2007 topic: Energy storage

Project update

Energy 'super store' aims for speed and power

Project details

Project title	A New Supercapattery Based Energy Storage System with an Advanced Power Electronic Interface for Intelligent Power Grids
Participant	University of Nottingham, United Kingdom
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

An emerging electricity storage technology that may provide reserve energy 'on demand' is being accelerated and scaled up through E.ON's International Research Initiative.

The novel 'supercapattery' – the name is taken from supercapacitor and battery – is thought to have the potential to solve many of the technical challenges involved in storing energy.

This concept combines the fast response time of supercapacitors, and the energy storage capability of batteries, in a device aiming to revolutionize load leveling on power grids.

The University of Nottingham proposed this project which is led by Professor George Z. Chen of the Department of Chemical and Environmental Engineering, and Professor Greg Asher and Dr. Christian Klumpner of the School of Electrical and Electronic Engineering.

The project aims to demonstrate numerous supercapatteries operating together with a storage capacity of about 1.5kWh.

A second part of the project is to develop an advanced power electronic interface to join the supercapattery to the grid.

Three key factors make it suitable for large-scale grid applications:

- Its potential efficiency is greater than 80 percent
- It can deliver recharge and discharge cycles measured in minutes
- It offers a high energy storage capacity.

Progress report – 1

The first aim of the project team was the design of a supercapattery and the manufacture of the advanced composite materials required for this device.

Extensive background research was carried out to support the design stage including reviewing existing technologies and published information.

This work involved preparation of the specifications for a supercapattery which would be tested in laboratory experiments and then successfully scaled up for commercial applications.

Trials are also planned using the composite materials which will form the electricity storage medium.

The project team has produced some sample advanced materials by synthesizing composites based on manganese oxide compounds and carbon nanotubes.

The structures and properties of these composites were examined using techniques such as electron microscopy, X-ray diffraction, and galvanostatic charging and discharging tests.

Synthesis of the composites was successful and subsequent analysis confirmed that the energy storage performance of the composites was as expected.

Work also commenced on the project's second aim, which is the development of the power electronic interface to link the supercapatteries to the grid.

The electronic interface comprises a power converter to join the direct current (DC) of the supercapattery to the alternating current (AC) of the grid. The electronic interface also handles the complexities of the different voltage and frequency levels in the two systems and the connections with the 'intelligent' distribution networks of the future.

The project team has also begun the design and construction of a device known as a DC/DC converter which will enable them to evaluate the behavior of supercapatteries when connected to a DC/AC power converter and the grid. The device works by 'stepping-up' the DC voltage from the supercapattery prior to it reaching the power converter and its connection to the grid.

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