electricity north west

Bringing energy to your door

CLASS

Customer Load Active System Services

A low cost, innovative solution which manages electricity demand by controlling voltage. . . but with the same great service to customers.

Our £9 million CLASS project successfully demonstrated that capacity can be increased by controlling voltage on the electricity network – a solution that could be rolled out nationwide.

The aim of CLASS was to trial a range of innovative techniques to manage electricity consumption using dynamic voltage control. The key to unlocking the huge potential value of CLASS was to prove that the techniques are acceptable to customers.

After the project went live in spring 2014, we worked with the National Grid to carry out four sets of trials, using a range of equipment installed at our control room and in 60 primary substations, serving 485,000 customers. Over 1,300 customer surveys were conducted to show that CLASS has no adverse effects on customers' electricity supply.

The findings from the trials and surveys successfully proved that using CLASS techniques can make maximum use of the existing electricity network and does not affect customers' perception of their electricity service.

Results from the trial show that if CLASS was rolled out across the whole of Great Britain the scale of the change in instantaneous electricity demand available would be greater than the output of a large coal-fired power station. This flexibility in electricity demand has the potential to radically change the way we keep the entire electricity system in balance, minute-by-minute.

CLASS technology

As part of the CLASS project we installed a device called an autonomous substation controller (ASC) at 60 primary substations. This device linked our control room management systems to the on-site automatic voltage control (AVC) relay. The AVC relay is a device used in our business as usual operations, which monitors voltage and operates the transformer on-load tapchangers, to maintain voltages within statutory limits. The ASC is the on-site intelligence of the CLASS system which, once activated or enabled from the network management system (NMS), via the remote terminal unit (RTU), makes decisions on what commands to send to the AVC and circuit breakers. At ten of the 60 CLASS substations, the ASC was also able to issue commands to trip one of the primary transformers and increase impedence. This reduced demand very quickly by lowering voltage, while keeping all customers supplied. The ASC was linked to the National Grid NMS via an ICCP link, which meant CLASS functions could be enabled and activated by the National Grid.

The changes in voltage and demand were measured by the primary monitors and sent through a standard resolution communications link, via the RTU, to the control room. The CLASS data was sent by a high resolution 3G (Envoy) communications link to a website (iHost), where information was stored by the second and to a resolution of one volt and one amp.

To make sure that customers did not experience voltages outside of statutory limits the normal primary monitoring equipment was replaced with more accurate equipment, which monitored voltages on the LV and HV systems.

CLASS trials

To demonstrate the CLASS approach and to understand if customers were aware of any effect on their electricity supply, we conducted four trials on 60 primary substations over a 12-month period. These were developed to demonstrate how voltage management techniques can reduce demand. The trial area represented 17% of our network and around 485,000 customers.

We collected and analysed data on voltage and power quality so that we could quantify the effects of the trial on the regional and national electricity networks. At the same time we engaged with customers in the trial area to understand if the trials had any noticeable effects on their electricity supply.

Engaging with our customers

CLASS customer engagement was split into two key stages:

- An engaged customer panel to evaluate and refine customer communication materials and a survey instrument
- A quantitative survey, designed to detect any changes in customers' perception of power quality during the trials.

The main objective of the customer surveys was to test the hypothesis that:

CLASS will be indiscernible to customers (customers will not see/observe/notice an impact on the supply quality when these innovative techniques are applied).

In total 496 domestic customers and 200 industrial and commercial customers were recruited to take part in a 20-minute baseline survey, which served as a benchmark for any potential changes to power quality perceived during the trials. Four subsequent seasonal surveys monitored the effect of the trials on power quality perception. These monitoring surveys were designed using a test and control method to distinguish genuine changes in customers' perception.

Analysis of the customer survey showed no significant change in the proportion of customers noticing a difference in the quality of their electricity supply.

The statistically robust findings from the customer surveys successfully proved that CLASS does not affect customers' perception of their electricity service and could be rolled out nationwide.

CLASS as business as usual

In November 2015 Ofgem granted us an extension to carry out further work on our CLASS project.

The extension was granted to demonstrate how CLASS technology can be deployed commercially by distribution network operators and bring forward the expected £50 million worth of potential customer benefits identified by the original project more quickly.

Baringa Partners were commissioned to develop a cost benefit analysis tool and produce a report to summarise the findings of this work.

As a result, early in 2017 our board gave the go ahead for CLASS to be adopted into business as usual, which could save our customers around £100 million over the next 25 years – and £300 million across Great Britain.

We have worked with our partners Schneider Electric to develop an enhanced AVC which is a revolutionary design and which will be installed in up to 260 of our primary substations.

The AVCs communicate directly with our control room which is the first time we have used the new functionality being provided as part of our new network management and telemetry systems.

Once there are enough sites ready we will be able to provide balancing services to National Grid, helping them to balance supply and demand for the whole of Great Britain.

TRIALS

Trial 1: investigated the voltage/demand relationship for normal increments and decrements of system voltage at primary substations across an annual period. The outcome from this trial was a half-hourly voltage/demand relationship matrix, developed by The University of Manchester, to understand how voltage control can be used to manage demand.

Trial 2: investigated demand response for peak load reduction in order to prevent or defer network reinforcement.

Trial 3: investigated demand response during frequency events to support the National Grid. This was achieved by opening one of a pair of primary transformer circuit breakers, or by changing the on-load tap positions of primary transformers.

Trial 4: investigated the viability of the tap staggering technique for the provision of reactive power services (ie regulation for high voltages) to the National Grid and the distribution network operator.

TO SEE OUR **COMPLETE CLOSEDOWN REPORT** AND **ASSOCIATED DOCUMENTS**, VISIT: **www.enwl.co.uk/class**