

GRID INTEGRATION



1 *Integration of Grid-Scale Energy Storage with Solar PV on the National Grid distribution system*

2 *A PV-ready socket installed at the electrical meter makes Plug and Play PV System interconnection safe and easy.*

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About Fraunhofer CSE

Fraunhofer CSE is an applied research and development laboratory dedicated to building tomorrow's energy future today. Our staff's expertise in solar photovoltaics, smart energy-efficient buildings, and grid technologies provides a platform for deeply integrating distributed energy resources through collaborative R&D with private companies, government entities, and academic institutions.

Grid Integration at CSE

The electric grid of the future will be fundamentally different than the grid of today. It will be greener, it will be much more distributed in both generation and control, and it will be characterized by bidirectional flows of power and information. Fraunhofer CSE's Grid Integration Group engages in collaborative R&D that facilitates the adoption of technologies that will support this transformation. Our research focus on how to fully realize the potential of tightly integrated distributed energy systems to:

- Increase the hosting capacity of the utility grid for renewable generation
- Leverage the potential for Distributed Energy Resources (DERs) to enable improved resiliency, reliability, and utilization efficiency
- Make it easier to deploy DER Systems at scale

Areas of Research

- Solar PV
- Energy Storage
- Interoperability, codes, and standards
- Microgrids
- Module-Level Power Electronics
- Systems Integration



Capabilities

■ Field Demonstrations & Pilots:

Developing and executing pilot demonstration of novel technologies in controlled and “real-world” environments. Our team combines deep expertise with a wealth of experience managing complex, multi-stakeholder projects.

■ Technology Assessment and Characterization:

3rd party assessment of DER technologies, including analytic assessment, benchtop testing, hardware-in-the-loop evaluation, and field trials.

■ Systems Integration and Implementation:

Cross-domain implementation of reference technology platforms to support development and testing of integrated storage systems. We work closely with Fraunhofer CSE’s PV and Building Energy Sciences teams, as well the Fraunhofer Institute for Solar Energy (ISE) to help industry solve cross-cutting challenges that sit at the intersection of solar generation, deployment, distribution, and consumption.

■ Control, Analysis, and Monitoring Software:

Development of software for controlling and monitoring DERs on embedded, mobile, and cloud-based platforms.

Facilities and Equipment

Fraunhofer CSE’s **Resilient Power Grid Lab** is a 30kVA hardware-in-the-loop test environment located in our Boston, MA “Living Laboratory”. Capabilities include:

■ DER Characterization

- Energy Storage Systems
- Inverters
- Solar PV
- Monitoring & Control

■ Multiple use cases

- Grid tied, islanded, and microgrid
- Variable duty cycles and Use Cases
- Real or Simulated Test Environment

■ State-of-the-art Equipment

- Regenerative Grid Simulator
- Regenerative Load Simulator
- Renewable Power Injection (Real or Simulated)
- Various Power Capabilities (Residential to lite-Commercial)
- Fully protected, sensed and configurable through System Controller

■ Integrates with “Connected Home” and Smart Devices

CSE’s Outdoor Test Site in

Albuquerque, NM, co-located with the CFV Solar Test Laboratory, is used to conduct outdoor testing for PV, building energy efficiency technologies, and smart grid applications. The site features solar resource and meteorological monitoring, I-V curve measurements of modules, capacity for systems up to 60 kW, multichannel continual current-voltage (I-V) curve tracing, DC/AC monitoring for microinverters and string inverters, and both fixed-rack and dual-axis tracking.

Research Partners

Fraunhofer CSE partners with a wide-array of leading governmental, industry, academic and research institutions around the world including:

■ Fraunhofer Center for Experimental Software Engineering (CESE)

conducts applied research and technology transfer to support the software-enabled innovations developed by our customers in industry, government, and academia. CESE develops and uses innovative, effective, and scalable model-based approaches to software and systems engineering to design and develop systems, to make those systems safe and secure, and to powerfully test and verify them. CESE also uses state-of-the-art measurement and analysis methods to support their software development.

■ Fraunhofer Institute for Solar Energy Systems (ISE)

is the largest solar energy research institute in Europe. The work ranges from fundamental scientific research relating to solar energy applications, through the development of production technology and prototypes to the construction of demonstration systems.

3 Installation and Commissioning of a ‘Plug & Play PV’ System in less than 75 minutes

4 Benchtop assessment of LED lighting technology