



- 1 100 kW lithium-ion battery system.
- 2 Multi-MW PV power plant.

QUALITY ASSURANCE FOR PV POWER PLANTS WITH BATTERY STORAGE

Demand-based feed-in of electricity from grid connected photovoltaic (PV) power plants will be of central importance in the future, in particular for the direct marketing of solar power. In addition to accurate prediction models, battery storage systems will play an essential role in offering solar power in a predictable and reliable way on the energy market as well as in compensating short-term fluctuations.

Based on its long-term experience, Fraunhofer ISE offers a wide range of services for planners, developers and investors in the areas of quality assurance for PV power plants, battery system technology and integration of battery storage in PV systems as well as in the field of simulation of energy systems. Our support lasts from the planning and implementation to the operation phase.

Technical Advice on Storage Selection and Dimensioning

With our extensive expertise, we advise our clients in selecting the appropriate battery technology for their specific application and support them in the planning of the storage system:

- simulation-based design of optimal battery storage (power and capacity) as well as system design including power electronics
- evaluation and optimization of operating control strategy
- simulation-based determination of levelized cost of electricity storage as well as levelized cost of electricity of the PV battery power plant
- advice on system integration

Fraunhofer Institute for Solar Energy Systems ISE

Heidenhofstr. 2
79110 Freiburg, Germany

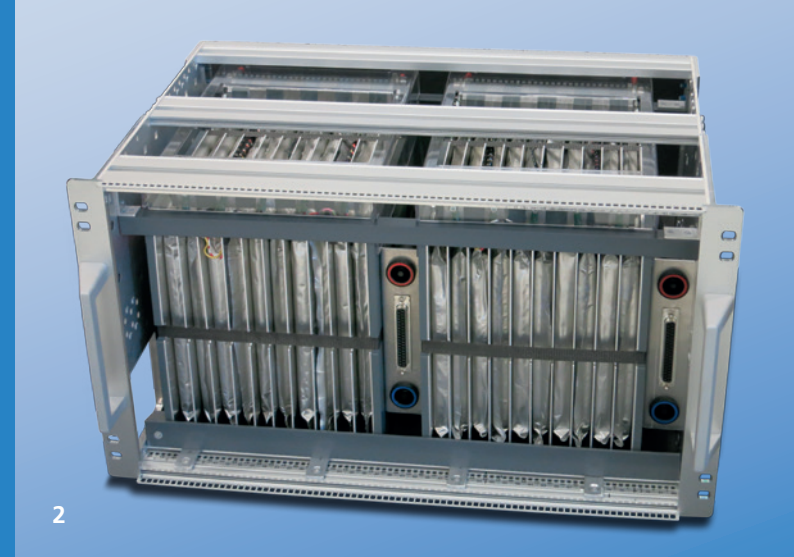
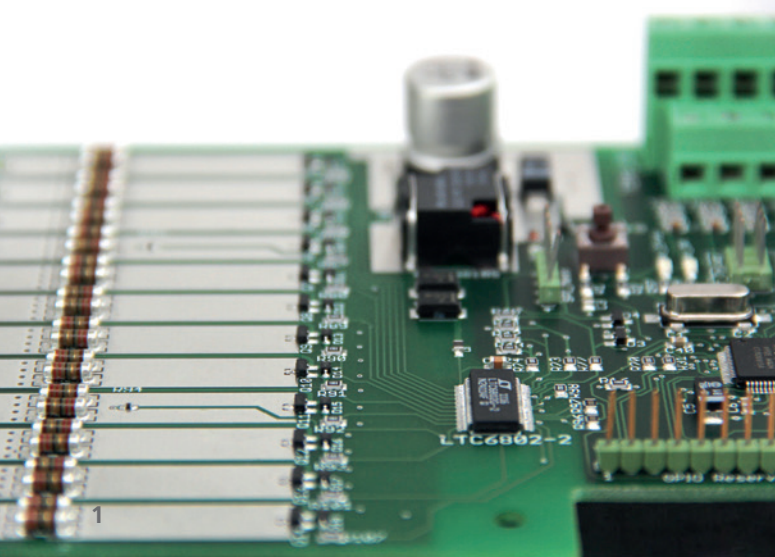
ServiceLab Batteries

Dr Matthias Vetter
Phone +49 761 4588-5600
storage.battery@ise.fraunhofer.de

ServiceLab PV Power Plants

Klaus Kiefer
Phone +49 761 4588-5218
pvmod.powerplant@ise.fraunhofer.de

www.ise.fraunhofer.de



Characterization of Battery Systems

- performance tests for battery cells, modules and systems up to 1000 V, 600 A and 250 kW using the relevant standards
- aging tests on cell and module level
- verification of the functionality of system components (battery management, safety devices, cooling, etc.)

Yield Prediction for the Overall System

Fraunhofer ISE offers yield predictions for PV battery power plants in an extensive and simple form. The yield assessments take into account the system-specific components (PV modules, inverters, transformers, battery storage, etc.) with their efficiencies, their interconnection and the chosen operating control strategy as well as the structure of the PV battery system at the planned location.

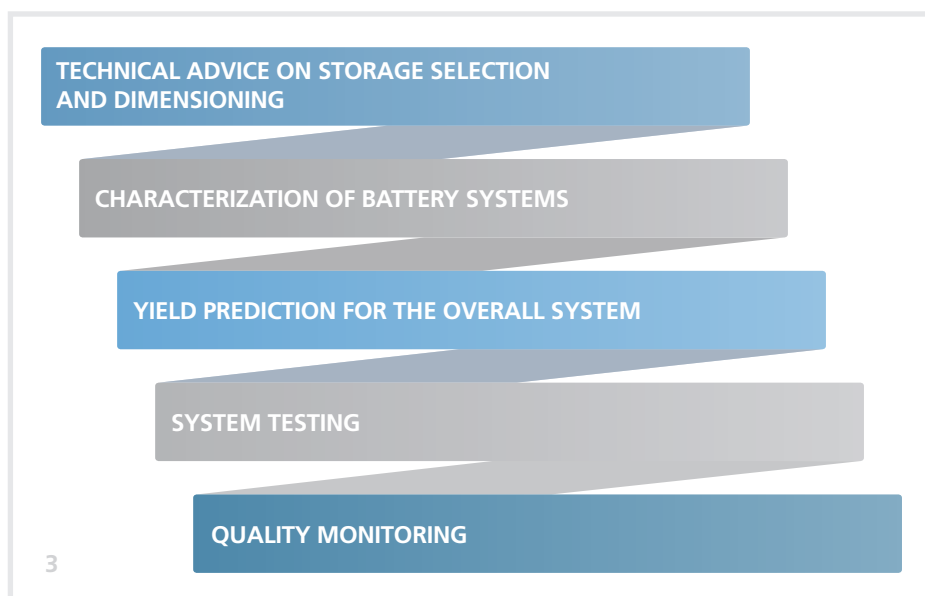
System Testing

To ensure that the power plant meets state-of-the-art quality and provides the promised service, we offer a comprehensive examination of the entire power plant:

- visual inspection
- verification of measurement equipment for system monitoring
- thermographic inspection of the PV power plant
- power measurement of the solar generator
- verification of the battery storage
- analysis of the operational data of the overall system

Quality Monitoring

An independent confirmation of the quality and performance of PV and battery storage components and complete power plants is highly relevant for manufacturers, Engineering-Procurement-Construction (EPCs), banks and investors. We provide individual, reliable and accurate PV and battery monitoring solutions for the duration of a few weeks up to many years. Our experts provide high-quality analyses of the operating states of all components of the PV battery power plant. This enables early detection of a non-optimal operation, thus securing valuable yields.



- 1 Close-up of a battery management unit, the heart of any battery system.
- 2 Battery modules with high cycle stability for stationary applications.
- 3 Fraunhofer ISE's range of services in the area of quality assurance for PV power plants with battery storage.