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UK Power Networks
Delivering your electricity

Demonstrating Energy Storage/Hemsby

Funding mechanism: LCNF Tier 1

Project budget: LCNF: £225,000
UK Power Networks: £2m

Status: Complete
Start date: September 2010
End date: January 2014

Project concept/overview/challenge

We installed a 200kWh Li-Ion battery at an electricity substation site in Hemsby, near Great Yarmouth. The purpose was to demonstrate that an intelligent energy storage system (ESS) can support our existing distribution network and allow more renewable generation to connect by smoothing their intermittent output, reducing voltage fluctuations and shifting load.

Stakeholder benefits

- Enable more renewable generation on the network without conventional reinforcement.
- Understand the performance of the storage device on the network to inform future installations.
- Understand the benefit of storage compared to other devices, with some, but not all, of the same capabilities such as a STATCOM.
- Identify network characteristics where electricity storage may present a compelling solution.

What we did/delivered

- Tested the storage device's capabilities on a real electricity distribution network.
- Demonstrated the load-shifting capability of the ESS.
- Assessed how an ESS could manage larger amounts of demand or generation.
- Considered and ranked the value of other uses for batteries, both to electricity network operators and intermittent generators.
- Assessed the potential lifetime of the battery.
- Embedded the findings into a design tool for network planners for use by the industry.

Findings

We discovered that an ESS is like a Swiss army knife – it can provide multiple benefits and are not just a way to store energy generated from renewable sources for use at times of low generation. The communications infrastructure, providing real-time network measurements as control inputs, and the automated control algorithm, managing peak loading to allow more renewable generation on a constrained network, were successfully installed and commissioned.

We proved that the ESS we installed:

- can store surplus energy when wind is blowing or the sun is shining
- is adaptable enough to predict when local demand will peak, and pick the best time to discharge its energy on to the network
- can measure the negative effects on the network and perform an equal and opposite action to cancel them out
- is able to ensure voltage remains consistent, and lights don't dip, when the wind suddenly drops or clouds cover the sun
- can make use of remote sensors to identify and correct problems on other parts of the network
- can switch between two different 11kV circuits, and even transfer surplus energy between them, this would normally require a back-to-back AC/DC/AC converter.

Our work has also shown that the installation footprint does not necessarily increase significantly for installations with a higher rating and/or energy capacity.

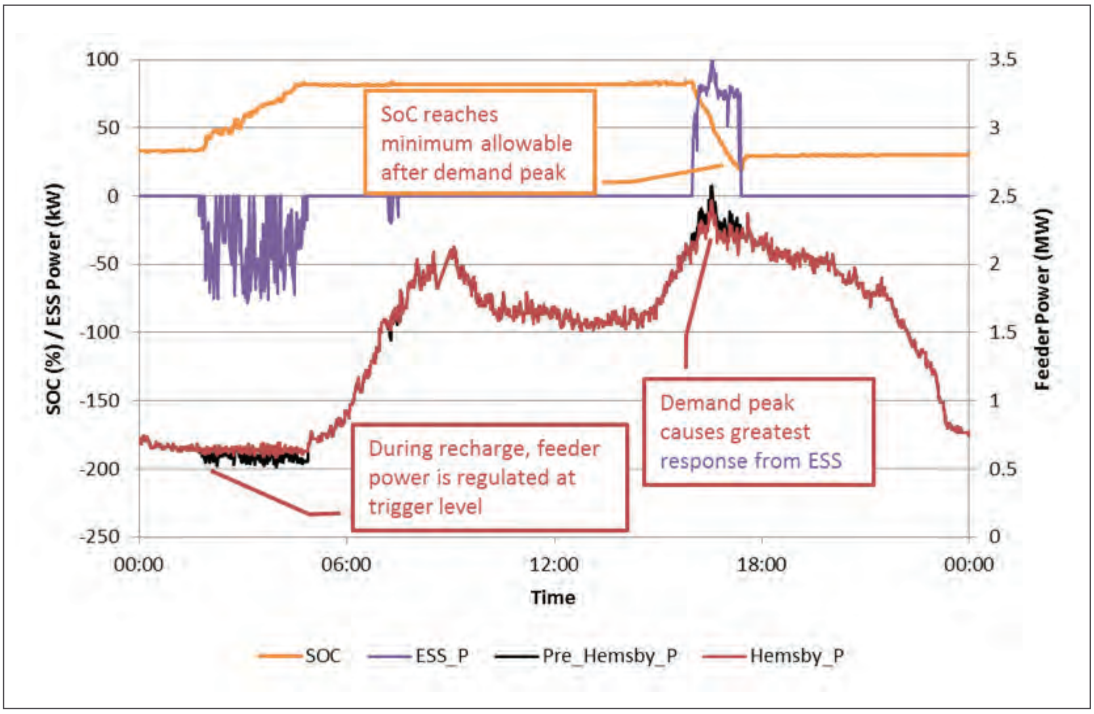

Figure 1 - Results from one day of peak shaving (load shifting)

— Battery state of charge (%)

— Battery power in/out (kW)

— Demand profile before peak shaving (MW)

— Demand profile after peak shaving (MW)

Next steps

- The closedown report from this project is available on our website – ukpowernetworks.co.uk/innovation.
- The learning from this project is informing our LCNF Tier 2 project, 'Smarter Network Storage', which has a larger capacity and includes the evaluation of business models and participating in markets.

Partners