High Wind Loads and Model Code for PV Arrays

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Solar ABCs Project
Stakeholders Second Quarterly Meeting
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Objectives

- Review wind load requirements for Gulf Coast and Eastern Seaboard regions and the applicability to PV array attachments
- Identify codes, conditions, or methods that allow for the adjustment of design wind loads on PV arrays
- Investigate adaptability of the identified structural designs in the model code
Participants

◆ FSEC
◆ FIU International Hurricane Research Center
◆ Miami-Dade County, District 8 Commissioner’s office
◆ Miami-Dade Building Code Compliance Office
◆ Various Industry Interests
**Design Wind Speed**

- 90 mph for most of the Continental US
- Up to 150 mph for Gulf Coast and Eastern Seaboard regions
- Minimum DWS is 100 mph in Florida
Roof Mounted PV Arrays

- Roof Mounted PV Arrays are typically designed as building Components and Cladding per existing building codes and standards.

- Components and Cladding are defined as elements of the building envelope that are not part of the Main Wind Force Resisting System (MWFRS).
Roof Zones

- End zones and corners experience the highest pressures.
- Arrays should be installed in the interior zone of the roof to minimize the wind loading.
Design Pressures

- Roof Component and Cladding design pressures can exceed 100 psf.
- Upward (negative) design pressures typically exceed the downward (positive) for components and cladding.
- Design pressures are the sum of internal and external pressures.
- 50 psf meets requirements for 100 mph wind zones.
- May be exceeded in 100+ mph wind zones.
Design Loads

- UL 1703 describes the mechanical loading tests for PV modules

- Minimum design load
  30 psf $\times$ 1.5 = 45 psf
ASCE 7 6.4.3 Air Permeable Cladding

Design wind loads shall be used unless approved test data or recognized literature demonstrate lower loads.

IBC 2003 1609.7.2 Roof Coverings

Exception: Rigid tile coverings that are air permeable and installed over a roof deck complying with 1609.7.1 are permitted to be designed in accordance with:

\[ M_a = q_n C_L b L_L a [1.0 - G_{c_p}] \]
Air Permeable Cladding

ASCE 7 6.4.3 Air Permeable Cladding
Design wind loads shall be used unless approved test data or recognized literature demonstrate lower loads.

- Wind loads on air-permeable components are recognized to be less than air-impermeable components.
- Guidance is lacking in ASCE 7 to determine the wind loading adjustment factors.
- Basic research is needed to develop test methodology for air-permeable component loads.
Mounting Hardware

- Array mounting rails and attachments transfer loads from the modules to the structure.

- Loads can be concentrated and may exceed the design strength of structural members if installed incorrectly.

- Mounting foot spacing affects the loading requirements.
Study Schedule

◆ Complete review of the wind load requirements on Gulf Coast and Eastern seaboard and their applicability to PV arrays: January 31, 2008

◆ Identify high wind permeable and resilient installations with reduced design wind loads: March 31, 2008

◆ Investigate selected structural designs with reduced wind loads for their adaptability in the model code: May 31, 2008
Stakeholders Involvement

- Help to identify and prioritize issues and needs
- Participate in quarterly panel meetings, website forum, and other related activities
- Provide input and assistance in panel study, and review study drafts