IISB

Load Shifting and Peak Shaving

Simulation, Prototype Development, Validation
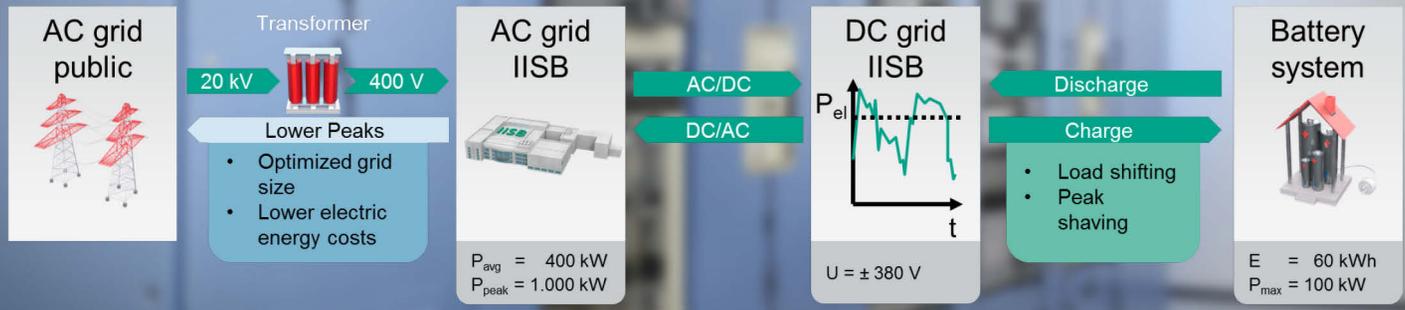
Description

This research aims to shift electrical loads and reduce power consumption peaks by using batteries. The main advantage of using a battery system is that no consumers have to be switched off and thus their production is not affected.

The price for electrical energy usually depends on the maximum power in an specific interval (e.g. 15 min average, period: one year). Furthermore high peaks lead to oversized electrical grids because they are designed for the maximum expected power. To counteract this, the electrical profile has to be smoothed.

The peak shaving system of the Fraunhofer IISB is composed of a battery system and a control unit. An algorithm based on prognosis functions calculates the setpoint of the battery power to charge or discharge it. The input data for the peak reduction system are power measurements in the AC-grid and output values of the battery system (e.g. power, SOC).

The control strategy has been developed in a simulation. The IISB's energy monitoring system supplies all necessary energy data.
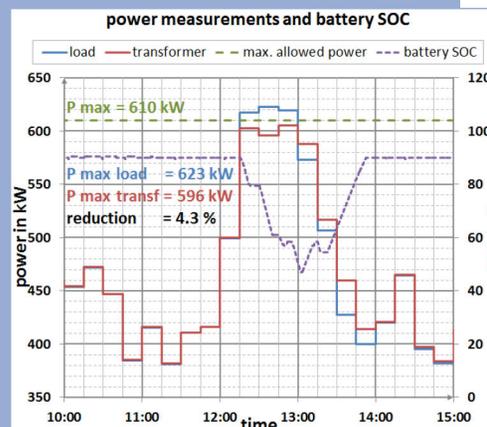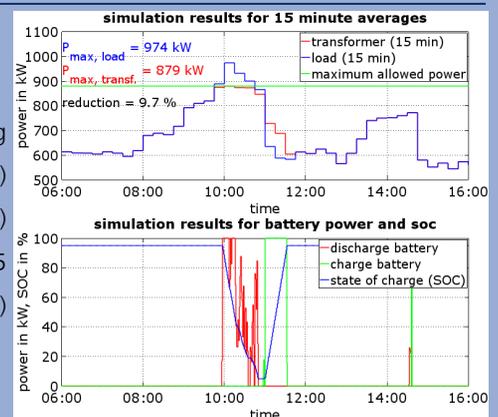
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Simulation results (different capacities)

Battery capacity	60 kWh	200 kWh
Battery power	100 kW	333 kW
Minimal SOC	5 %	10 %
Maximum SOC	95 %	90 %
Maximum allowed 15-min power	880 kW	810 kW
Power limit for loading batteries	840 kW	760 kW
Peak without battery system	974 kW	974 kW
Peak with battery system	879 kW	809 kW
Reduction	**10 %**	**17 %**

Simulation results and measurements

Simulation results for peak shaving with a battery (capacity = 60 kWh) (parameters: see table above) date of input data: 14-Aug-2015

→ reduction = 95 kW (9.7 %)

Services and solutions

- Load prognosis based on internal measurements (consumer power usage) and weather (temperature and relative humidity)

- Simulation of energy systems with different electrical loads, generators and storage configurations

- Development of control strategies for electric components (e.g. battery systems) of the energy system

- Peak reduction with electrical storage as a special application of load shifting

- Dimensioning storage systems (capacity and power) for peak shaving based on load profiles of the grid

Measurements of the battery system (capacity = 40 kWh, power = 45 kW)

date of measurement: 9-Jun-2016

→ P_{max} was not exceeded
→ reduction = 27 kW (4.3 %)
→ duration = 45 minutes