Project update

Battery building blocks for the storage challenge

Project details

Project title	HERMES – Highly Efficient and Reliable Modular Battery Energy Storage Systems
Participants	E.ON Energy Research Center, RWTH Aachen University, Germany, Aalborg University, Denmark
Start date	2007

Key aims

- Design and development of a viable battery energy storage system with large-scale potential
- Identification of the optimum size for batteries to be building blocks in the system
- Selection of the most suitable storage technologies to operate with different energy uses.

Project summary

A new energy storage concept using batteries as building blocks in a modular system is being pioneered under the E.ON International Research Initiative.

The project aims to develop the ideal size and design of battery which can be linked together to store energy as power networks change to meet future demands.

Three of the project experts are based at the RWTH Aachen University: Professor Rik De Doncker is Director of the E.ON Energy Research Center (E.ON ERC). Together with Professor Dirk Uwe Sauer he heads the Institute for Power Generation and Storage Systems at E.ON ERC as well as the Institute for Power Electronics and Electrical Drives.

The third expert from RWTH Aachen University is Professor Armin Schnettler, who heads the Institute for High Voltage Technology. The fourth academic is Professor Frede Blaabjerg from the Institute of Energy Technology at Aalborg University.

The proposed battery energy storage system (BESS) will offer fast response times and provide large volumes of energy, potentially up to 100MW.

The project's main objective is to identify an optimized design for a battery building block of 1MW to 5MW to be used in storage systems with energy capacities ranging from 1 second to 12 hours.

Progress report – 1

Research has begun spanning the operational scenarios and potential technologies that are central to developing a battery energy storage system suitable for widespread future use.

Progress has been made in all of the project areas of activity, beginning with steps to examine the performance and operating requirements of the systems.

Five scenarios have been selected involving services for local and medium voltage networks, multi-storey car parks for charging electric vehicles, uninterruptible power supplies and storage of energy from wind farms.

A range of battery infrastructures suitable for each application was evaluated, taking account of the scenarios' different energy and capacity needs. Work also took place to match the storage system's direct current converters to the alternating current of the applications.

The link between the battery storage and the grid, the power electronic interface, was investigated. A number of configurations were examined and a comprehensive report including analysis and simulations was completed.

Similarly, research was carried out into medium voltage storage systems which can be connected directly to the grid with a high degree of efficiency.

The project includes a ground-breaking development, the first ever test facility for batteries up to 6kV at a university test centre. The design of the test bench was completed, safety and monitoring systems were investigated and construction has commenced.

In addition, assessments were made of existing storage technologies, particularly their performance in the crucial areas of efficiency rates and life expectancy.

These technologies include conventional batteries using lead-acid, nickel-cadmium and lithium-ion, supercapacitors, high temperature batteries and redox-flow cell systems. Initial investigations have taken place into battery costs.

Work also took place on a life cycle assessment for batteries detailing their through-life energy usage and environmental impacts. The total life cycle costs of batteries were investigated in a parallel study.

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