

PLUG AND PLAY PV FOR AMERICAN HOMES



- 1 A PV-ready socket installed at the electrical meter makes system interconnection safe and easy.
- 2 Fraunhofer CSE Plug and Play PV system installation and commissioning takes less than 1 day.
- 3 Installer takes photo of completed installation to submit for regulatory approval.

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Overview

The Fraunhofer Center for Sustainable Energy Systems CSE is developing Plug and Play PV systems to dramatically reduce the soft costs of residential PV installations, targeting a goal of \$1.50/Watt installed cost by 2020, down from an average of \$3-4/W installed cost in the U.S. today. The project vision is to make PV systems similar to an appliance – installed quickly, easily, and safely, even by someone with no prior PV installation experience.

The holistic approach to design integrates technologies into a system architecture that simplifies code compliance and automates permitting, inspection, and interconnection – to reduce the time to commission and to remove the uncertainties in those processes that increase soft costs.

Additionally, soft costs are reduced through the very rapid installation of Plug and Play PV systems. In demonstrations in 2014, 2015 and 2016, teams of two to three people with no prior PV installation experience installed and commissioned several 3kW Plug and Play PV system in under 75 minutes.

Key Features

■ **Ease of installation:** Use of pre-configured wiring, touch-safe connectors, adhesively mounted or rack mounted modules, solar-ready connector

■ **Ease of proof-of-code-compliance:** Plug and Play PV systems have been designed for ease of inspection, and feature an electronic safety self-test to ensure that the system is installed safely and meets code requirements

■ **Electronic permitting, inspection and interconnection processes:** Plug and Play PV systems use a standardized data transmission protocol to facilitate regulatory approvals, making these processes fast and predictable





System & Standard Developments

The Fraunhofer CSE Plug and Play PV systems project is funded by the U.S. Department of Energy SunShot Initiative. Fraunhofer CSE demonstrated the technical feasibility of Plug and Play PV system installation and commissioning of a prototype. Several technologies of Plug and Play PV are currently in various stages of commercialization with the eventual end goal of having a complete, commercialized system available to the general public.

Fraunhofer CSE is also developing a Plug and Play PV System industry standard that will specify how these systems interface with utilities, jurisdictions, and the homeowner, but will allow flexibility in other aspects of Plug and Play PV system implementation – making Plug and Play PV systems a framework for low-cost solar while allowing solar system manufacturers and consumers to identify the most attractive solutions.

4 *Installing the Plug and Play PV system during the 2016 prototype installation and commissioning demonstration.*

5 *Touch-safe connectors enable safe and easy installation of the Fraunhofer CSE Plug and Play PV system.*

Stakeholder Benefits

The system-level approach of Plug and Play PV Systems will provide benefits to all stakeholders:

Consumers:

- A safe PV system, quickly and easily installed at low cost
- Significantly reduced up-front costs and accelerated return-on-investment

Installers:

- Reduced uncertainties in permitting and inspection make installations more efficient, increasing revenues
- An efficient installation process enables installers to serve larger markets

Solar System Manufacturers:

- Higher volume of sales
- Increased share of the installed system value (i.e., increased margins)

Retailers:

- New market opportunity for retailers
- New distribution channels

Utilities:

- Significantly faster interconnection, less routine work
- More insight into installed base of distributed generation resources

Jurisdictions:

- Simplified permitting and inspection process - to support rapid adoption
- Safer systems

Project Team

Fraunhofer CSE's Plug and Play PV development team is comprised of a multidisciplinary group of partners, including the following manufacturers:

- Lumeta Solar
- SunPower
- VoltServer
- ConnectDER
- 3L Power
- Royal Adhesives & Sealants
- Mennekes
- Phoenix Contact

In addition, the following team members provide support with code, standards, demonstration, and validation:

- Sandia National Laboratories
- National Grid
- Eversource
- Green Mountain Power
- CSA Group
- Tufts University
- Vermont Law School
- Center for Environmental Innovation in Roofing
- City of Boston
- City of Worcester
- Town of Dartmouth
- Town of Falmouth
- Asphalt Roofing Manufacturers Association