



**Fraunhofer**

ISE

FRAUNHOFER INSTITUTE FOR  
SOLAR ENERGY SYSTEMS ISE

# A SHORT OVERVIEW





## **Fraunhofer Institute for Solar Energy Systems ISE**

Founded in Freiburg, Germany, in 1981, the Fraunhofer Institute for Solar Energy Systems ISE is the largest solar energy research institute in Europe, with a staff of 1270. It creates technological foundations for supplying energy efficiently and on an environmentally sound basis in industrialized, threshold and developing countries. With its research focusing on energy conversion, energy efficiency, energy distribution and energy storage, it contributes to broad application of new technology. In 2019 the Institute's budget (including investments) totalled 102.6 million euros (preliminary).

Together with clients and partners from industry, politics and society in general, Fraunhofer ISE develops technical solutions that can be implemented in practice. It investigates and develops materials, components, systems and processes in five business areas. In addition, Fraunhofer ISE also offers testing and certification procedures. It features an excellent laboratory infrastructure. Fraunhofer ISE is certified according to the quality management standard, DIN EN ISO 9001:2015.

## Spectrum of Activities

In its research activities, Fraunhofer ISE develops new products, processes or services and optimizes existing ones. To do so, the Institute finds promising technical solutions and transfers technology from science and research to industry and society at large. As a partner for industry, the Institute orientates itself according to our clients' requirements and contributes toward their economic value generation.

The Institute carries out research and development projects at various phases in the life cycle of a given technology. Depending on the task and requirements of our clients and the technological readiness level of the topic, the Institute offers services in various forms:

- » New material/process
- » Prototype/pilot series
- » Patent/licence
- » Software/application
- » Analysis based on measurement technology/quality control
- » Advice/planning/studies



## Business Areas

### Photovoltaics

#### Silicon Photovoltaics

- » Feedstock, Crystallization and Wafering
- » Epitaxy, Si-Foils and SiC Deposition
- » Characterization of Processing Materials and Silicon Materials
- » Doping and Diffusion
- » Surfaces: Conditioning, Passivation, Light-Trapping
- » Contacting and Patterning
- » High-Efficiency Cell Fabrication and Analysis
- » Pilot Processing of Industrially Relevant Solar Cells
- » Metrology and Production Control
- » Technology Assessment

#### III-V and Concentrator Photovoltaics

- » III-V Epitaxy and Solar Cells
- » Concentrator Assemblies
- » Concentrator Optics
- » High-Concentration Systems (HCPV)
- » Low-Concentration Systems (LCPV)
- » Silicon Concentrator Solar Cells
- » Power-by-Light

## Emerging Photovoltaic Technologies

- » Dye Solar Cells
- » Organic and Perovskite Solar Cells
- » Photon Management
- » Tandem Solar Cells on Crystalline Silicon

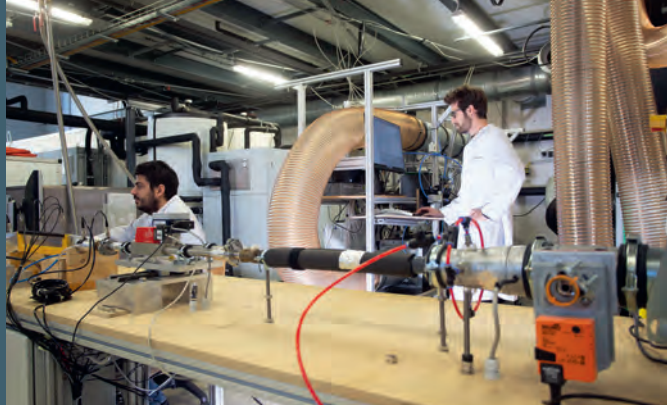
## Photovoltaic Modules and Power Plants

- » Module Technology
- » Module Calibration
- » Service Life and Failure Analysis
- » Photovoltaic Power Plants
- » Integrated Photovoltaics
- » Solar Radiation and Performance Prediction

## **Energy Technologies and Systems**

### Energy Efficient Buildings

- » Building Envelopes
- » Building Operations Management
- » Building Systems Technology
- » Low-Temperature Solar Thermal
- » Heat Pumps
- » Heat and Cold Storage
- » Ventilation and Air Conditioning



### Solar Thermal Power Plants and Industrial Processes

- » Solar Thermal Power Plants
- » Concentrating Collectors
- » Water Treatment and Materials Separation
- » Thermal Storage for Power Plants and Industry
- » Industrial Processes and Process Heat
- » Efficient Heat Exchangers

### Hydrogen Technologies and Electrical Energy Storage

- » Thermochemical Processes
- » Fuel Cell Systems
- » Electrolysis and Power-to-Gas
- » Battery Cell Technology
- » Battery System Technology
- » Applied Storage Systems

### Power Electronics, Grids and Smart Systems

- » New Devices and Technologies
- » Power Converter Systems
- » Inverters in Power Grids
- » Smart Grids
- » Energy System Analysis



## Accredited Laboratories

In addition to its R&D activities Fraunhofer ISE offers independent testing and certification services to commercial enterprises and scientific institutions. Complementing its research and development centers, the Institute has two calibration and five test laboratories which are accredited:

- » CalLab PV Cells
- » CalLab PV Modules
- » TestLab PV Modules
- » TestLab Solar Façades
- » TestLab Solar Thermal Systems
- » TestLab Heat Pumps and Chillers
- » TestLab Power Electronics



## R&D Infrastructure

A special feature of Fraunhofer ISE is its excellent technical infrastructure. Laboratories with a floor area of 16 700 m<sup>2</sup> and extremely modern equipment and facilities are the basis for our competence in research and development. The R&D infrastructure of Fraunhofer ISE is divided into seven Laboratory Centers and four production-relevant Technological Evaluation Centers:

- » Center for High Efficiency Solar Cells
- » Center for Optics and Surface Science
- » Center for Material Characterization and Durability Analysis
- » Center for Heating and Cooling Technology
- » Center for Energy Storage Technologies and Systems
- » Center for Power Electronics and Sustainable Grids
- » Center for Fuel Cells, Electrolysis and Synthetic Fuels
- » SiM-TEC – Silicon Materials Technology Evaluation Center
- » PV-TEC – Photovoltaic Technology Evaluation Center
- » Module-TEC – Module Technology Evaluation Center
- » Con-TEC – Concentrator Technology Evaluation Center



## **External Branches and Cooperations**

- » Fraunhofer ISE Laboratory and Service Center LSC, Gelsenkirchen, Germany
- » Fraunhofer Center for Silicon Photovoltaics CSP, Halle/Saale, Germany
- » Fraunhofer Chile Research – Centro para Tecnologías en Energía Solar (FCR-CSET), Santiago, Chile

## **Networking within the Fraunhofer-Gesellschaft**

- » Fraunhofer Cluster of Excellence Integrated Energy Systems CINES
- » Fraunhofer Alliances: Energy, Batteries, Building Innovation, Space and Water Systems (SysWasser)
- » Fraunhofer Electromobility Systems Research
- » Fraunhofer Group: Materials, Components
- » Fraunhofer Networks for Electrochemistry, Energy Storage Systems and Grids, Intelligent Energy Grids, Sustainability, Wind Energy
- » Fraunhofer Initiative “Morgenstadt – City of the Future”
- » Sustainability Center Freiburg (together with Albert Ludwig University of Freiburg)

## Contact

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