Case study

Optimising Regional Clusters of Smart Energy Networks

Encraft worked with the City of Wolverhampton Council and a number of technical partners to model the impact of smart energy control solutions in an area of the Black Country.

Project Outcomes

- 9% community energy bill savings
- 25% reduction in winter peak load
- 83% reduction in summer peak export

This project modelled smart controls implemented in each property across Wolverhampton Business Park and an adjacent residential area to explore the range of impacts across domestic and industrial properties.

The project considered a baseline scenario with the network as is, and then a future scenario to 2020 with and without smart control technology considering projected deployment of distributed generation and low carbon technologies such as heat pumps and electric vehicles that could stress the network.

The algorithm worked to optimise consumption within the community against price tariff signals to minimise the cost to the consumer by shifting manageable devices and optimising the time of use of energy generated from solar panels using local battery storage.

Modelled equipment

- Solar panels
- Heat pumps
- Electric vehicles
- Battery storage
- Managed devices (washing machines,
- dishwashers, tumble driers)
- Smart controls

The modelling demonstrated that this kind of technical solution has potential to save end customers up to 9% on electricity bills via demand shifting and tariff optimisation (in addition to any direct benefits of microgeneration in the forms of avoided electricity purchase and feed-in tariffs).

An additional benefit was the ability to reduce peak grid load by up to 25%. This is achieved by maximising community self-consumption of low carbon on-site power generation, by introducing energy storage technologies, and balancing demand with managed 'smart' devices. Potential capacity over-loading on one of the two substations studied was reduced from 160% to 103% by the algorithm, a reduction of 35.7%. This implies less need for grid reinforcement and lower cost of connection for new housing developments.

The graphs below show the changing load profile of a substation supplying the residential area with and without the addition of smart controls. The green zone indicates the range within which the transformer is happy to operate. When the load rises above or below this zone then problems can occur.

In the winter the main benefit of the smart control algorithm is the 25% reduction in peak load on the network to bring the winter evening peak back down to within the green zone. In summer the problem encountered is the export of power from the distributed generation within the community that is unable to be used locally in the time of peak generation in the middle of the day. The algorithm successfully minimises this period of export to avoid the problems this can cause on the network.

Next steps

This 12 month study has demonstrated proof of concept for the technology, but will need to be validated in a 2-3 year test and pilot programme. The study has identified a specific pilot location, comprising an under-loaded substation with two housing sites about to be opened to development adjacent. Given that the sub-station at this location is currently operating below capacity, trials can be conducted in such a manner that they permit the technology to be safely tested 'live' and its effectiveness measured without compromising the local 11kV network.

For further information please contact Kate Ashworth, Practice Head of Distributed Energy Projects or Archie Corliss.