better Tools | Efficient Markets | Lower Costs

Lower costs = Larger Market

- Residential PV break-even installed price in 2008 assuming full retail net metering, state incentives and 30% TC.
- Residential PV break-even installed price in 2015 assuming full retail net metering and 30% TC.



Solar 3.0 2012 Goals

- Develop a comprehensive Solar 3.0 implementation plan
  - Motivate adoption of optimal permitting and inspection practices by code officials and related stakeholders
  - Increase awareness of tools, standards, and guidelines by 50%
  - Achieve 30% Solar 3.0 Tool Kit adoption by code officials in the targeted communities
- Select Top 100 communities for maximum adoption
  - Communities will receive in-person and online workshops at no cost to implement Solar 3.0 toolkits
  - Communities will be coached and evaluated for "Solar readiness"
- Establish www.Solar30.org as a clearinghouse of expert information on solar PV system deployment best practices

Top 100 Targets in 2012

Roof Top Challenge or Solar America Cities Participant

High Alternate Energy Cost & High Insolation (Sunshine)

Renewable Portfolio Standard Adopted

High PV Installed Base

> 500,000 Population

green corridor solar sonoma county 80 Other U.S. Cities


PV Industry


Code Officials


Inspectors

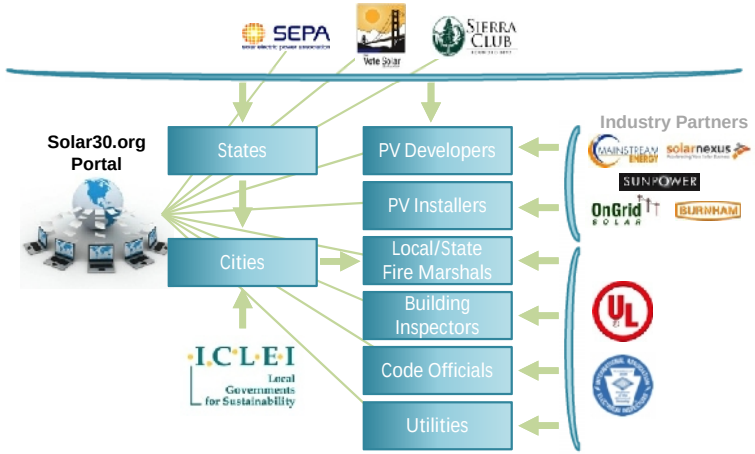

Fire Marshals


Utilities

Solar 3.0 Cost Reduction Tools

- Solar 3.0 Resource Toolkit
  - Industry best practices
  - Comprehensive curriculum
  - Metrics & dashboards
- National Outreach
  - State
  - Metro region
  - City
- Stakeholder Education
  - Cities
  - Utilities
  - PV industry

Solar 3.0 Outreach & Channels



Accomplishments To Date

- Solar30.org web site & tool kit
- Survey of installation practices
- PV Online Training joint development
- Companion course development
- California Guidebook contributions
- Baseline metrics analysis
- Events program started

PV Online Training

Objective –

To educate code officials in using proper methods for:

- Inspecting residential solar PV installations
- Detecting common installation mistakes
- Applying an expedited permit process

- Training uses DOE's NTER online training platform
- Training to be available in May
- An information button or "i-button" references the National Electrical Code.
- Hands-on companion workshops are being planned by Regional Training Providers and SolarTech's 3.0 initiative

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PV Online Training for Code Officials

Modules

1. Roof Mounted Arrays and Wire Management
2. Electrical: Roof and Ground Mounted
3. Ground Mounted Arrays
4. Appropriate Signs
5. Equipment Ratings
6. Expedited Permit Process

This content will be presented via text, drill-down information, and a variety of media including still photos, videos, and selected 3D models.

Capstone

- How to Identify Solar Installation Problems

This will be an immersive, highly interactive lesson using 3D models and game-based interaction techniques.

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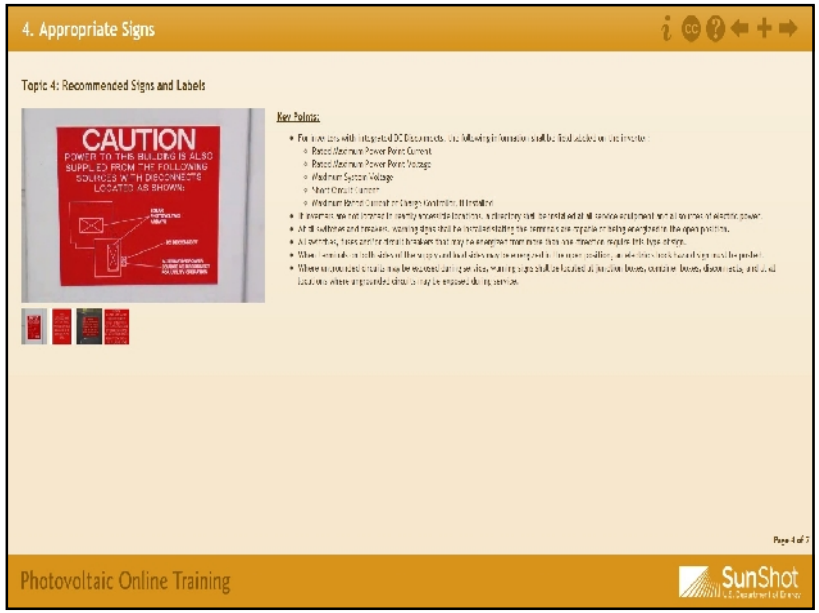

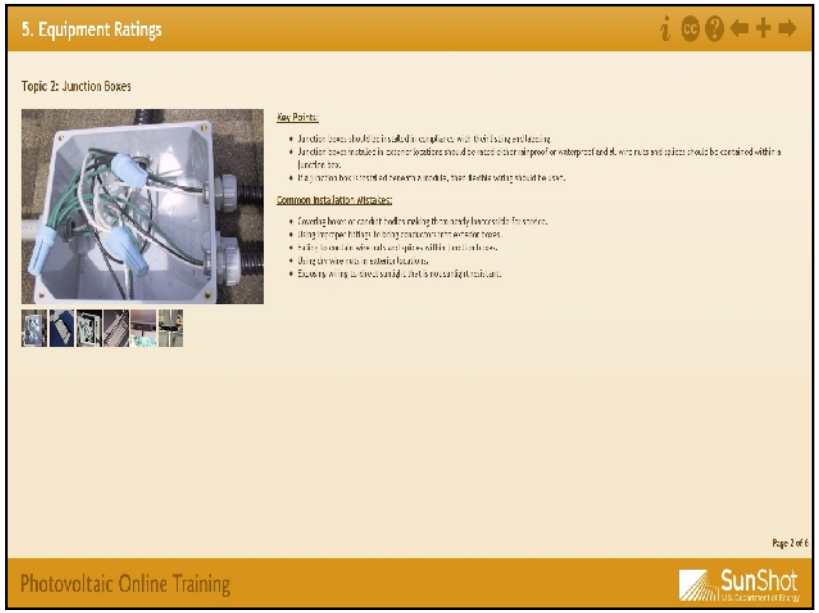
5. Equipment Ratings
Topic 2: Junction Boxes
Key Points:
Common Installation Mistakes:
Page 2 of 6
Photovoltaic Online Training
SunShot


Capstone
BACK

Solar Photovoltaic Workshop

Presented in Partnership by:

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Solar Photovoltaic Workshop

Developed in Partnership with:

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PV Installation Concerns

- Utility compatibility and interaction
- Environment
  (e.g. indoor, rainproof, corrosion resistant)
- Maximum number of modules
- Fire exposure ratings
- Location on roof
- Effect on roof covering
- Wind and snow loading

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Items needed to Inspect PV?

- Permits
- Plans
- Wiring
- Attachment
- Equipment

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Plans - Electrical

- Electrical plan should be submitted that includes the following:
  - Locations of main service or utility disconnect
  - Total number of modules, number of modules per string and the total number of strings
  - One-line diagram of system
  - Specify grounding/bonding, conductor type and size, conduit type and size and number of conductors in each section of conduit

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Plans - Electrical (cont.)

- Electrical plan should be submitted that includes the following:
  - Make and model of modules, inverter(s) and/or combiner box if used
  - If batteries are to be installed include them in the diagram and show there locations and venting
  - Equipment cut sheets including inverters, modules, AC and DC disconnects and combiners

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Plans - Electrical (cont.)

- Electrical plan should be submitted that includes the following:
  - Labeling of equipment as required by Article 690 and Article 705
  - Site diagram showing the arrangement of panels on the roof or ground, north arrow, lot dimensions, and the distance from property lines to adjacent buildings/structures (existing and proposed)

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Plans - Structural

- Structural plan identifying support information for roof mounted systems including the following:
  - The type of roof covering and the number of roofing layers installed
  - Type of roof framing, size of members and spacing
  - Weight of panels, support locations and method of attachment

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Plans - Structural (cont.)

- Structural plan identifying support information for roof mounted systems including the following:
  - Framing plan and details for any work necessary to strengthen the existing roof structure
  - Any relevant calculations (when required)
  - Location of PV equipment on the building

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Plans - Structural (cont.)

- Structural plan identifying support information for roof mounted systems including the following:
  - Where an approved racking system is used...
    - provide documentation showing the manufacturer of the rack system
    - maximum allowable weight the system can support
    - attachment method to the roof or ground
    - product evaluation information or structural design for the rack system

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Plans - Code Requirements

- Site Plan –
  NEC 80.21 (Annex H), IBC 107.2.5, IRC R106.2
- One-Line Diagram –
  NEC 215.5
- Attachment Details –
  NEC 110.3(B), IBC 107.2.1, IRC R106.1.2
- Equipment Specifications –
  NEC 690.4(D), IRC R905.16.1, IRC R905.16.3, IRC M2302.3, IRC M2302.4, IBC 1505.8, IBC 1507.17.1, IBC 1507.17.3, IBC 1509.7.2, IBC 1509.7.4

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Attachment

- The International Building Code (IBC) Section 106.3 Load Supports
- Dead loading and wind loading of roof are covered in IBC 1603.1.4, 1603.1.8, 1604.2, 1606,2

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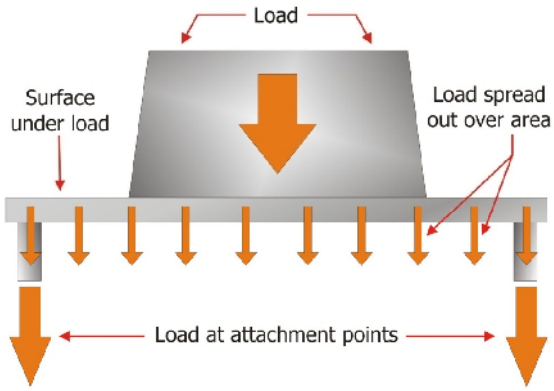
Rooftop Loading



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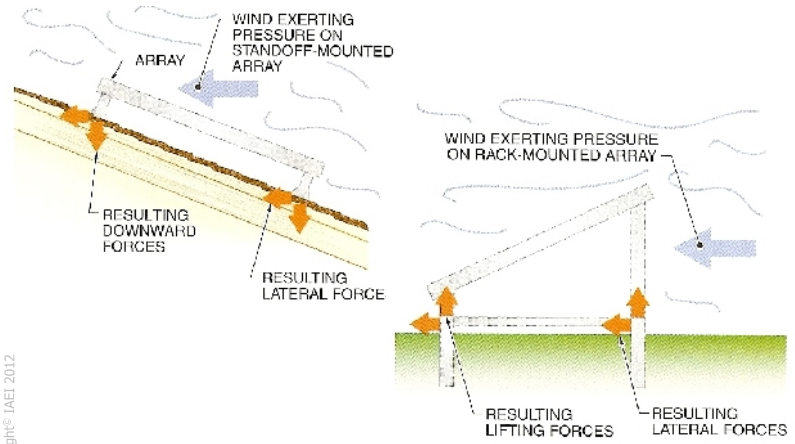
Wind Loading



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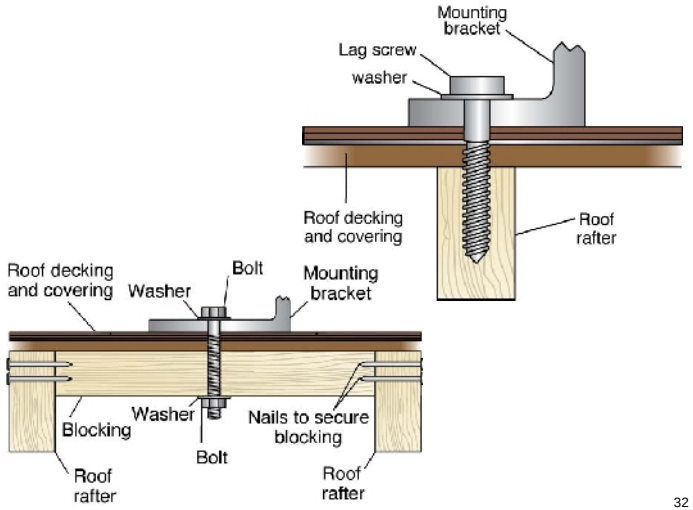
Rooftop Anchorage



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Key Inspection Points

- Number of PV modules and PV model numbers match plans
- Array conductors and components are installed in a neat and workman like manner
- PV array is properly grounded
- Electrical boxes are accessible and connections are suitable for environment
- Array is fastened and sealed according to attachment detail
- Conductors ratings and sizes match plans

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Key Inspection Points (cont.)

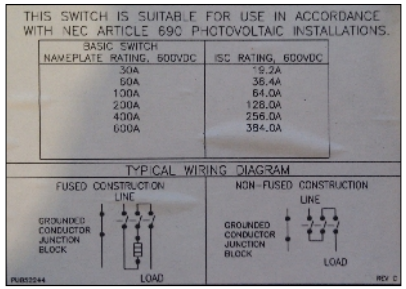
- Appropriate signs are properly constructed, installed and displayed, including:
  - Sign identifying PV power source system attributes at dc disconnect
  - Sign identifying ac point of connection
  - Sign identifying switch for alternative power system

Key Inspection Points (cont.)

- Equipment ratings are consistent with application and installed signs on the installation, including:
  - Inverter has a rating as high as max voltage on PV Power Source sign
  - DC-side OCPD's are DC rated at least as high as max voltage on sign
  - Switches and OCPDs are installed according to manufacturers specifications

Key Inspection Points (cont.)

- Many 600 volt dc switches require passing through the switch poles twice in a specific way



Photos courtesy of Jeff Fecteau

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Key Inspection Points (cont.)

- Equipment ratings are consistent with application and installed signs on the installation, including:
  - Inverter is rated for the site ac voltage supplied and shown on the ac point of connection sign
  - OCPD connected to the ac output of the inverter is rated at least 125% of maximum current on sign, and is no larger than the maximum OCPD on the inverter listing label
  - Sum of the main OCPD and the inverter OCPD is rated for not more than 120% of the busbar rating

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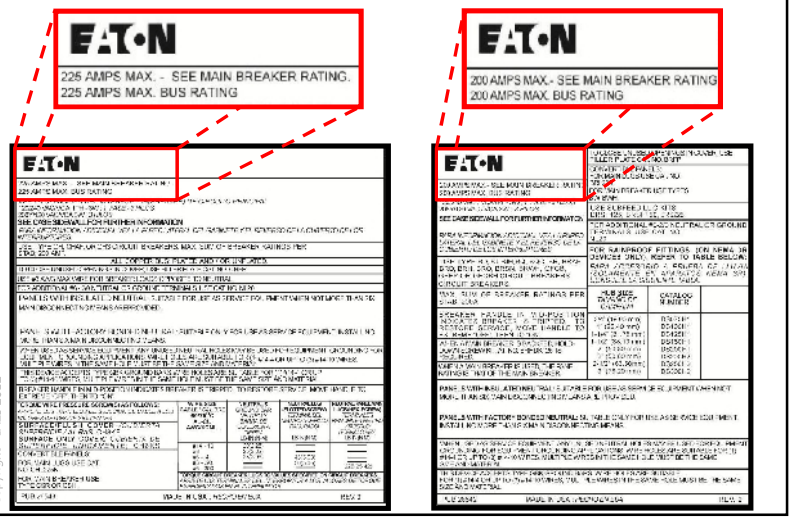
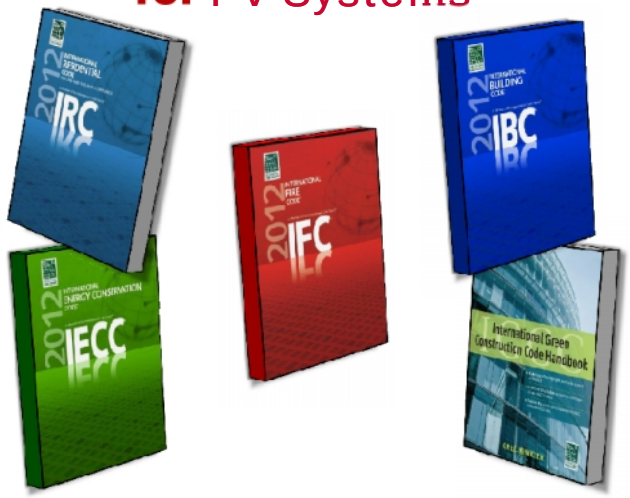
Key Inspection Points (cont.)



Other Code Requirements for PV Systems



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Solar 3.0 Event Schedule

- Workshops (with CEU's)
  - July 24 - Boston, MA
  - August 28 - Plano, TX
  - Sept 26 - Phoenix
  - Oct 11 - Madison, WI
  - Nov 16 - San Francisco, CA
  - Oct/Nov – NY/NJ
- Outreach
  - July 11 - San Francisco, CA
  - Oct XX - Washington, DC
  - Sept 10 - Orlando, FL

Get Involved Solar 3.0

- Come to www.solar30.org
  - Sign up for news
  - Complete your community or utility profile
  - Explore best practices in Permitting
- Join Solar 3.0 on LinkedIn
- See how Solar 3.0 can benefit your community


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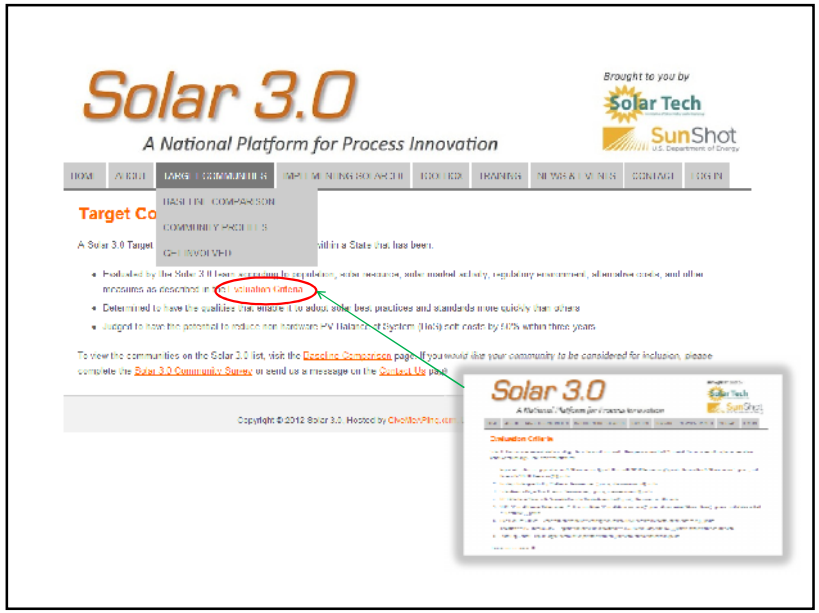
Announcing Solar 3.0 Program Mobilization Event at Intersolar 2012
Register Today for SVLG's 12th Annual Energy Summit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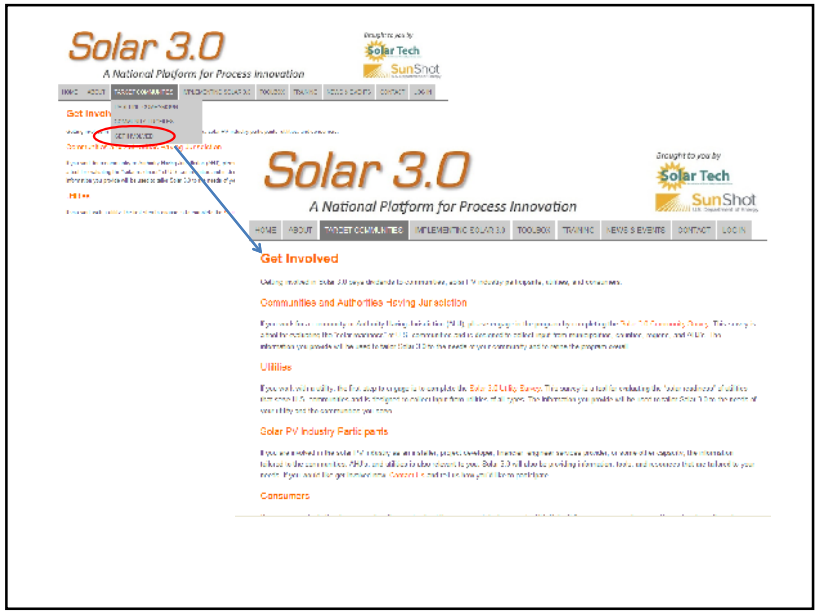
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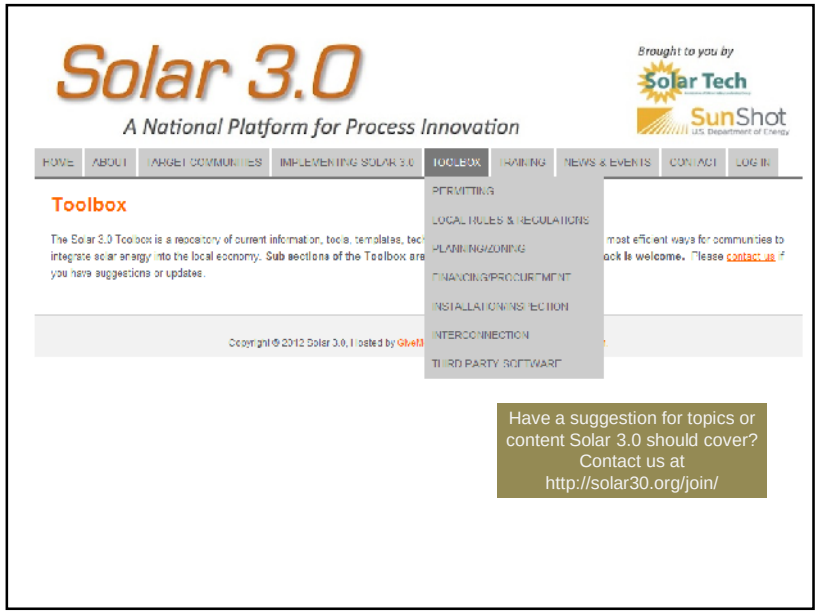
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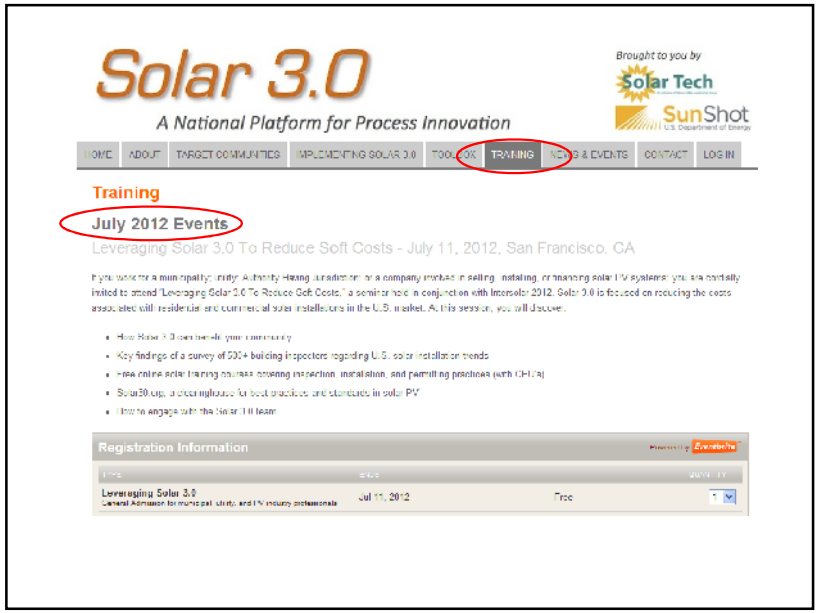
LOCAL RULES & REGULATIONS
PLANNING/ZONING
FINANCING/PROCUREMENT
INSTALLATION/INSPECTION
INTERCONNECTION
THIRD PARTY SOFTWARE
Have a suggestion for topics or content Solar 3.0 should cover? Contact us at http://solar30.org/join/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Leveraging Solar 3.0 To Reduce Soft Costs - July 11, 2012, San Francisco, CA
Registration Information
Leveraging Solar 3.0
Jul 11, 2012
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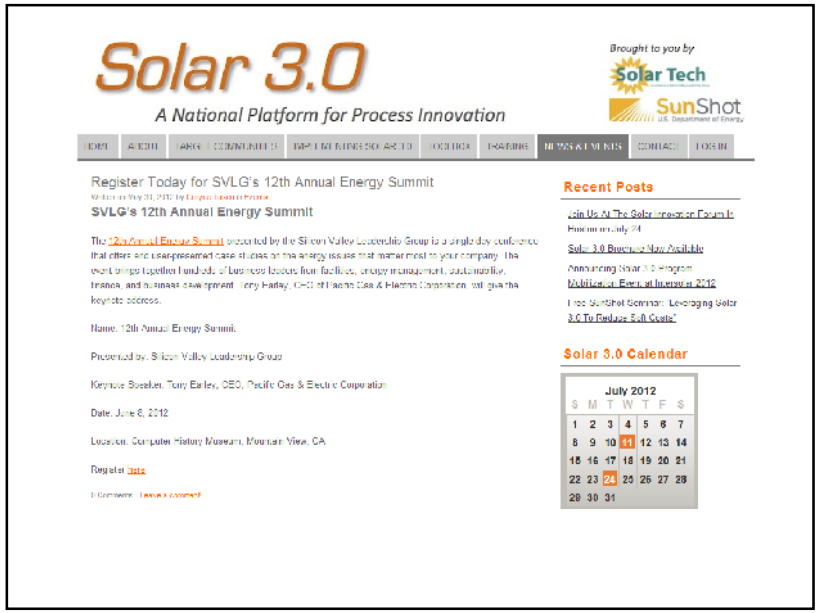
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Recent Posts
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July 2012

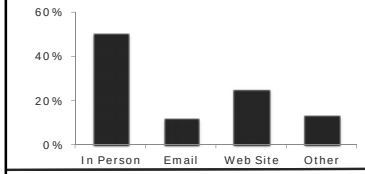
Solar 3.0 – Key Metrics from Code Officials and Local Governments

Recent surveys conducted by the International Association of Electrical Inspectors (IAEI) and ICMA of code officials and local governments have highlighted a number of issues in the realms of permitting, inspection, and interconnection for the Solar 3.0 team to address. They include:

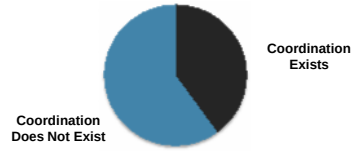
- **In most jurisdictions, permits have to be obtained in person.**
- **Coordination between non-municipal utilities and authorities having jurisdiction is limited.**
- **Few local governments engage in solar education campaigns.**
- **A vast majority of local governments do not offer expedited or streamlined permitting processes for standard PV systems.**
- **Most jurisdictions do not make solar permitting information or fee schedules available online.**
- **A major lack of training amongst both code officials and solar installers exists.**

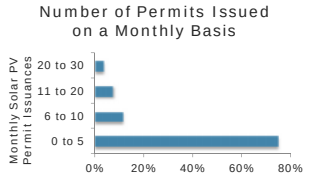
Solar 3.0 – Key Metrics from Code Officials

Only 25% of jurisdictions provide permits in an online location

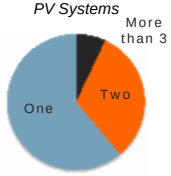


60% of AHJs do not coordinate with the local utility on PV solar processes





Number of Departments Required to Review PV Systems

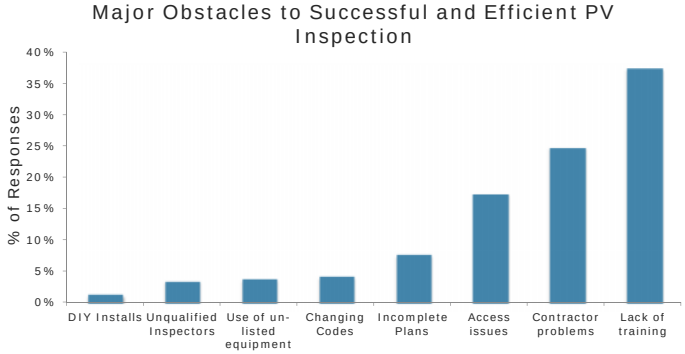


40% of jurisdictions require more than one department to review of PV system permits

Source: International Association of Electrical Inspectors. *Survey of Solar Installation Practices*. www.Solar30.org. April 2012.

Solar 3.0 – Key Metrics from Code Officials

A recent survey of the International Association of Electrical Inspectors determined that a lack of training amongst both inspectors and the solar industry is the single largest barrier to more efficiency in permitting, inspection, and interconnection of rooftop solar PV systems.



Source: International Association of Electrical Inspectors. *Survey of Solar Installation Practices*. www.Solar30.org. April 2012.

Solar 3.0 – Key Metrics from Local Governments

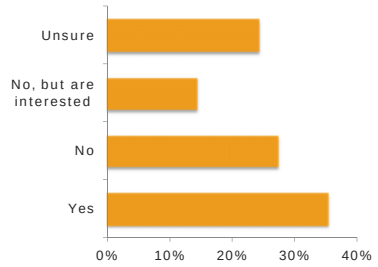
Financial and customer acquisition issues are a major component of non-hardware balance of system costs. Solar 3.0 will also track key metrics in these areas using iterative ICMA surveys as they become available.

Metric	2011 Survey Result
% of jurisdictions reporting existence of bulk purchasing/solarize and/or customer aggregation programs.	**8%**
% of jurisdictions reporting that third party financing is available.	**35% yes, 23% no, 42% unsure**
% of jurisdictions with an active community solar program.	**2%, 5% in progress**

Source: ICMA. *ICMA Solar Survey of Local Governments 2011*. ICMA. Available at: http://icma.org/en/icma/knowledge_network/documents/kn/Document/303523/2011_ICMA_Solar_Survey_Summary_Results

Solar 3.0 – Key Metrics from Local Governments

Responses to the following Question: "Have your code officials gone through training on approving permits and inspecting solar PV installations?"



Source: ICMA. *ICMA Solar Survey of Local Governments 2011.* ICMA. Available at: http://icma.org/en/icma/knowledge_network/documents/kn/Document/303523/2011_ICMA_Solar_Survey_Summary_Results

Of 2,500 local governments surveyed, only 13% offer an expedited process for rooftop PV installations

What Can You Do?

- Pull: the program and tools towards you
- Push: the tools out through your networks
- Tell: the story

Solar3.0 = Better Tools | Better Markets | Better Business

Questions?

Thank You