Founded in 1981, Fraunhofer ISE, with a staff of 1200, is the largest solar research institute in Europe. Fraunhofer ISE develops materials, components, systems and processes in five business areas. For concentrated solar thermal power-, energy storage- and water treatment-technology, we develop materials, components, systems and processes. In addition to its R&D, the institute offers testing and certification procedures. Furthermore, it features an excellent laboratory infrastructure. In the SFERA-III project, we offer access to the following installations:

C-lab: Optical testing and simulation of materials and components for concentrated solar thermal. The laboratory is equipped with equipment for characterization of solar reflectors (reflectance and scattering), mirror facets (shape and slope), absorbers and transmittive materials (absorptance, transmittance and emittance). Specular reflectance (VLABS) is measured for acceptance angles between 1mrad and 30mrad and incidence angles between 8° and 60°. Shape and slope of mirrors are measured with deflectometry with resolution from 1 µm to 1cm, samples from 5cmx5cm to 6mx2m or photogrammetry. For validation and impact assessment, an interface to optical simulations with ray-tracing is used (from components up to system simulations for LFC, PTC and Tower systems).

C-Lab field: Concentrator optics heliostat- and mirror test-field. The concentrator optics lab test field offers outdoor testing of heliostats, heliostat tracking, focal point tests, outdoor exposure of solar mirrors and testing of soiling on curved and flat mirror facets. It is equipped with three heliostats, a flexible target for focal point analysis and exposure racks and curved mirror facets for soiling assessment.

CD-Lab: Durability testing of materials for concentrated solar thermal. The durability lab comprises outdoor and indoor facilities. Outdoor test sites to expose materials / components are located at Freiburg, Germany, Gran Canaria, Spain, Negev Desert, Israel and Zugspitze, Germany. The outdoor test benches are equipped with systems for high-resolution climate data and sample monitoring. All sites are equipped with similar monitoring equipment: Temperature, Wind speed, Relative humidity, Irradiance (global and UV), corrosion information. For accelerated aging tests, we offer two climatic cabinets. Combined testing with controlled irradiation (UV), temperature and humidity. Salt spray testing with possibility to adapt testing conditions (salt concentration, temperature, cycles) for large size samples.

TES-Lab: Testing of materials and components for molten salt storage. The TES-Lab is equipped with laboratory set-ups for testing of molten salt materials, characterization of components for usage in molten salt environment (flow meters, valves, heating systems) and a single-tank molten salt facility. The storage vessel for testing of molten salt mixtures has a comprehensive temperature measurement system and wall heating measures to compensate heat losses and prevent salt mixing. We offer the evaluation of the salt stratification with special focus on the thickness of the thermocline zone of the storage tank during charging and discharging processes at various temperature differences (up to a maximum temperature of 550 °C) and various mass flow rates. Different salt mixtures and other fluids can be tested.

WT-Lab: Water treatment and desalination laboratory. The water treatment lab is equipped with laboratory set-ups for testing of water quality, industrial anorganic waste water treatment and desalination. With a special focus on testing and application of membranes for MD, RO, ED, DD from lab-scale to industrial scale. We offer detailed simulation models of MD-membrane processes, dimensioning of advanced ED processes and flexible operation of RO-processes. Further we offer simulation of water treatment processes and water saving plans for CST plants.

<u>Services currently offered by the infrastructure:</u>
We offer R&D related testing and certification services to industrial clients and in public research projects. Laboratory infrastructure can be used to analyse very different materials and components, from first lab samples to market-ready products, with TRL levels between 2 or 3 and 9.
<u>Optical materials and components:</u>

- Development and testing of solar reflector materials, absorber and glass- or foil-based coatings
- Development and testing of solar mirror facets for CST technology
- Development and testing of PTC, LFC and CSR components and prototypes

- Characterization of soiling

Heliostat field:

- Development of camera-based measurement methods for heliostat and receiver characterization
- Qualification of heliostats, tracker testing for heliostats and other technologies

Durability and lifetime:

- Development and manufacturing of PV modules, solar thermal collectors and mirrors
- Reliability, durability, energy yield of PV modules, solar thermal collectors and solar mirrors
- Qualification and testing equipment and procedures for PV components, BOS and grid connection, solar tracker, solar mirrors, absorber coatings.

Molten salt storage:

- Development of single-tank storage concepts, characterization of temperature distribution, flow pattern and heat losses
- Testing of industrial components for usage in molten salt environment
- Characterization of molten salt mixtures

Water treatment and desalination:

- Development and manufacturing of membrane-based desalination and water treatment processes. Characterization of ion-selective ED-membranes, characterization of MD-membranes via liquid entry pressure
- Vapour pressure measurement of unknown solutions
- Development of new energy recovery systems for RO
- Mineral extraction and fluid recovery, energetic optimization of separation processes

Our service units attracted many researchers and students during the last years. The access activity will provide unique opportunities for testing of materials and components for collectors, storage and water treatment to European research teams. We offer scientific and laboratory support from planning, testing to evaluation. Fraunhofer ISE campus offers a stimulating research environment and office space for users. Fraunhofer ISE has experience in offering support to external users in the framework of international projects, such as STAGE-STE, INSHIP or EERA PV projects.