

Solar America Board for Codes and Standards



UNDERSTANDING THE CAL FIRE SOLAR PHOTOVOLTAIC INSTALLATION GUIDELINE

Bill Brooks, P.E.
Brooks Engineering

UNDERSTANDING THE CAL FIRE SOLAR PHOTOVOLTAIC INSTALLATION GUIDELINE Study Report Overview

This report provides the context and background information for the California Department of Forestry and Fire Protection's (CAL FIRE's) *Solar Photovoltaic Installation Guideline (Guideline)* which was released on April 22, 2008. In May 2010, the International Code Council (ICC) approved a revised version of the *Guideline* for inclusion in the 2012 version of the International Fire Code (IFC). This elevates the importance of the *Guideline* from a recommendation to a legally binding code, and makes the thorough understanding of the reasoning behind the *Guideline* even more important.

To develop the *Guideline*, CAL FIRE organized a task force of fire service and solar industry representatives, building officials, and codes and standards experts. This report provides information about how the task force developed the *Guideline* and why task force members recommended that photovoltaic (PV) systems be designed and installed to accommodate firefighting operations. Additionally, this report provides an overview of each section of the *Guideline*, indicating the corresponding section of the IFC in parentheses, repeating the language from the *Guideline* in italics, and including clarifications in plain text.

Why the Report is Important

The purpose of the *Guideline* is to help firefighters identify PV systems, protect electrical wiring, and safely access roofs for vertical ventilation operations during fire suppression activities. The *Guideline* includes guidance about clearly marking conduit and equipment; access, pathways, and smoke ventilation; and the location of DC conductors in both residential and commercial buildings.

Although the *Guideline* provides specific information that ensures compliance in these areas, there is little information about how the recommendations were developed. Without the information contained in this report, local fire officials may be unwilling to consider alternative means and methods, choosing instead to rigidly implement the IFC. Rigid enforcement creates a process that lacks flexibility, and the complexities of the built environment require flexibility. CAL FIRE's intention in working with the PV industry was to facilitate the installation of PV systems while addressing the concerns of firefighters. A better understanding of the lengthy deliberations that went into the development of CAL FIRE's *Guideline* will encourage balanced and thoughtful enforcement.

Issue

PV systems present unique hazards for firefighters. In a building without a PV system, firefighters can disconnect the utility alternating current (AC) service to protect themselves from electric shock during fire suppression activities. When a PV system is present, however, the situation is not as straightforward, and the PV system can pose dangerous and even fatal risks to firefighters.

When utility power is interrupted, the AC output of the PV system inverter instantly shuts down, and the power flowing to the AC wiring in the



building or to local utility lines stops. When the AC power stops flowing, the direct current (DC) power from the PV system also stops flowing.

The issue is that although the DC current isn't flowing, the PV array's DC voltage remains, and the PV system rests in an open-circuit condition awaiting the return of the utility power. This open-circuit condition is hazardous to anyone coming in contact with the circuits, and firefighters accustomed to conventional AC power systems but unfamiliar with PV systems can be exposed to dangerous and potentially fatal risks.

Key Findings

The CAL FIRE *Guideline* begins with several pages of introductory information, including a history of the task force that developed the document, a short explanation of PV systems for stakeholders unfamiliar with the technology, a resource list for further study, and an explanation of what local governments must do to adopt the guidelines and enforce them as a local ordinance. The brief PV system background provides basic facts, including that PV systems only produce electricity during daylight hours, the typical locations of AC and DC disconnects, and that DC voltages can reach 600 volts. The introduction also describes other types of solar systems and notes that solar thermal systems for heating water or air may look similar to PV arrays, but do not present the electrical hazards of a PV system.

The following is a list of the five main sections from the *Guideline*. These are covered in detail in this report, organized by section and indicating the corresponding section of the IFC in parentheses, the language from the *Guideline* in italics, and clarifications in plain text.

- Marking (IFC 605.11.1)
- Access, pathways, and smoke ventilation (IFC 605.11.3)
- Location of DC conductors (IFC 605.11.2)
- Non-habitable buildings (IFC 605.11.4)
- Ground-mounted photovoltaic arrays (IFC 605.11.4)

For more information please contact Mr. Larry Sherwood, 303-413-8028, larry@sherwoodassociates.com.

Download the full report: www.solarabcs.org/fireguideline

About Solar America Board for Codes and Standards

The Solar America Board for Codes and Standards (Solar ABCs) is a collaborative effort among experts to formally gather and prioritize input from the broad spectrum of solar photovoltaic stakeholders including policy makers, manufacturers, installers, and consumers resulting in coordinated recommendations to codes and standards making bodies for existing and new solar technologies. The U.S. Department of Energy funds Solar ABCs as part of its commitment to facilitate widespread adoption of safe, reliable, and cost-effective solar technologies. For more information, visit the Solar ABCs website: www.solarabcs.org

**Solar America Board
for Codes and Standards**

www.solarabcs.org