Solar Code Development

An Introduction to the Practice and the Process
Agenda

- Model Code Development
- Solar Code Requirements
- SEIA Engagement
The U.S. Safety System

Installation Codes

Product Standards and Certification

Inspection and Enforcement

Safe Products and Safe Installations
Purpose of Installation Codes and Standards

Basis for adoption by jurisdictions

Reasonable and practical safeguarding of people and property

Mitigate hazards
  • Fire
  • Electric shock
  • Personal injury

Sustainability and environmental impact
Code development drivers

New technology
Field incidents
Improvement
  • Research
  • Enforcement issues
  • Interpretations
How model codes address new technology

Code proposals
Alternate materials and methods
Temporary Interim Amendments (TIAs)
  • Technical merit
  • Emergency nature
U.S. Model Installation Codes and Standards Developers

ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers
IAPMO – International Association of Plumbing and Mechanical Officials
ICC – International Code Council
NFPA – National Fire Protection Association
ASHRAE (www.ashrae.org)

ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings

ASHRAE 189.1 - Standard for the Design of High-Performance Green Buildings
IAPMO (www.iapmo.org)

Uniform Plumbing Code
Uniform Mechanical Code
Uniform Solar Energy and Hydronics Code
ICC (www.iccsafe.org)

International Building Code
International Existing Building Code
International Residential Code

International Fire Code

International Plumbing Code
International Mechanical Code

International Energy Conservation Code
International Green Construction Code
NFPA (www.nfpa.org)

National Electrical Code (NFPA 70)
National Fire Code (NFPA 1)
Building Construction and Safety Code (NFPA 5000)
ANSI-Consensus Process (ASHRAE / IAPMO / NFPA)

Submit Proposal
Technical Committee Meeting
  • Report on Proposals (ROP) or First Draft Report
Submit Public Comment
Technical Committee Meeting
  • Report on Comments (ROC) or Second Draft Report
Technical Committee Reporting Session
Standards Council

Final vote = Any member of the association present at the TCRS
Governmental-Consensus Process (ICC)

Submit Proposal
  • Monograph published

Code Action Hearing (CAH)
  • Report on CAH

Submit Public Comment
  • Public Comment Hearing Agenda published

Public Comment Hearing (PCH)
  • PCH Results published

Final vote = Governmental members of ICC
Stakeholders

Manufacturers
Designers
Installers
Third Party Certification and Testing Organizations
Authorities Having Jurisdiction (AHJs)
Fire Service
Academia
Insurance
Building Owners and Facility Managers
How to be involved

Make proposals
Show up to testify at code action and public comment hearings
Participate in key chapter meetings prior to code hearings
Booth at AHJ organization conference expos

USEHC proposals are due July 1, 2016
IBC-Structural and IFC public comments are due July 22, 2016
Code Resources and Supporting Documents

ASHRAE - Handbooks
IAPMO - Illustrated Training Manuals
NFPA - Handbooks
Adoption of codes and regulations

Amended by federal, state, and local government
Regulations establish requirements for standards
Regulations establish requirements for third party certification
- OSHA – Nationally recognized testing laboratories (NRTLs) – 29 CFR 1910
- States
- Cities and Counties
Solar Code Requirements

Joseph Cain, P.E.

Chair, SEIA Codes & Standards Working Group
### International Fire Code (IFC) and NFPA 1

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International Building Code (IBC)

- Rooftop-mounted PV Systems
  - Fire Classification (1505.9, 1510.7)
  - Wind provisions (1510.7)
  - Live load (1607.12.5)
- Ballasted, unattached PV systems on low-slope roofs
  - Seismic provisions (1613.6)
- BIPV solar shingles
  - Fire Classification (1505.8)
  - Installation (1507.17)
  - Wind provisions (1507.17.8)
International Residential Code (IRC)

- Rooftop-mounted PV systems
  - Fire classification (R902.4, R907.3)
  - Wind provisions (R907.2)
  - Live load (R324.4.1)
- BIPV solar shingles (R905.16)
  - Fire classification (R902.3)
  - Wind resistance (R905.16.7)
- Solar thermal energy systems (Chapter 23)
- Solar Ready Roofs (Appendix U)
International Residential Code (IRC)

- Important: Rooftop setbacks and access pathways printed in error in 2015 IRC 1st printing (R324.7)
- Group R-3 occupancies (single-family and duplex) covered in 2015 IFC
- Intent was to cover IRC one- and two-family dwellings within IRC
- Disapproved at Final Hearing
- R324.7 does not really exist
- SEIA working on fix for 2018 IRC
International Existing Building Code (IEBC)

- 2015 International Existing Building Code (IEBC) is still silent on solar
- SEIA proposal for 2018 IEBC was disapproved at ICC Committee Hearings
- There might be attempts to bring it back with public comments
Int’l Energy Conservation Code (IECC)

- Definition “on-site renewable energy” (C202)
- Residential Energy Rating Index (ERI) method (R406)
- Residential Solar Ready Roofs (Appendix RB)
- ASHRAE 90.1 is another energy standard for buildings (excluding low-rise residential buildings)
Int’l Green Construction Code (IgCC)

• 2015 International Green Construction Code (IgCC) is still light on solar provisions
• 2015 IgCC is not widely adopted
• For 2018 edition, IgCC is being combined with ASHRAE 189.1, and developed under the ASHRAE process
Int’l Plumbing & Mechanical Codes (IPC,IMC)

- Solar Heating & Cooling (SHC) aka “Solar thermal”
- ST panels
- Storage tanks
- Heat exchangers
- Roof anchors for fall protection
Uniform Plumbing & Mech. Codes (UPC, UMC)

- Solar Heating & Cooling (SHC) aka “Solar thermal”
- ST panels
- Storage tanks
- Heat exchangers
- Roof anchors for fall protection
International Solar Energy Provisions (ISEP)

- Assembled and published by ICC
- ISEP is *not* a model code
- Solar provisions from several “I-codes” integrated into one book
- Select solar electrical provisions included under agreement with NFPA
- ICC commentary added
- Serves as a quick reference for implementation and enforcement
2012 USEC was for solar thermal components & systems only
2015 edition expanded for PV & hydronics, and renamed USEHC.
Select solar-specific PV electrical code requirements included under agreement with NFPA
- Electrical provisions not all-inclusive
- Applicable provisions are also found in NEC Chapters 1 through 4
- Need to use NEC for other req’s
NFPA 70: National Electrical Code

Jason Fisher, SolarCity
SEIA Representative to NFPA 70 Code Making Panel 4
With Ward Bower, Ward Bower Innovations
National Electrical Code (NEC) NFPA-70

- Covers the majority of electrical installations
- Not covered – autos, boats, planes, trains, mines, utility-owned generation and T&D
- Covers some utility-owned property (i.e. offices)
- Covers privately-owned generation
NEC Revision Process

- Authored by volunteers from broad stakeholder groups
- 19 Code-Making Panels (CMP) + Correlating Committee
  - Manufacturers, Users, Installer/Maintainers, Labor, Research/Testing, Enforcement, Insurance, Consumers, Special Experts
- SEIA has seat on CMP-4 (Jason Fisher and Ward Bower) covering PV, Wind, Interactive Systems and Microgrids
NEC Content

- Introduction + 9 Chapters + Annexes (not enforceable)
- Chapters include:
  - Articles
  - Parts
  - Sections
- Chapters 1-4 apply to all electrical installations (unless modified by chapters 5-7)
- Chapters 5-7 are special conditions (PV = 690 and 705)
NEC Versions

Significant Impacts on PV:

- 2008 Expanded listed PV equip requirements
- 2011 New PV dc Arc Fault Protection
- 2014 Expanded Arc Fault Protection and Ground Fault Protection. New Rapid Shutdown
- By Mid 2017 Most of the U.S. is expected be on 2014 version
NEC Current Revision

- 2017 revision based on >4,000 Public Inputs to be published late 2016 includes:
  - Major rewrites to Article 690 (PV)
  - Expanded Rapid Shutdown
  - New Articles:
    - 691 Large Scale PV
    - 706 Energy Storage (480 remains)
    - 710 Stand Alone Systems
    - 712 DC Microgrids
- SEIA was heavily involved
NEC Next Version

2020 Revision Cycle Approx. Dates (see www.nfpa.org)

- Public Input before July 2017
- First Draft Meeting Dec 2017
- Public Comments on First Draft May 2018
- Second Draft Meeting Nov 2018
- NITMAMs before Feb 2019
- Membership Meeting June 2019
- Appeals before July 2019
Codes & Standards Working Group

• Member and industry driven initiatives focused on existing, new and upcoming new codes and standards proposals and requirements

• Meets bi-weekly by teleconference, in-person at Solar Power International

• Examples of Working Group accomplishments
Success story: NEC 2017 Revisions

- From 2014 SEIA played a leading role in developing consensus Public Inputs from the PV industry into the NEC 2017 revision process.
- 8 Task Groups were formed with dozens of industry volunteers
- Multiple meetings including F2F
- 84 Public Inputs submitted
- Inputs provided foundation for significant 2017 changes
Success story: NEC Article 710

Motion submitted for June 2016 membership vote on NEC 2017

If successful, this motion would have eliminated the new Article 710 on Stand Alone Systems that contained important content removed from Article 690 recognizing premises generation and load systems not connected to utility systems.

SEIA and other supporters spoke against this motion at the meeting and the motion failed.

SEIA will continue work with CMP-4 to improve this new article.
Success story: UL 1703 fire test modified

- SEIA Codes & Standards Working Group engaged in development of Fire Testing under UL 1703
- Stakeholders agreed to modify fire test protocol

Before, with PV at zero offset: Most systems failed

1st item ignited; 2nd item ignited: Comparative results
Success story: Rooftop Guards/Anchors

3111.1.3 Guards. Installations shall comply with Section 1015.6 prior to installation of solar thermal systems or photovoltaic solar energy systems.

1015.6 Mechanical equipment, systems and devices. Guards shall be provided where various components that require service appliances and equipment within the scope of this code, including but not limited to HVAC equipment, refrigeration equipment, exhaust fans, energy recovery equipment, pollution control units, smoke control fans, solar thermal equipment, are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of such components. The guard shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

Exception: Guards are not required where permanent fall arrest/restraint anchorage connector devices that comply with ANSI/ASSE Z 359.1 are affixed for use during the entire roof covering lifetime. The devices shall be reevaluated for possible replacement when the entire roof covering is replaced. The devices shall be placed not more than 10 feet (3048 mm) on center along hip and ridge lines and placed not less than 10 feet (3048 mm) from the roof edge or open side of the walking surface installed.

Exception: Guards are not required where permanent fall arrest/restraint anchorage connector devices that comply with ANSI/ASSE Z 359.1 are installed.

- Success: SEIA Modification to strike out subsection 3111.1.3 approved
- Success: Proposal for Section 1015.6 disapproved
- Success: Proposal for Exception approved (strike out spacing req’s)
- Success: SEIA modification to strike out “permanent” approved
Success story: Rooftop pathways/setbacks

• SEIA worked with the fire service for improvements in 2015 IFC Section 605.11
  – New exception allows the fire code official to modify or exempt access pathway and setback requirements if rooftop operations are not employed
  – Clarified requirements for nonresidential smoke & heat vents, roof hatches, and skylights

• 2018 NFPA 1 improved (in “first revision”)

• For 2018 IFC and IRC
  – “Colorado compromise” incorporated into 2018 IFC
  – Residential access pathway and setback requirements improved and relaxed under certain conditions
Success story: S52-16 Disapproved

S52-16
IBC: 1512.2 (New).
Proponent: Mike Ennis, representing SPRI Inc. (m.ennis@mac.com)

2015 International Building Code
Add new text as follows:

1512.2 Ballasted photovoltaic panel systems. Ballasted photovoltaic panel systems installed on low-slope roof assemblies shall be secured to eliminate movement/slippage at design wind speeds determined in accordance with Section 1609.

Reason: Manufacturers of single ply roof membranes have experienced damage to their roof membranes due to slippage/movement of roof mounted ballasted photovoltaic modules. For this reason SPRI is requesting an addition to the code to require that these systems be secured to prevent slippage and movement at design wind speeds. Following are some examples of this issue.

- If successful, this proposal would have prohibited unattached rooftop PV systems, instead always requiring “secured” systems
- SPRI concern is possible damage to single-ply roof membranes from sliding PV systems (IBHS wind-tunnel study)
- SEIA is actively working with SPRI to address their concerns
SEIA Membership & Benefits

• Market & industry intelligence and research
• Powerful advocacy and influence
• New business development opportunities
• Tools and programs to advance your business

• Upcoming SEIA Codes & Standards Webinars:
  – Solar Installed: The People and the Process enabling Market Acceptance and Installations (August)
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Thank you for attending!