Fraunhofer

IISB

FRAUNHOFER INSTITUTE FOR INTEGRATED SYSTEMS AND DEVICE TECHNOLOGY

LOAD SHIFTING AND PEAK SHAVING

Simulation, Dimensioning, Prototyping, Validation

Legend
- Energy flows
- Data flows
- Information
- Control

Energy monitoring → Data → **Simulation** *MATLAB* → Parameters
- aperiodic

→ **Control** *powermanager*

Power and energy measurements, status

AC grid public — Transformer — 20 kV / 400 V — **AC grid IISB** — AC/DC / DC/AC — **DC grid IISB** — Discharge / Charge — **Battery system**

Lower Peaks
- Optimized grid size
- Lower electric energy costs

P_{avg} = 400 kW
P_{peak} = 1.000 kW

P_{el}
t

U = ± 380 V

- Load shifting
- Peak shaving

E = 60 kWh
P_{max} = 100 kW
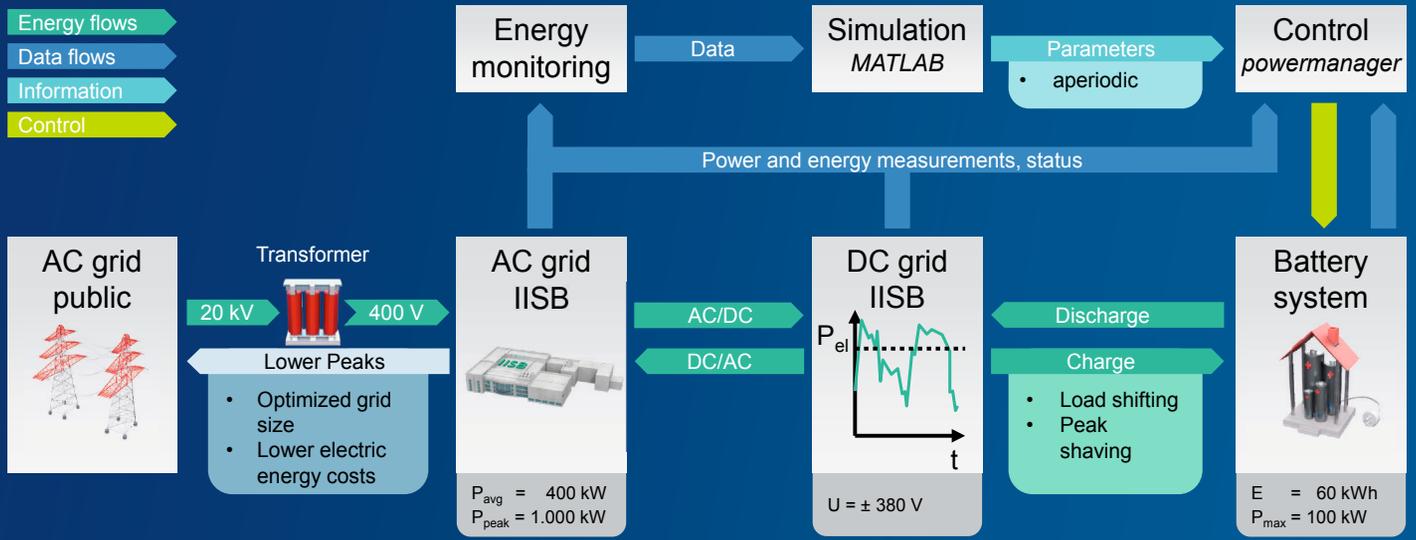
Description

The Fraunhofer IISB offers algorithms and dimensioning tools for the reduction of power consumption peaks (peak shaving) with battery energy storage systems (BESS), thermal energy storages (TES) and combined heat and power units (CHP). The main advantage of using an energy storage system is that no energy consumers (e.g. manufacturing plants) have to be switched off and thus the production is not affected.

Electrical energy costs usually depend on the maximum peak power in a specific interval (e.g. 15 min average). High savings in costs for electrical power are possible due to smoothing the load profile. Furthermore, high electric peak loads lead to oversized electrical grids because they have to be designed for the maximum expected power.

The algorithms are validated by the demonstration platform at the Fraunhofer IISB. The test system consists of a battery system with a capacity of 60 kWh and a maximum power of 100 kW. The algorithms are executed online in an overall system control.

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Services & solutions

- Dimensioning of electrical and thermal storage systems (capacity and power) for peak shaving based on measured load profiles of the power grid
- Simulation of expected influences of peak shaving on the local energy grids
- Development of advanced control strategies for load shifting with electrical (e.g. battery systems) and thermal (storages, CHPs etc.) components
- Support for the realization of load shifting projects and validation of the results

Currently available solutions:

- Algorithms for peak shaving with electrical and thermal energy storages and operational strategy (finite state machine) for the integration of CHPs
- Tools for dimensioning energy storage systems (mathematical optimization) and evaluation of economic aspects based on a given load profile (e.g. payback periods)
- Tools for the prediction of smoothed load profiles based on simulation models of energy storage systems and grid components (e.g. CHP)

Screenshot of App for data and peak analysis, dimensioning of battery systems, simulation of smoothed load profiles and economic evaluation.

Simulation result & measurement
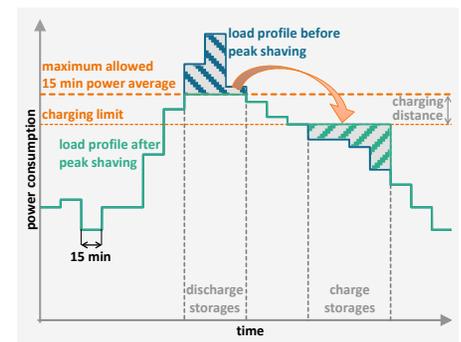
Schematic representation of the algorithm for peak shaving.
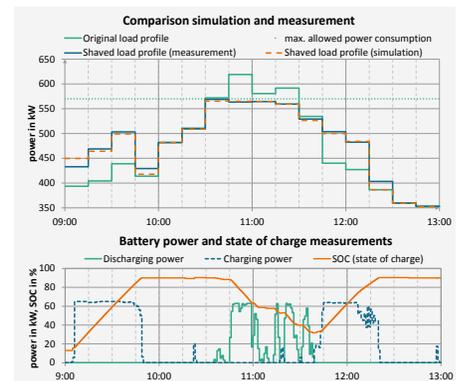
Validation of the peak shaving algorithms by IISB's demonstration platform. P_{max} was not exceeded, the reduction is 56 kW (9 %).