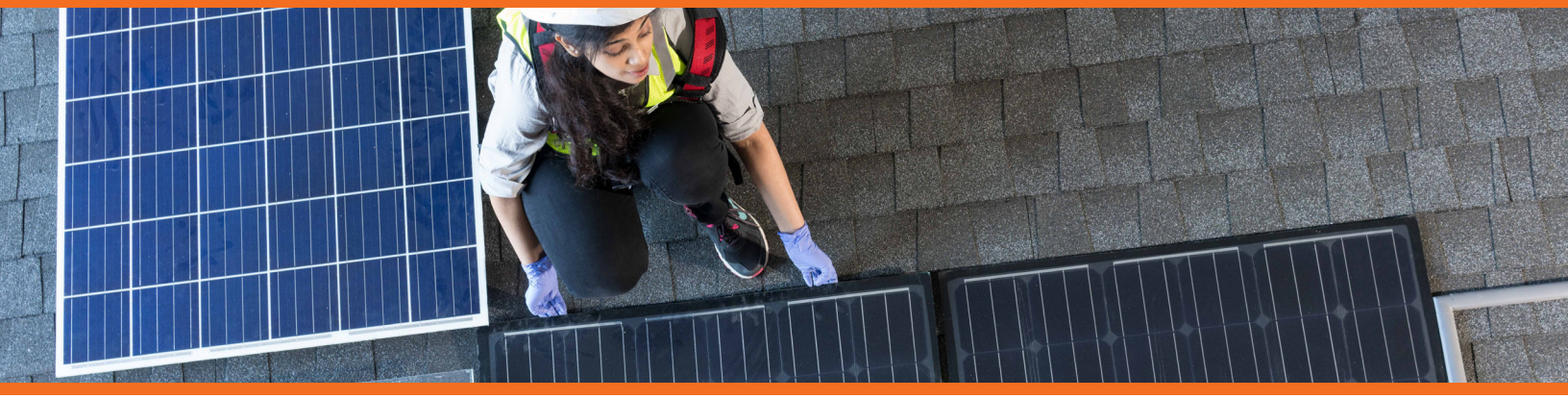
Fraunhofer USA

FRAUNHOFER CENTER FOR SUSTAINABLE ENERGY SYSTEMS CSE

PHOTOVOLTAIC TECHNOLOGIES



1 *Solar PV modules being mounted in Fraunhofer CSE's PV Technologies Laboratory.*

Fraunhofer Center for Sustainable Energy Systems CSE

Massachusetts Office
5 Channel Center Street
Boston, MA 02210

New Mexico Office
5600A University Boulevard SE
Albuquerque, NM 87106

Contact

Cordula Schmid, Ph.D.
Associate Director,
Photovoltaic Technologies
Phone: 617-714-6515
cschmid@cse.fraunhofer.org
cse.fraunhofer.org/photovoltaic-technologies

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.

Photovoltaic Technologies at CSE

Our mission is to accelerate the growth of photovoltaic (PV) energy generation by conducting applied research on innovative PV module concepts, new materials and components, and on PV systems.

We support the development of innovative PV module designs and materials through proof of concept, pilot production, and lifetime testing. Our in-house R&D expertise includes module optical and thermal design, process development for novel materials, energy modeling, and durability assessment.

An experienced team of researchers, supported by a world-class network of research partners, addresses client needs through innovation to reduce cost, increase efficiency, and enhance durability of PV modules in support of our clients' technology commercialization efforts.

Skills and Capabilities

- Module and system performance assessment, based on outdoor exposure testing and characterization
- Module reliability, including accelerated stress tests
- Failure analysis and materials characterization
- Assessment of new module materials for conventional and lightweight modules
- Module prototyping
- Novel approaches to power electronics
- PV system integration
- Novel PV mounting approaches
- Demonstrations and pilots

Areas of Research

- **Module Design, Fabrication & Prototyping:** Fabrication facilities with support for novel encapsulants, edge sealants, back sheets, solar glass, and new form factors.
- **Building Integrated PV (BIPV):** Design and testing of building integration approaches, development and testing of unconventional mounting approaches to residential PV, assessment of building integration on module performance, and assessment of building integration on building energy dynamics
- **Module & Material Characterization:** EL and IR imaging, precision flash testing, angle of incidence performance, energy yield testing, failure analysis, and polymer Science and Engineering
- **Accelerated Aging and Testing:** Development of new test methods to simulate rigorous operating conditions including effects of humidity, temperature and mechanical stress.
- **Outdoor Exposure and Performance Testing:** Long-term, grid-connected and off-grid outdoor exposure testing in northeast and southwest climates.
- **Quality Analysis:** Durability and degradation, compliance with rated characteristics, and energy output

Equipment

Fraunhofer CSE offers an extensive range of equipment capabilities, including:

- **Pilot Module Prototyping Line**
- **Pulsed Class A+A+A+ Solar Simulator**
- **Indoor Environmental Testing**
- **Imaging** (EL, IR)
- **Outdoor Testing** (New Mexico and Massachusetts)

Facilities

Fraunhofer CSE's Living Laboratory is an innovative 50,000 ft² research center and clean energy demonstration project located in the Boston Innovation District in South Boston. It houses a Building Integrated Photovoltaics (BIPV) lab which allows researchers to measure outdoor performance, energy yield and durability of rooftop and façade-integrated PV modules.

Fraunhofer CSE also maintains research facilities and outdoor test fields in Revere, MA and Albuquerque, New Mexico, the latter being co-located with CFV Solar Test Laboratory.

Key Projects

- **Plug and Play PV Systems**
- **Building Integrated Photovoltaic (BIPV) Systems**
- **PV Module Durability Initiative**

Research Partners

- **Fraunhofer Institute for Solar Energy Systems (ISE):** 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.
- **CFV Solar Test Laboratory:** A joint venture of the CSA Group, the Association for Electrical, Electronic & Information Technologies (VDE), Fraunhofer ISE, and CSE, CFV offers complete certification and non-certification testing services for a range of PV technologies, including flat panel, thin film and concentration PV (CPV).

Fraunhofer CSE also cooperates with other leading governmental, academic and research institutions around the world.

2 *Accelerated materials degradation testing in our Innovation Laboratory.*

3 *Module mounting for simulation in lab.*

4 *Climate chamber for accelerated aging and testing.*