# Solar PV Panels- Electrical and Fire Code Design Guidelines

## WHAT ARE ELECTRICAL CODE AND FIRE CODE DESIGN GUIDELINES?

To properly plan a safe and efficient solar energy system project, careful consideration must be given to all design elements. Buildings must be properly sited, planned with correct structural support, and interconnections pertaining to the electrical system and fire code safety must be considered so that all elements will comply with code provisions.

This handout is to provide guidance in planning for a solar energy system that operates efficiently and safely, and meets electrical and fire code requirements reflecting best practices and latest technologies. The information below should be viewed as guidance in planning for some of the most common and critical factors to consider. It is not the intent that this serves as a complete summary of all code provisions pertaining to solar energy systems. Please reference the solar provisions of the International Fire Code (IFC) and National Electrical Code (NEC) in their entirety. Web site links are provided to these publications under "Additional Information and Helpful Links".

The following information presented in checklist format is to summarize key code provisions to be incorporated into the design of a solar energy system as applicable to the project.

**INTERNATIONAL FIRE CODE- SOLAR ENERGY SYSTEM PROVISIONS**

| ✓ | Code Section | Summary Description |
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| ❑ | 907.2.22 | Automatic smoke detection shall be installed in storage battery rooms. |
| ❑ | 907.2.23 | Automatic smoke detection shall be installed in areas containing capacitor energy storage systems. |
| ❑ | 1204 | Roof access and pathways capable of supporting fire fighters have been planned as required by code including pathways to ridge, setbacks at ridge, proximity to emergency escape and rescue openings, perimeter pathways, interior pathways, and near smoke and heat vents. |
| ❑ | 1204.4 | Code required clearances around ground mounted arrays are met. |
| ❑ | 1204.5 | For systems with rapid shutdown, labeling requirements have been met including the exact wording, color, size, posting location, and graphics style. |
| ❑ | 1206.2.1 | For systems with storage battery systems, specific permit information is submitted including battery room location and layout, battery quantities and types, manufacturer's specifications, signage, room's fire-rated assemblies, rack storage information, and the room's fire protection systems for the storage battery room. |
| ❑ | 1206.2.3 | A hazard mitigation analysis plan with code required criteria is submitted. |

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| ❑ | 1206.2.4-1206.2.8 | Stationary storage battery systems shall comply with code requirements of structural design, impact protection, combustible storage, testing and maintenance, room location and separation requirements, maximum size of battery arrays, signage, and disconnects. |
| ❑ | 1206.2.8.7 | Outdoor installations shall comply with separation, storage, exiting, and security requirements. |
| ❑ | 1206.2.9 | Battery storage systems within buildings shall be of certain maximum quantities per battery types or meet Group H ( hazard) occupancy type provisions. |
| ❑ | 1206.2.10 | Storage batteries and battery storage systems shall be listed in accordance with UL 1973 or UL 9540, or manufacturer's instructions, and provided with an approved energy management system as applicable. |
| ❑ | 1206.2.10.4-1206.2.10.5 | Battery chargers shall be listed to UL 1564, and inverters listed to UL 1741 |
| ❑ | 1206.2.10.6-1206.2.10.8 | Vented batteries shall be provided with correct safety caps and storage batteries shall be provided with thermal runaway protection and toxic gas detection accordance with IFC Chapter 60. |
| ❑ | 1206.2.11 | Fire detection and extinguishing systems shall be provided per code. |
| ❑ | 1206.2.11.3 | Ventilation of battery rooms and cabinets shall be provided per the International Mechanical Code (IMC) and International Fire Code (IFC) including monitoring requirements, spill control, and neutralization. |
| ❑ | 1206.2.12 | Monitoring requirements, spill control, and neutralization shall be provided per the specific type of batteries in accordance with the code. |
| ❑ | 1206.3 | Capacitor energy storage systems exceeding 3 kWh shall comply with design, location, signage, array sizing, disconnects, and construction requirements of the International Fire Code. |
| ❑ | 1206.3.2.6-1206.3.6 | Capacitor energy systems located outdoors shall comply with location and means of egress requirements, security, maximum quantities, fire detection and suppression systems, spill control, testing and maintenance requirements. |

## NATIONAL ELECTRICAL CODE- SOLAR ENERGY SYSTEM PROVISIONS

| ✓ | Code Section | Summary Description |
|---|---|---|
| ❑ | 705.12 | The point of utility interconnection will be located on the supply side of the service disconnect or on the load side with a dedicated breaker or disconnect. |
| ❑ | 705.12 | For load side connections, the total rating for overcurrent devices plus 125% of the inverter output must not exceed 120% of the panelboard busbar ratings. |
| ❑ | 690.12 | Rapid shutdown device is readily accessible and clearly labeled. |
| ❑ | 690.4 | PV modules must be listed to UL 1703. Inverters and combiner boxes must be listed to UL 1741. Module and rack assemblies must be bonded per UL 2703. |
| ❑ | 690.7 | One and two family dwellings have a maximum PV voltage of 600 volts DC. |
| ❑ | 690.47 | A grounding electrode system is present. |
| ❑ | 690.13 | The PV disconnect serves to disconnect the system from all other systems. |
| ❑ | 690.31 | Conductors are of the proper size, type, and labeling for the intended current capacity and location. |
| ❑ | 690.31 | DC wiring in buildings is installed in metallic raceways. |

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| ❑ | 110.3 and 690.43 | Modules are bonded and grounded per the manufacturer's installation instructions. |
| ❑ | 690.31 | All parts of the system have the correct warning labeling per the code. |

Note: For additional assistance beyond the guidelines listed here, please visit Interstate Renewable Energy Council's (IREC) design guidelines at: https://irecusa.org/

Also visit: Bill Brooks, P.E. Solar America Board for Codes and Standards, Understanding the Cal Fire: Solar Photovoltaic Installing Guide - http://www.fsec.ucf.edu/en/education/southeast_training_network/Background%20on%20CA%20PV%20Installation%20Guide.pdf

## ADDITIONAL INFORMATION AND HELPFUL LINKS

- To view the Village of Lake in the Hills Solar Landing Page visit: https://www.lith.org/cd/page/support-solar-energy-growth

- To view the Village of Lake in the Hills *Solar-Ready Voluntary Guidelines* visit: https://www.lith.org/sites/default/files/fileattachments/community_development/page/6571/solar-ready_building_design_guidelines_3.25.19.pdf

- To view the Village of Lake in the Hills *Solar PV Panels* project guidelines and permitting checklist including *Solar Express Permits* visit: https://lith.org/sites/default/files/fileattachments/community_development/page/1166/solar_pv_panels_permit_information.pdf

- Building Codes currently adopted and applicable to solar photovoltaic projects include:

  2012 International Residential Code (IRC)
  2012 International Building Code (IBC)
  2012 International Fire Code (IFC)
  2011 National Electrical Code (NEC)

  To review these code publications visit: https://codes.iccsafe.org/category/Illinois

- For in- depth guidelines to assist you in preparing your submittal please review the Interstate Renewable Energy Council publication, *Model Inspection Checklist for Residential Rooftop PV.* Visit their web site and permit submission guidelines at: https://irecusa.org/wp-content/uploads/2018/03/PV-Inspector-Checklist-March-2018.pdf

- Additional information pertaining to solar installations has been compiled by the Solar America Board for Code and Standards (Solar ABCs). Visit their web site at: http://www.solarabcs.org/about/publications/reports/expedited-permit/

- For information pertaining to ComEd requirements to connect to the grid, please visit: https://www.comed.com/MyAccount/MyService/Pages/ConnectingToTheGrid.aspx