

BUILDING TOMORROW'S ENERGY FUTURE TODAY



1 With Fraunhofer CSE's Plug and Play PV systems installation, commissioning takes less than 1 day. See our demo video here: cse.fraunhofer.org/lpnp

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Developing a Sustainable Energy Future

The transition to a sustainable energy future is one of the major challenges for our society in the coming decades. Fossil energy sources, which emit greenhouse gases, need to be phased out and replaced by renewable energy sources such as solar and wind. The efficiency of our energy use needs to be increased on a massive scale.

This transition requires an increasingly deep integration of various energy technologies throughout energy generation, distribution and consumption. As the complexity of this integration increases, so does the need for increased systems level development, demonstration and insight.

In order to address these specific challenges, the Fraunhofer Center for Sustainable Energy Systems (CSE) was founded in 2008 as an applied research and development laboratory dedicated to *building tomorrow's energy future today*.

Contract R&D Services for the Sustainable Energy Industry

Fraunhofer CSE's key strength is its multidisciplinary research team comprised of mechanical and electrical engineers, polymer and silicon materials scientists, chemists and physicists, as well as social scientists with expertise in:

- Building Energy Systems
- Building Enclosures and Materials
- Solar Photovoltaic Technologies
- Grid Integration

CSE provides a platform for deeply integrating these distributed energy resources through collaborative R&D with private companies, government entities, and academic institutions.

Additionally, CSE launched the Fraunhofer TechBridge Program in 2010 to support early-stage startup companies by helping to identify and de-risk promising technologies to solve industry challenges. By performing targeted validation, development and demonstration work, TechBridge evaluates and prepares innovative early-stage products for investors and industry.



CSE works with industrial and government clients on projects ranging from short tests, which last several weeks, to complex technology development, which includes code and standards work that lasts several years.

CSE conducts its research from its Living Lab in Boston, MA, and performs outdoor testing at Revere, MA and Albuquerque, NM.

Inside the Living Lab

CSE and 37 industry partners established a Living Lab for energy efficient building technologies at 5 Channel Center in Boston's Seaport District. The building combines the historic architecture of a 100-year-old warehouse with cutting-edge design concepts and energy technologies to drastically reduce the building's energy consumption. The living lab houses CSE's research facilities, including a pilot solar module fabrication line, and extensive characterization / environmental testing resources.

2 *Fraunhofer CSE's building houses 50,000 ft² of lab and office space in an energy-efficient retrofit of a 100-year-old building.*

3 *In addition to contract research, Fraunhofer CSE's scientists conduct internal R&D to advance new ideas.*

Building Energy Systems

The Building Energy Systems Group conducts field monitoring, data analytics, energy modeling, and behavioral research to develop insights into the real-world performance of building systems, with a focus on how occupants interact with building systems and influence energy consumption. The team applies these insights to develop new building performance assessment and control algorithms, assess the performance of emerging technologies, and to support product and policy development.

Building Enclosures and Materials

The Building Enclosures and Materials Group analyzes and develops building enclosure materials, components, and systems. Their performance is tested in lab and field conditions—both in new construction and building retrofits. The team focuses on novel building materials, thermal insulations, heat storage technologies, dynamic building components, and building integrated solar PV (BIPV) technologies. This work is supported by the development of advanced simulation software tools.

Grid Integration

The Grid Integration Group accelerates the development, commercialization, and deployment of technologies that will enable our power distribution infrastructure to operate with greater reliability, efficiency, security, responsiveness, at lower cost, and with higher levels of renewable energy

generation. Grid Integration works together with the PV Technology and Building Energy Systems groups to fully realize the potential of tightly integrated distributed energy systems at high renewable energy penetration. .

Photovoltaic (PV) Technologies

The PV Technologies Group accelerates the growth of photovoltaic (PV) energy generation by conducting applied research on innovative PV module concepts, new materials and components, and on PV systems.

This includes pilot fabrication of PV modules, thorough performance characterization, as well as durability and reliability testing. The in-house expertise includes optical and thermal design, process development for novel materials, and testing methodology development.

TechBridge Program - Technology Commercialization

The Fraunhofer TechBridge Program engages with the energy startup company ecosystem. TechBridge uses several tools, including competitions, to solve concrete industry challenges. The most promising startup technologies are identified and de-risked with Fraunhofer's deep technology expertise in form of validation, development, and demonstration projects.