



Technical description Battery system in Nordhavn, Copenhagen

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Purpose

For the first time in Denmark, a distribution company, Radius, has integrated a battery in the power grid. The battery operates as a flexible energy storage. At grid power peaks, the battery functions as a local energy storage as well as source that can take the pressure of the grid. In the future, it is expected that the batteries will reduce the need for power grids designed to manage peaks, and the batteries may reduce the need for costly extensions of existing networks, if consumption increases as a result of electric vehicles, heat pumps, etc.

Functions

The battery system has been divided into two independently controlled systems, which can operate separately or as a system. As an example, one system can charge electric vehicles of the parking house, while the other system delivers peak shaving on the grid. If the grid is too weak in special circumstances, it can be supported with voltage or frequency regulations from the overall battery system. The battery can be recharged at times when electricity is low-priced, i.e. mainly at night, and can then again send power back to the grid at peak load periods. Fully charged, the battery can provide power for about 60 homes during 24 hours.

An RTU ensures communication between the battery and Radius' SCADA system as well as the upcoming MicroSCADA Pro control system at DTU PowerLab.

Construction

The total battery solution has been placed in two connected rooms of 10 and 12 square meters in the parking house Lüders in Nordhavn. The complete battery solution consists of several elements,

- Five individual battery racks, each containing 14 Li-ion battery modules
- Two separate inverters that convert the DC power of the batteries to the AC power of the grid
- A Master Control System that controls the entire system and applications and ensures safety
- Cooling, ventilation and a special extinguishing system in the room where the battery modules are located

Safety systems

The room where the battery racks are located contains a number of safety systems that secure the safety of people as well as the assets and operation of the plant. An Advanced Battery Management system constantly monitors the battery cells. The inverters have one additional layer of security built in ensuring that no abnormal operation of the batteries can arise. Moreover, an inergen system has been installed, which will be activated in case of fire in the battery compartment. The inergen plant reduces the oxygen content in the air, so a fire cannot be spread. A VESDA system (Very Early Smoke

Detection Apparatus) has also been installed. The entire battery system has been installed in rooms classified as fire cell in class BS60. That means that walls, ceilings and door have been constructed so that there may be a fire in the room for 60 minutes, without penetrating and spreading. Finally, the installation includes a "dry sprinkler" system with Storz coupling from the outside, so that the room can be cooled down with water.

Technical specifications

Batteries

Supplier: LG-Chem
 Type: JP3
 Energy: 460 kWh (5 individual racks each 92 kWh)
 Data: 750 V DC
 Life time: 10 years (according to the expected load profile of the project)
 Technology: Li-ion

Inverters

Supplier: ABB
 Type: ESI-I
 Power: 630 kW (two individual inverters each 315 kW)
 Data: 400 V AC/750 V DC
 Life time: 15 years (according to the expected load profile of the project)
 Technology: IGBT-based inverter

LV distribution board

Type: Cubic
 Data: 1600 A
 Protection: ABB T-max circuit breakers
 Monitoring: ABB M2M voltage quality instruments

Control system

The Master Control System is used for remote control, control and communication.

The system controls

- Frequency regulation (FDR). Control of the power supplied from the battery system to 10kV grid, if the frequency falls below 50 Hz
- Peak Shaving (PS). Controlling power discharged from the battery, when the consumption in Nordhavnen exceeds a defined maximum level
- Control and monitoring of functionality and vital system data from the Master Control RTU

Data from the various units presented in a clear and intuitive local operator control panel. Control and monitoring can also be managed from the control centres of Radius, giving Radius the option of receiving important alarms and controlling the system remotely.

Fire protection plant

Type: Inergen
 Capacity: 45 m³
 Time: 120 sec. to a required level

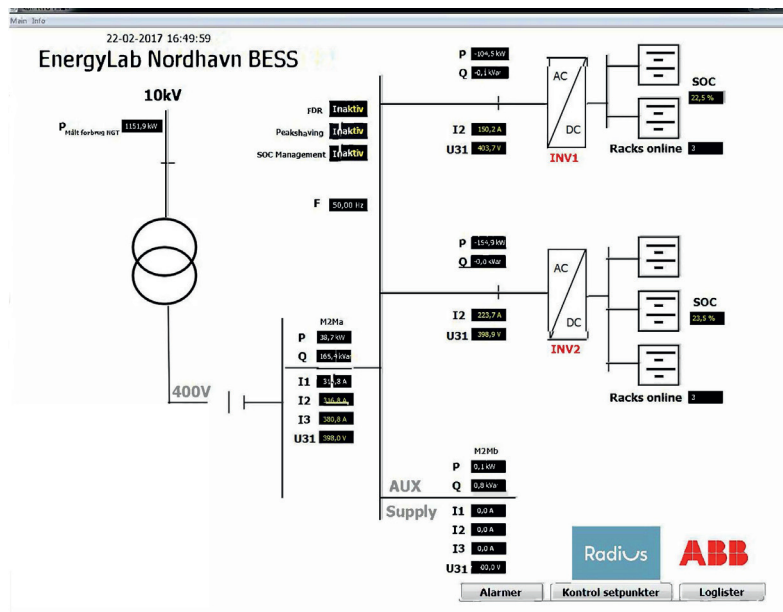
Fire monitoring plant

Type: VESDA (Very Early Smoke Detection Apparatus)
 Connection: ABA system

Cooling and ventilation plant

Power: 10 kW cooling capacity
 Refrigerant: R134a
 Life time: 15 years

Master Control User interface



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