Fraunhofer USA

FRAUNHOFER CENTER FOR SUSTAINABLE ENERGY SYSTEMS CSE

OUTDOOR TESTING

1 *Outdoor testing facilities in Albuquerque, NM.*

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Providing Field Performance and Durability Data for the Solar Industry

The Fraunhofer Center for Sustainable Energy Systems (CSE) maintains outdoor testing facilities for long-term exposure tests under varying climate conditions in Massachusetts and New Mexico. CSE's outdoor test sites are designed to address a pressing industry need for enhanced feedback on actual field performance and durability of both existing and new PV technologies.

Fraunhofer's Outdoor Test Fields supports PV module and component manufacturers in assessing the actual field performance and durability of their products and to enable systems integrators to obtain the crucial data they need to meet ever-tightening performance and lifetime expectations.

Primarily used for PV solar testing, these facilities also have capabilities to conduct field evaluations of advanced building envelope materials / assemblies, smart grid systems, and building integrated photovoltaic (BIPV) systems.

PV Testing Services at Fraunhofer's Outdoor Test Fields

Services offered at these facilities include:

Multichannel I-V Curve Tracing

- Modules biased at maximum power point, open circuit or short circuit between traces
- Local irradiance measured with both a secondary class pyranometer and PTB calibrated monocrystalline reference cell
- Module temperature monitoring

Grid Connected System Performance Evaluation

- String / module level performance monitoring
- Comparative analysis of system performance ratio
- Long-term lifetime testing of modules and systems
- Soiling studies
- Potential and light induced degradation (PID / LID)
- Thin film stabilization analysis

IEC Outdoor Testing

- PVSyst .PAN file determination – Sandia Performance Model coefficent determination

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PV Testing Services at Fraunhofer's Outdoor Test Fields (Cont.)

Model-Based Testing

- Temperature coefficient; angle of incidence; irradiance dependence, spectrum dependence

Grid-Connected Systems Hosted Monitoring

- String/module level performance monitoring
- Performance ratio determination
- Multi-site system comparison (Albuquerque, Boston, Canary Island)

Concentration PV (CPV) System Monitoring and Characterization

- CSOC Determination
- Angle of Acceptance
- Temperature Testing

Albuquerque, NM

Fraunhofer CSE's solar research laboratory in Albuquerque has the following features:

- Over 310 days of sunshine annually
- Climate capable of inducing module temperature changes of over 60°C over the course of a single day
- Solar resource (including spectrum) and meteorological monitoring
- I-V curve measurements of PV modules, strings, and systems up to 60 kWp
- Automated multichannel continuous I-V curve measurements
- DC/AC monitoring and analysis
- Grid capacity above 25 kWp
- Fixed rack mounting systems with adjustable mounting angle, single-axis, and dual-axis tracking

The Albuquerque laboratory is co-located with **CFV Solar Test Laboratory**, a joint venture of the CSA Group, Fraunhofer ISE and Fraunhofer CSE. CFV operates indoor testing facilities, including large-scale climate chambers; solar simulators; and other standard UL and IEC testing capabilities. They also offer complete North American and IEC certification and non-certification testing services.

Boston, MA

There are two Massachusetts facilities in Charlestown and Revere. The Revere site is co-located with a 3-acre, 750 kW solar power plant operated by National Grid. The site provides unique test capability for the northeastern climate zone and features:

- Solar resource and meteorological monitoring
- Test modules compared against grid-connected commercial arrays
- 24-hour monitoring
- Peak power tracking Solar spectrum analysis I-V curve tracing
- Hot spot testing
- NOCT characterization
- Thermal imaging in operation

The Charlestown site, located at the Massachusetts Clean Energy Center's (MassCEC) Wind Technology Testing Center (WTTC), includes capabilities such as:

- DC/AC monitoring and analysis
- Grid capacity above 25 kWp
- Fixed rack mounting systems

Gran Canaria, Spain

The Canary Island site, run by Fraunhofer ISE, has a maritime climate with a saline atmosphere where it is possible to study the corrosion resistance of modules and components.

- DC/AC monitoring and analysis
- Fixed rack mounting systems
- Automated multichannel continuous I-V curve measurements

2 & 3 *At Fraunhofer CSE's Revere, MA outdoor testing facilities, modules are exposed to both winter and marine conditions.*

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