



# Reducing Soft Costs

Codes and Standards Education For Building Officials

# Codes and Standards for Solar

Solar codes and standards are complicated by the need for multiple trades and skillsets

- Electrical
- Roofing
- Plumbing
- Carpentry
- IT



# Growing Complexity in Codes/Standards

- Alphabet soup of codes, standards, and industry best practices
  - Growing more complex every year
- Confusion is the new solar standard



# Codes, Standards, and Best Practices

- Codes
  - Set of rules specifies **minimum level of safety** to protect public
  - Legally required/enforceable
- Standards
  - Voluntary guidelines approved by recognized organization
  - Often used as the basis for codes
- Best Practices
  - Guidelines established by “Subject Matter Experts”
  - Improves long term performance of solar systems

## The Wheel of Accountability





# AHJ - Authority Having Jurisdiction

## Authority Having Jurisdiction (AHJ)

- “An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.”



# AHJ's interpret and make the rules

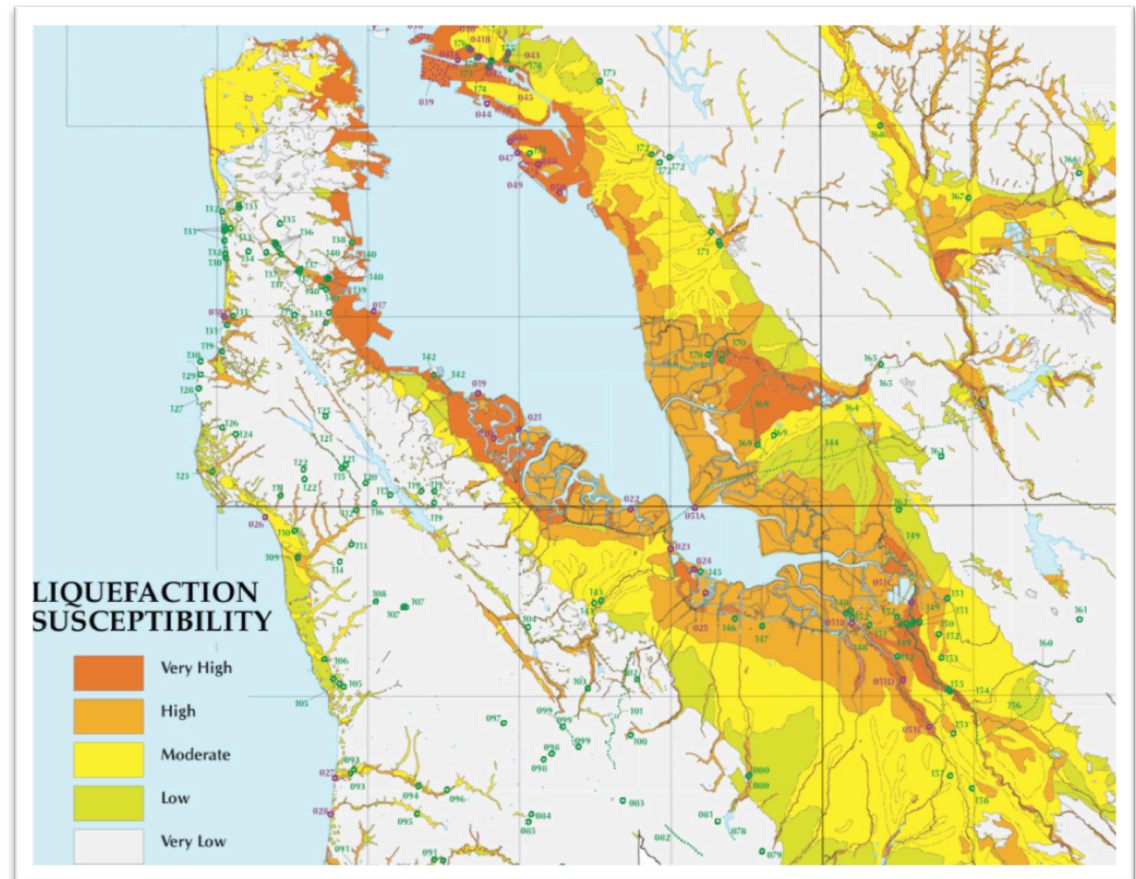
- AHJ's interpret codes and standards based upon the state law and state building code requirements
  - Most states electrical, building, and fire codes are based upon NEC, IBC, IRC, IFC, or NFPA1



# AHJ's interpret and make the rules

AHJ's legally empowered to amend building, electrical, fire codes based on unique conditions

- Climatic
- Geological
- Seismological
- Topographical

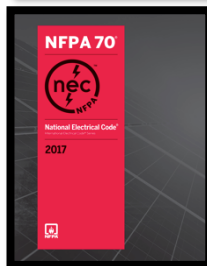


Soil liquefaction map for San Francisco Area helps highlight unique seismological and geological variables driving jurisdictional implementation of codes and standards

# Codes/Standards in Solar

- Most PV systems were not permitted and inspected until the 2000's
- PV permitting now represents over half of permits issued by many building departments
- Unfortunately codes and standards are getting more complex and building officials struggling to keep up

## Electrical



1703 1741



2703

## Fire

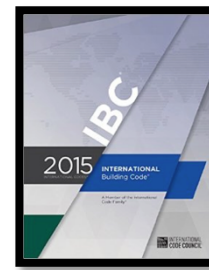


1703



2703

## Building

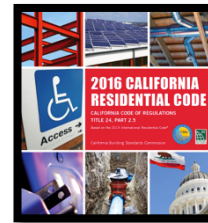


TILE ROOFING INSTITUTE



NRCA

## State





# Options to resolve AHJ conflicts

- If permit denied or inspection failed due to incorrect codes/standards interpretation, you can appeal the AHJ decision to higher authority
  - Chief building official, city council, board of supervisors, fire chief, etc..
  - Concerns about future permitting/inspection difficulties
- More than 90% of codes/standards interpretation disputes can be resolved via effective communication



# Jurisdictional Outreach Services

- Many solar manufactures provide technical support in resolving interpretation issues
- CALSEIA codes/standards committee provides education and member support for resolving jurisdictional interpretation
- Center for Sustainable Energy
  - Don Hughes provides jurisdictional outreach to support solar installers



# Combination Inspectors Growing Trend

- National trend toward combination inspectors
  - Fewer electrical inspectors
- Couple this reality with the growing technical complexity of solar codes and standards
- The challenges are understandable

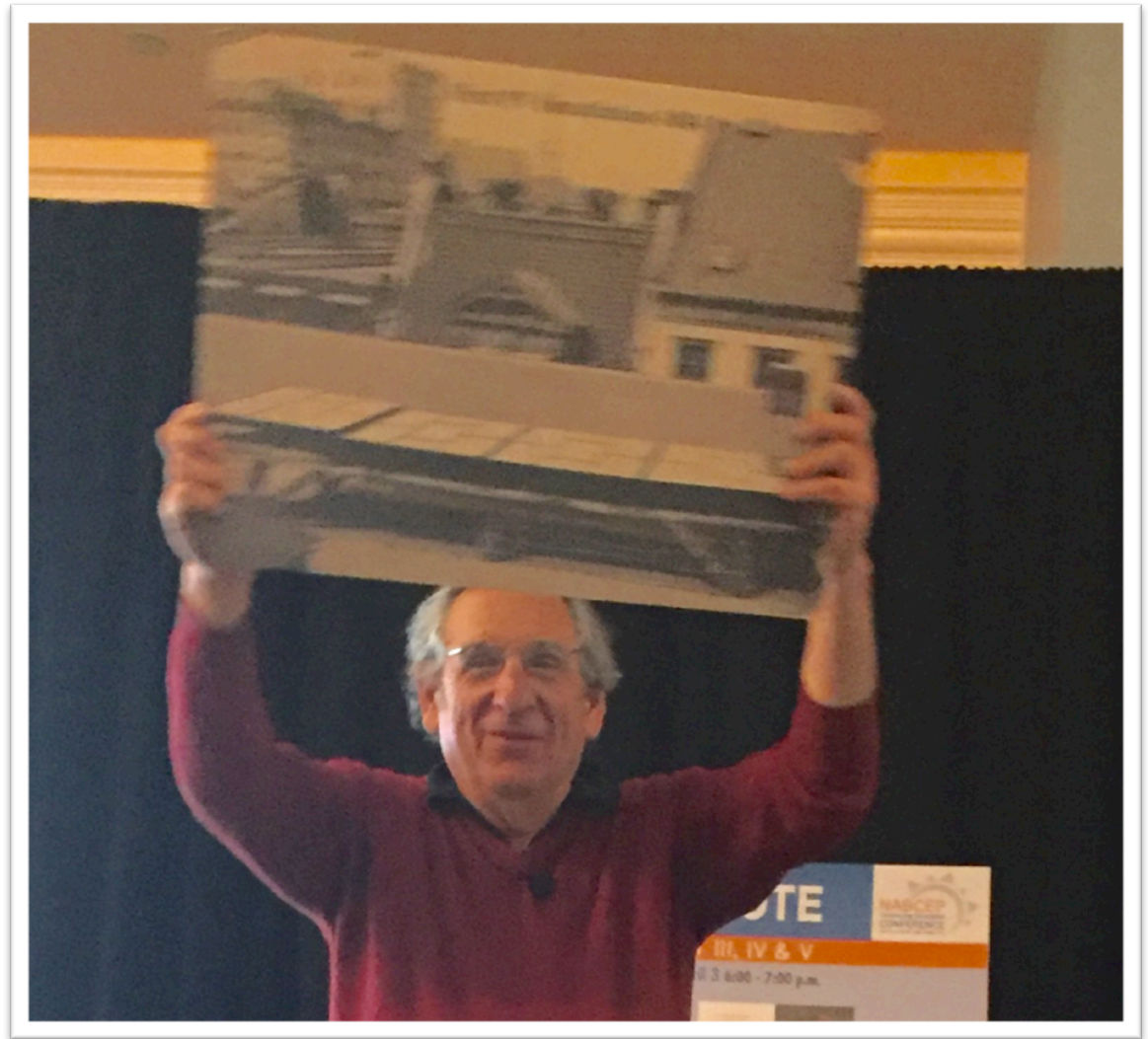


Fewer electrical inspectors,  
more combination inspectors



# Solar PV debuted in the 1800's

Solar Historian John Perlin shows off the first rooftop PV system in 1880's in Manhattan





# Early 80's Racking Systems

Stand up rack  
Custom fab angle iron



A true "Rack-less" system  
Gravity held modules





# UL 2703

## Rack Mounted PV Systems



### Quick Rack® Rail Free Racking System

Quick Rack by Quick Mount PV®  
Max upward pressure: 35 psf  
Max downward pressure: 50 psf  
Max down-slope pressure: 23.4 psf  
Conforms to UL STD 2703  
Patents 7,762,027; 8,938,932



**Fire rating:**  
see installation  
manual for  
requirements

**Intertek**

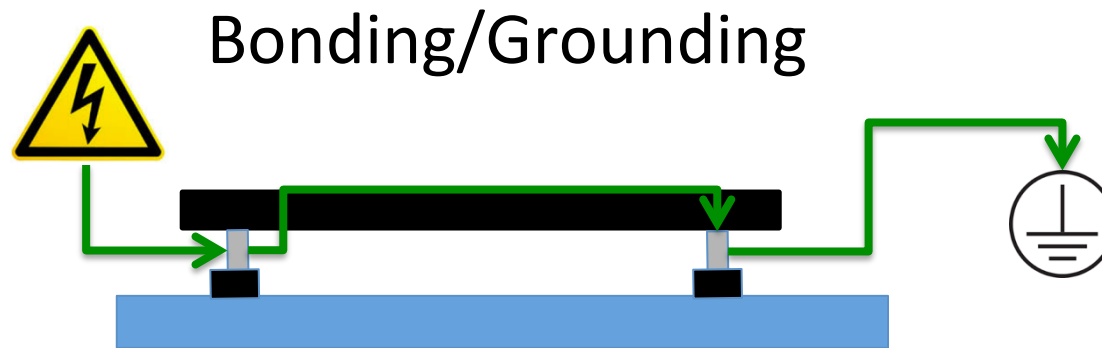
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Made in USA



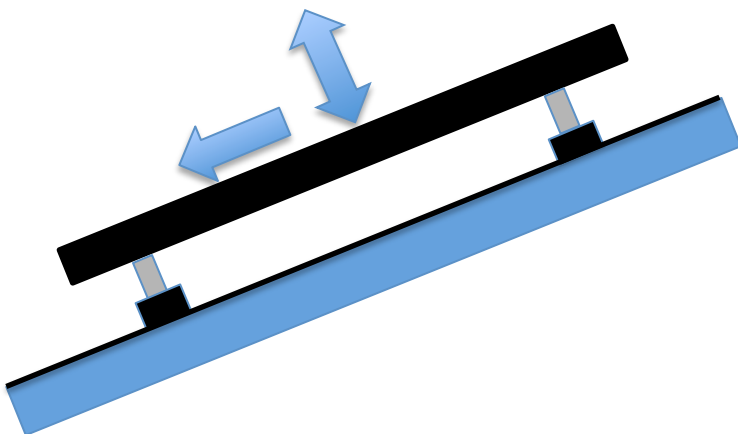
**PV MOUNTING SYSTEM  
CLASS A E361971**

# UL 2703 has three major attributes



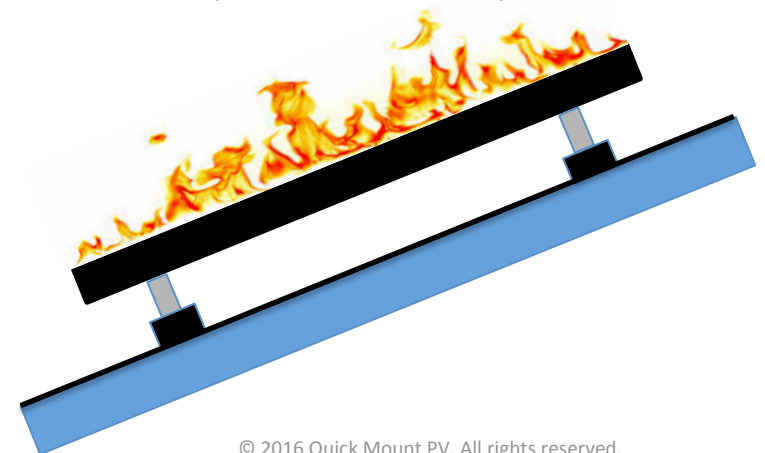
## Mechanical Loading

Upward, Downward, Downslope



## Fire Classification

(UL 1703/2703)





# Roof attachments are not part of UL 2703 bonding/grounding

- Roof attachments are not part of the UL 2703 listing
  - Rare exception, some systems listed with specified mounts
  - Most steep slope UL 2703 listed systems avoid specifying roof attachments to give installer options





# Roof attachments are not part of UL1703/2703 fire classification

- **Roof attachments are not considered in the PV system fire testing** unless they are specified in the installation instructions
- Most steep slope PV systems avoid specifying roof attachments in the installation instructions to give installers maximum flexibility in roof attachment selection



# Building Official Education

- IAEI Chapter Meetings
  - Southwest Section Meeting next August in San Diego
- ICC Chapter Meetings
  - Top building officials regularly attend
- State Building Official Orgs
  - CALBO: California Building Officials
  - NEBOEA: New England Building Officials Education Association



# Solar Energy Action Committee

- Monthly meetings between top building officials and solar industry
  - Formed by LA County in 2015
- Effective way to address codes and standards interpretation as well as permitting and inspection issues



# Solar Energy Action Committee

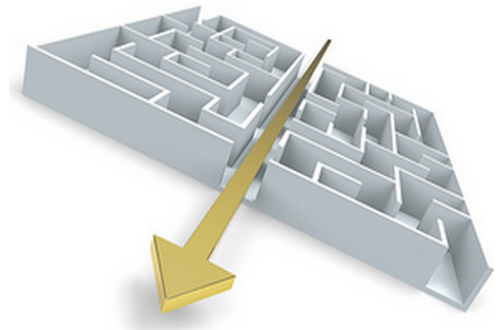


- **Building officials**
  - LA County, LA City, San Diego County, San Diego City, Oceanside, Bakersfield
- **Utilities**
  - SDG&E, SCE, LADWP
- **Test labs**
  - UL, Intertek, CSA, TUV, QAI
- **Solar installers**
  - SolarCity, Sunrun, Sungevity
- **Manufacturers**
  - Quick Mount PV, Ironridge, Enphase, Solaredge
- **Organizations**
  - CALSEIA, Center for Sustainable Energy



## SEAC published guidelines on permitting, inspection, and interconnection

- AB 2188 Streamlined Permitting Requirements
  - <http://www.seacgroup.org/ab2188>
- UL 2703 Information Bulletin
  - <http://www.seacgroup.org/ul2703>
- Utility Interconnection Requirements for one and two family dwelling rooftop solar systems
  - <http://www.seacgroup.org/utilityinterconnection>
- Energy storage permitting/inspection guidelines in development.
  - Utilize new UL subject standard and NEC 2017 codes



SEAC is helping  
clear the confusion

# Questions

