Future Networks Newsletter Winter 2016/17

WESTERN POWER DISTRIBUTION INNOVATION

New Projects

The Smart Energy Isles is a European funded project launched by The Isles of Scilly Council along with Hitachi. As part of this project they hope to create the infrastructure and systems to allow the Isles of Scilly to increase their renewable generation capacity.

We will be aiding the project indirectly through technical support and investigating the impact of a community, such as the Isles of Scilly, controlling both generation and demand within an established Active Network Management zone.

There will be a multithreaded approach looking at building a sophisticated software platform, setting up an Energy Enterprise, installing controllable demands in residents' homes and installing controllable charging infrastructure for a fleet of publically available electric vehicles. Each of these areas are seeking to maximise the use of renewable generation which is intended to be installed alongside the project. This approach could allow other communities to maximise their use of renewable generation which would have otherwise been curtailed.

The **Plugs and Socket project** is WPD's contribution to a larger £19m programme of work managed by Centrica which also involves National Grid and Exeter University. Together we will create a trading platform for flexibility services to act as a central point putting those who need flexibility services in touch with those who can provide them. This central "socket" is a hub to which many different parties can connect using their "plugs". As well as enabling trading, it provides a means for parties to notify each other of their planned activities, so that forecasts can be as accurate as possible. The same platform could be used for local energy trading and so the project is also known as the Local Energy Market.

Illustration depicting Centrica's vision of a flexible future

We expect the increase in renewable generation connected to the distribution network, alongside the increased uptake of electric vehicles and heat pumps, to result in challenging conditions for the distribution network. Where network constraints are only likely at certain times, it can be better value for money to try and alter the flow of power over the network through the use of flexible power services rather than investing in network upgrades. As well as Distribution Network Operators (DNO), National Grid is expected to increase their use of flexibility services. Suppliers and generators may also want to purchase services making coordination and communication between the various parties more important.

The trial will utilise the 132kV and 33kV networks and will make use of flexibility services to avoid simulated constraints for peak periods or after a network fault. As part of the project, WPD will consider the processes to predict short term and future constraints far enough in advance to allow for potential flexibility service providers to make the investments required. The project will also consider other aspects of using flexibility services, such as how to predict the likely cost and availability of services or how best to validate service delivery.

The platform will be trialled in Cornwall and will involve Centrica installing batteries and micro Combined Heat and Power (CHP) units to help businesses and domestic customers provide flexibility services. The trial will also allow us to investigate the different ways flexibility services can be sold ranging from advance contracts to something more like a spot market.

Assets

Our **OpenLV** project has been awarded £4.9 million funding as part of Ofgem's Network Innovation Competition (NIC).

The project will trial a new open and flexible solution that will be installed in Low Voltage (LV) substations, providing a much-needed enhanced data platform for local electricity grids. This platform will enable the development of Apps to provide benefits to customers, community energy groups, DNOs and the wider industry. The project started in January 2017 and will run until April 2020. The OpenLV Solution will provide consumers with network demand information for their local network and offer them the ability to develop and deploy new Apps to meet their local energy needs.

The OpenLV Solution will be deployed in 80 LV substations. These devices will show how the overall solution can release additional network capacity from existing LV network assets, how they can be used to enable the development of community or customer driven Apps, as well as enabling companies (including non-energy companies) to develop innovative Apps.

OpenLV will be hosted by us and use data from our network, and will be delivered in partnership with EA Technology, a trusted third party innovation technology company. Nortech and Lucy Electric GridKey will provide monitoring equipment and power distribution equipment expertise for the project.

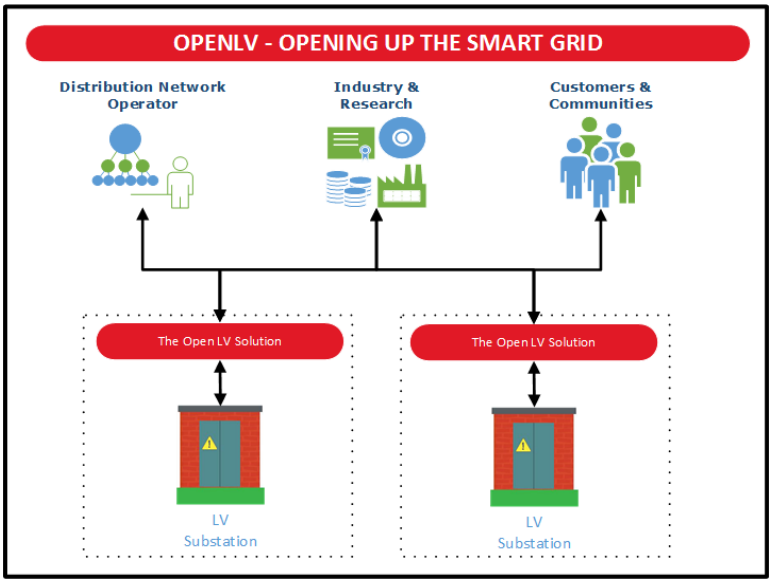


Diagram used within the NIC bid to illustrate the OpenLV Solution

In May 2016 we began a **Superconducting Cables Network Feasibility Study**; the project aims to explore the possibility of using superconducting cable technologies to address network capacity issues.

Electricity distribution networks, especially in urban locations, are rapidly reaching their capacity limits requiring reinforcement. At such locations, land and space availability could prevent the implementation of traditional reinforcement methods such as building new substations or installing additional transformers. Therefore, investigating alternative approaches to provide additional network capacity is incredibly important.

The unique characteristics of superconducting cables including their high power density, low losses and reduced space requirements could enable the interconnection of substations. Interconnecting substations allows spare capacity to be transferred to areas of the network where it's needed, hence overcoming the challenges of conventional solutions.

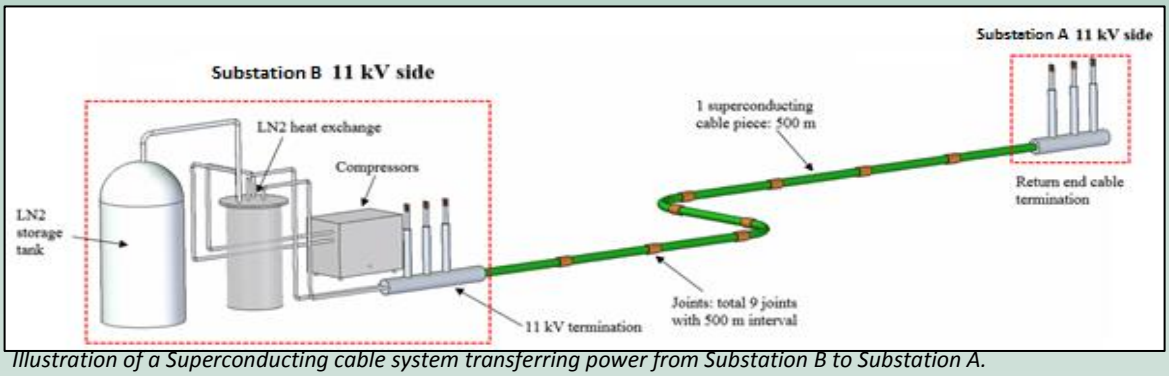


Illustration of a Superconducting cable system transferring power from Substation B to Substation A.

The study is nearing completion and we've found that in comparison to conventional cable solutions, existing superconducting cable technologies have unique benefits which could help solve challenging capacity issues in electricity distribution networks. However, the costs of such systems can be significant. Net Present Value analysis was performed to see how the two solutions compare over 50 years and showed that the superconducting technology is still more expensive than traditional reinforcement.

We will continue to explore the type of implementations that could potentially be considered in the future, taking into account among others the possible changes in the cost of the superconducting cable technology. Our final report will be published in May 2017.

Customers

The **Electric Nation** project has held a number of 'Ride and Drive' events for our staff, at various depots, and further events are planned for other depots in the spring.

DriveElectric staff recently attended an Electric Nation test drive event in Nottingham City centre (left) and further public demonstrations and displays at key events will commence in Spring/early summer to keep the momentum going. The Ultra-Low cities of Bristol, Milton Keynes, Nottingham and Derby will be given particular focus.

There are now 197 people that have registered an interest and suitability surveys are being sent out to these participants.

10 pilot Electric Vehicle (EV) charging point installs have been done and a full training day has been held for the installers. The project aims to have 40 customers signed up and surveyed by the end of January 2017 with the first real installs completed by month end. A rolling programme will then continue throughout the year.

The Sunshine Tariff project is drawing to an end with results being presented in a webinar on the 7th February. Full reports will be available on our website shortly. Despite difficulties in customer recruitment as well as data collection, the trial has provided significant learning:

Economic assessment - showed the limited subsidies that could reasonably be offered by developers. Most of the value offered through the tariff came through the benefits of half hourly settlement such as reduced Distribution Use of System (DUoS) charges, as well as a higher off peak rate.

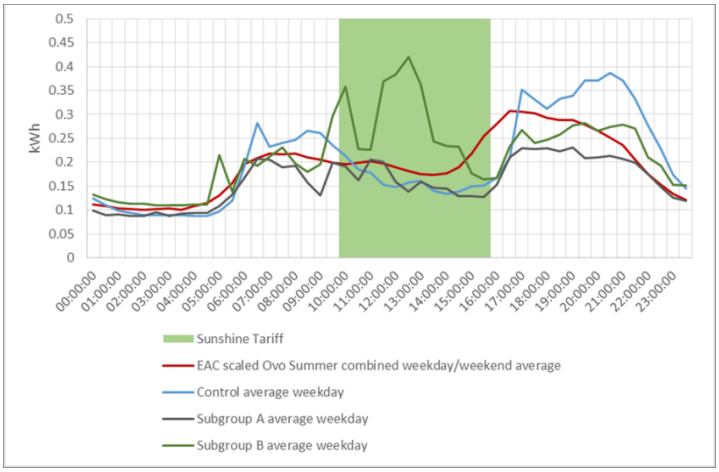
Customer recruitment - Whilst many customers showed interest in the trial, very few translated into sign ups. This reluctance was due to a multitude of factors such as: the difficulty of switching supplier, a lack of flexible loads, little or no savings due to Photo-Voltaic (PV) installations. Other factors such as the short nature of the trial reduced sign up as the effort required outweighed the potential benefits. In addition the market situation around the trial affected the attractiveness of the tariff. Over the recruitment period many other suppliers lowered tariffs, reducing the value of the Sunshine Tariff. These challenges and changes highlight the difficulties of engaging with domestic customers, especially where a new supplier is required. The trial also highlighted the value of trusted local advice, almost three quarters of customers cited links to WREN as reasons for joining the trial.

With the reduced customer numbers, statistically significant conclusions on customer shifting habits could not be derived, however several behaviours were noticed in customer data. These were reinforced through qualitative data such as surveys and interviews. These highlighted the limited level of shifting provided by customers in general. It would take approximately 650 customers to allow the connection of a 250kW solar farm. Households with automation provided significantly more response than those without, shifting approximately 13% of their load into the required timeframes. This was probably due to having more flexible loads such as immersion heaters and electric vehicles.

Overall the sunshine tariff showed that an offset connection agreement is not feasible in current conditions. Learning from the Sunshine Tariff shows the importance of key external changes which would improve the viability of domestic demand side response. These are:

- High penetration of smart metering and domestic half hourly settlement.
- Simpler and more efficient supplier switching.
- Increases in domestic flexible loads.
- Increased penetration of automation.

To gain more understanding on our current views on domestic DSR please check the overview paper on our website.



Graph showing sunshine tariff customer electricity usage over the trial versus the control group and the baseline.

Operations

The **Voltage Reduction Analysis** project closed down last year and the findings are being implemented into our standard policies.

Following the Low Voltage Network Templates project, we reduced the voltage settings across its East Wales, Cardiff and Swansea areas. This project looked to assess the effects of this change on both demand and voltage to help inform any future changes to network voltages.

The University of Bath, conducted extensive statistical analysis on over 200 million data points to identify any changes caused by the modified settings. The analysis found that the reduction in voltage caused a statistically significant reduction in both average and maximum demands as well as average reactive demand at the monitored substations. No reductions were identified where settings hadn't been altered.

The 0.88% average reduction in voltage settings caused a 1.16% reduction in average demand over the year and a 1.13% reduction in maximum demand. If scaled to the whole of South Wales, the reduction in average demand would equate to a yearly decrease of 131.9 GWh, worth approximately £14.9m on customer bills over a year. This would also save ca. 70,000 tonnes of CO_2 per year. In addition the reduction in maximum demand would release capacity on thermally constrained LV networks.

Voltage profiles were also analysed as part of the project. Following the change in settings, voltages still sit at the higher end of the allowable spectrum with scope for further reductions. The change of settings also reduced the already low number of voltage excursions. A small increase in under-voltage excursions was offset by a much larger reduction in over-voltage excursions.

Building on this improved understanding of the benefits and effects of voltage reduction, we will be reducing 11kV voltage settings by 100V across its network. This will enable further reductions in demand and further savings. This will be rolled out over the course of the 3 year maintenance cycles of 11kV Automatic Voltage Control (AVC) schemes.

The findings have also fed into the ENA's Statutory Voltage Limits task force which is investigating the potential for widening the LV voltage limits from +10%:-6% to +10%: -10%, in line with the wider European standards. The potential for lower voltages would allow for further savings to be delivered.

Investigations into National Grid's Operation Juniper were also carried out, confirming the low responses mentioned. This was due to a combination of time of implementation but also a smaller than expected reduction in voltage seen at the distribution substations.

Our **Entire** project is reaching the end of the design phase and will be looking to go public on the customer proposition as well as the areas required by the end of this quarter.

As part of our licence condition to run an efficient, co-ordinated and economical network, we are looking at innovative new ways to release network capacity. By utilising Demand Side Response (DSR), we aim to avoid or defer costly capital works to reduce the cost of the network whilst releasing capacity quicker.

Our need for DSR is dependent on the condition and loading of individual assets. As such it is very location specific, potential providers must be connected to the relevant network to provide a service. We will use the Flexible Power brand to help identify and recruit customers in the areas to help deliver value to the wider bill payer.

Previous experience has shown us that combining revenues is key to making local network led DSR viable. Flexible Power is focussed on allowing participants to access multiple market mechanisms, allowing providers to maximise value. By supplementing our local requirement with value from existing national services, providers see the true value of their flexibility whilst the burden of individual services is reduced for wider electricity customers.

To deliver this, Flexible Power has put in place the required technology and contractual frameworks to manage customer flexibility. Where required Flexible Power can control, manage and remunerate customers for benefits provided across the different services. Alternatively Flexible Power can provide contracts for the local network issues, letting customers decide the best way of maximising value.

The project will initially be focussed on WPD's East midlands area. These are listed below:

LOCATION	ISSUE
Warwick, Harbury BSPs	Approaching limits of circuit capabilities under N-2 conditions
Berkswell GSP	Approaching limit of Super Grid transformer capability under N-2 conditions
Brackley, Banbury BSPs	Approaching limits of circuit capabilities under N-2 conditions
Rugby, Daventry, Pailton, Whitley BSPs	Approaching limits of circuit and transformer capabilities under N-1 conditions
Stony Stratford, Bradwell Abbey, Bletchley BSPs	Approaching limits of circuit and transformer capabilities under N-1 conditions

Find out more

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