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Hello and welcome to the latest edition of the Customer-Led Network Revolution News

A lot has happened since the last edition of our CLNR newsletter – and we have now entered an exciting new phase of the project, having achieved some key project milestones over the past six months.

Installation of the various network technologies we are trialling is now complete, including six energy storage batteries sited at locations across the Northern Powergrid electricity network (see page 8) We are looking forward to sharing the results from this pioneering trial.

Where trials are already underway, we have been sharing our early findings at academic conferences and industry events (page 13). We have already collected and analysed a year's worth of data from real-time thermal rating on HV and EHV overhead lines, which will be of interest to network operators looking to draw conclusions about network capabilities.

Our customer trial recruitment drive concluded in the summer with some impressive results. More than 12,000 domestic, SME, industrial and commercial customers are taking part in the project, with recruitment targets achieved in the majority of the 22 different trials we are running.

We gained some valuable insights throughout our trial recruitment process and to ensure this knowledge is shared with other DNOs and LCN Funded projects, we commissioned a report from industry think-tank Sustainability First. The report covers lessons learned and makes recommendations for future projects trial design. You can read the highlights on page 4 and the full report on our website at:

www.networkrevolution.co.uk/industryzone/projectlibrary

I'm pleased to be able to share some other project highlights in the coming pages including;

- Evidence given to the Energy and Climate Change Committee on the implications of the national smart meter rollout.
- The publication of interim findings on customer flexibility and the effects of measures like time-of-use tariffs, as well as early findings from our demand side response trials with industrial and commercial customers.
- A partnership with Charge Your Car (North), which has significantly boosted our number of EV trial participants.
- Knowledge sharing at high profile conferences and industry events, and the success of our CLNR dissemination events.

Read on to find out more about the progress of the CLNR project. We always like to hear from you too, so please feel free to share your thoughts and feedback, contact us using the email below.

Liz Sidebotham
Editor

info@networkrevolution.co.uk

The great trial recruitment challenge

With almost 11,000 domestic electricity customers and a further ca. 2,000 SME, industrial and commercial customers now signed up to the various CLNR trials, a complex and comprehensive recruitment drive has now concluded.



The project has passed a significant milestone and is entering an exciting new phase as the collection of trial data and in-depth analysis takes place, but the journey to this point hasn't always been straightforward and the project has successfully overcome some significant challenges along the way, including the slower than expected uptake of certain low carbon technologies.

To ensure our experiences are shared with the industry, we commissioned a report by Sustainability First, to understand what we did right, what we could have done differently and enable other DNOs to benefit from lessons learned when designing their own LCN Fund projects.

Stavros Sachinis, from British Gas, said: "This project is the largest of its type to be undertaken in the UK, so from the very start, we knew we had to be ambitious to recruit the high volume and diverse range of customers needed for the 22 different trials we are running."

"We had some fantastic early successes, recruiting almost 9,000 of our smart meter customers onto our large control group relatively quickly, but our most popular recruitment drive was for the Off-Peak Saver 3 Rate time-of-use tariff trial, which was oversubscribed. We were encouraged by how customers quickly appreciated how a fairly complex but flexible tariff could benefit them and fit with their lifestyles."

The greatest challenges were faced at an early stage in the project, with the team having to look outside the British Gas customer base to populate some of the low carbon

technology trials and a slower than anticipated take up of heat pumps and electric vehicles.

Taking heat pumps as an example, we found that fewer customers had installed this technology than had been expected, largely due to the financial incentives offered by the Government's Renewable Heat Incentive not being implemented as expected. However, a £2.8m grant from the Department of Energy and Climate Change meant we were able to deploy heat pumps, and there are now more than 400 installed.

Stavros added: "With any large multi-partner project like CLNR, challenges with aspects such as customer recruitment and new technology are to be expected. The important thing is to remain adaptable and innovate to deliver successful outcomes.

"I'm pleased that we managed to recruit a significant number of customers and we are now entering an exciting stage in the project where more robust trial findings can be delivered. We're looking forward to the results, which will enable us to understand the role customers can play in helping electricity networks to facilitate greater volumes of low carbon technologies."



[Click here to read the report from Sustainability First](#)





CLNR experts take to the Commons

Following the announcement that the UK's smart meter rollout will be pushed back a year to 2020, representatives from the CLNR project Professor Harriet Bulkeley from Durham University and Stuart Rolland, Managing Director of Smart Metering at British Gas, were invited to discuss the topic with the Energy and Climate Change Committee at the House of Commons.

Professor Bulkeley and Stuart Rolland joined a handful of other professionals from across the energy sector at the Palace of Westminster in May 2013 and shared their knowledge and experience along with some of the preliminary findings from the CLNR project.

Professor Bulkeley told the inquiry: "We have spent almost 500 hours speaking to people about in-home displays and smart meters. What we found is roughly two-thirds of the people that we have spoken to are very enthusiastic about their in-home displays, about one-third of them are less enthusiastic, and about 3% disconnected them, so very few actively move away from them.

"We find the idea of a smart grid trial has provoked within people a sense of a civic relationship with the grid. They treat it not so much as a matter of a consumer relationship, but they are quite engaged with their own role in keeping the lights on, in securing energy futures, in decarbonisation and the climate change agenda."

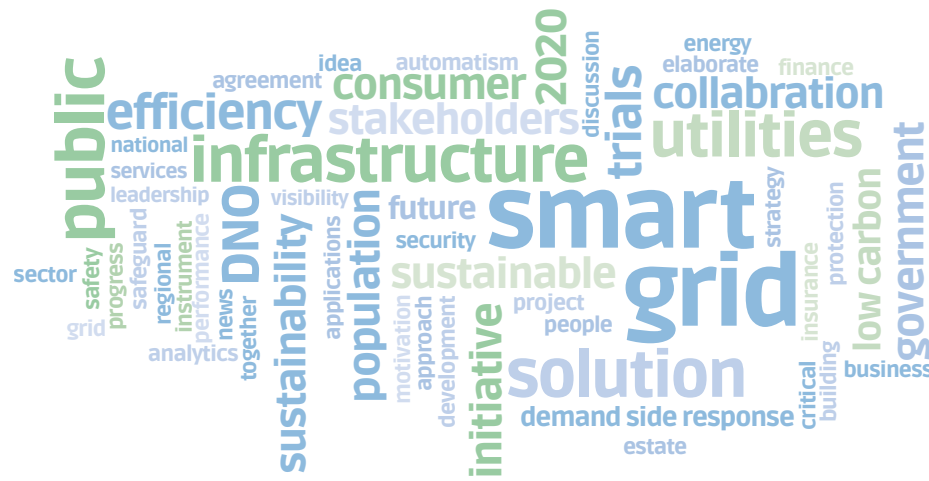
Stuart Rolland added: "A very interesting part of the CLNR smart meter trials is trying to understand whether you can shift consumer behaviour in terms of when energy is used



outside of the peak period. We have had very good early results, indicating that you can shift about 14% of the peak usage, which is very significant actually in terms of the overall objectives of smart metering."



[Read transcripts from the inquiry here](#)



Profile

Professor Phil Taylor, Head of Sustainability at Newcastle University

Leading expert in renewable energy Professor Phil Taylor has long been an advocate of a socio-technical approach to secure an economical, flexible and reliable smart grid of the future.

As the academic lead on the CLNR project and with a background in the engineering industry, Professor Taylor is keen to bridge the gap between industry and academia.

He asserts that it is essential for the entire energy industry – from DNOs to energy suppliers to generation owners – to collaborate and share their knowledge and experiences, instead of working independently of each other.

Professor Taylor explains: “A multi-disciplinary methodology is crucial to create an electricity network that can meet the demands of the future, which is fast becoming the present.

“In the past, the electricity distribution network was a relatively one-way street – electricity flowed down high voltage networks towards consumers at low voltages – now, with renewable sources, such as solar power and wind farms, the power is flowing in both directions, and the traditional method of reinforcing the network may not prove the best solution for dealing with this.

“As the demands on the network have become more complex and variable, it’s becoming increasingly important to take advantage of all the historical and real-time information and emerging technologies available, whether it’s exploring the sociological and psychological factors at play for customers or using IT and mathematics to improve the existing network.”

Professor Taylor brings a breadth of knowledge to the CLNR project from his experience working with DECC on smart grids, and leading renewable energy consultancy Senegy Econnect, combined with his involvement in energy research with Cambridge University, Imperial College London, University of Strathclyde, Scottish Power, Siemens and EON, amongst others.

In April of this year, Professor Taylor switched from his role at Durham University, as Deputy Director of the Durham Energy Institute, to join Newcastle University as the lead on the Science Central research project and Director of the Newcastle Institute for Research on Sustainability (NIREs).

The move is one that has numerous benefits for the CLNR project, as Professor Taylor explains: “Joining Newcastle University has opened the door to a number of new opportunities and while we are still engaged with the brilliant social science team at Durham University, the engineering work that is so important to the project can now be completed at Newcastle. There is also a fantastic transport research team at Newcastle University, allowing CLNR to tap into the EV data amassed through Charge Your Car and the Switch EV project.

“Newcastle University also has a number of experts in the field of power electronic converters, which connect electrical energy storage and renewable energy systems



to the grid, and this is a growing area of importance for the industry and is of particular interest to the CLNR project.

“My position at Newcastle will allow us to draw on an even wider field of expertise and data and that can only benefit the CLNR project.”

Throughout Professor Taylor’s career much has changed, and it has become apparent that engineering alone cannot create the smart grid of the future we are striving for; consumers have a key role to play too.

“To be able to match supply to demand, within the network constraints, we need to make the grid more intelligent to be able to integrate demand side response, customer involvement, and energy storage into our existing networks,” he added.

“Consumers are willing to be more flexible and are motivated by a range of factors, not just financial benefits. Both domestic and commercial customers have shown an appetite to change their energy practices for environmental and community-focused reasons.

“The CLNR project is truly ‘customer led’ in the sense we recognise that people are an integral part of the smart grid, and that new network technologies are being utilised to enable customers to make the low carbon transition in a timely manner and at a reasonable cost.”

“In the past, the electricity distribution network was a relatively one-way street – electricity flowed down high voltage networks towards consumers at low voltages – now, with renewable sources, such as solar power and wind farms, the power is flowing in both directions, and the traditional method of reinforcing the network may not prove the best solution for dealing with this.





ABOVE: Our 2.5MVA/5MWH energy storage battery at Rise Carr in Darlington.



“Each of these locations has been carefully selected so that we can test the impact on power flow and voltages in a variety of different trial scenarios. Energy storage is attracting interest from Distribution Network Operators for a number of reasons, from the capital costs of managing peak energy demand to the potential to increase grid efficiency and assist with the integration of renewable energy, so real-world results are critically important.”

Focus on our energy storage trials

The CLNR project is trialling pioneering smart grid technologies, including electrical energy storage, at strategic points on Northern Powergrid's electricity network.

The concept is relatively simple. Described as 'giant batteries,' these devices absorb excess energy and discharge it back onto the network during periods of peak demand.

Ian Lloyd of Northern Powergrid, who is leading the project's network technology trials, explains why this pioneering project is so significant.

"This project is unique because we are trialling six different sized batteries (the largest of which is a 2.5MVA/ 5MWh device) on a live network, in a range of locations, from densely populated urban areas in Darlington to rural Wooler in Northumberland and Maltby in South Yorkshire, where we have a high concentration of customers with solar PV connected to the network.

"Each of these locations has been carefully selected so that we can test the impact on power flow and voltages in a variety of different trial scenarios. Energy storage is attracting interest from Distribution Network Operators for a number of reasons, from the capital costs of managing peak energy demand to the potential to increase grid efficiency and assist with the integration of renewable energy, so real-world results are critically important."

Professor Phil Taylor explains the role energy storage could play in the smart grid of the future: "The smart grid, with energy storage at its core, represents an unprecedented opportunity to cost-effectively de-carbonise the electricity system whilst maintaining security of supply.

"However, to realise the smart grid we will need to match supply to demand, in real-time and within network constraints, so it is critical to carry out testing, technology improvements, consumer education, development of standards and regulations, and to share information between projects to ensure that the benefits we can envision become a reality."

Dr Dave Roberts of EA Technology adds: "One example of the use of energy storage is called 'peak-logging'. The batteries are charged during the night or middle of the day when the network load is low and then discharged at the peak-time, typically early evening, to prevent the network becoming overloaded.

"These units can also play a part on a network where there is a lot of solar generation. The generation is at its peak during the day when people may be out and electricity usage is low. The battery soaks up the additional generation and re-plays it in the evening at the time of peak energy usage."

Ian concludes: "With the complex specification, procurement and installation process now complete, we are now looking forward to seeing the results of our ambitious undertaking. These trials will help Northern Powergrid to understand how energy storage can be used to offset peak loads and increase efficiency, whilst ensuring customers experience continuity and quality of supply."



Watch a time lapse video showing our battery being installed at Rise Carr



Customer trials deliver new insights

In April of this year, we published early analysis of data from our customer flexibility trials. One of the project's main aims is to understand levels of customer flexibility – that is, the ability of a customer, or group of customers, to change their patterns of electricity usage, and what the cost of this flexibility might be.

This information will help us to understand consumer appetite to adopt new behaviours that could help alleviate pressure on the electricity network. A practical example of this is the time-of-use tariff we are trialling, where energy customers are encouraged to move more of their electricity use outside of peak times of demand.

“The load profiles in this report will be of interest to distribution network operators, engineers and designers, as well as academic bodies and the wider energy industry,” said Robin Wardle of Durham University.

“It’s very much a snapshot of the data that has been collected so far, but it does highlight some interesting aspects of customers’ use of electricity, and provides an insight into which technical, social and economic solutions might be feasible when attempting to integrate new low carbon technologies into existing networks.”

Robin added: “It’s important to remember that these trials are on-going and the findings presented here are very much a first look at the data. Over the coming months we will be conducting more in-depth analysis and, as the project progresses, we will deliver more robust findings and share these with our many stakeholders.”

Our early findings on customer flexibility suggests that:

1. Tariffs do appear to have an effect on consumption, with early results showing customers on time-of-use tariffs shifting their usage and consuming less energy during the early evening peak.
2. Solar PV customers consume more energy through the day when their PV is generating, which may slightly offset consumption in the early evening peak, during the summer months. The data also suggests that automating load switching, where solar PV generation is used within the home to heat water for example, can deliver notable changes in the levels of electricity imported to and exported from the home.



To read the full report, [click here](#).





Exploring demand side response

Another CLNR study looks at initial results from demand side response (DSR) trials with industrial and commercial customers, who provided ancillary services to help manage the distribution network.

Preston Foster of Northern Powergrid explains: “Demand side response (DSR) is the term given to the management of energy demand, and as part of the CLNR project we’ve been trialling the concept with selected industrial and commercial customers.

The study looks at two generic DSR product offerings. ‘Fast reserve’ was pitched at customers who could be flexible with their load or on-site generation if demand on the network approached capacity, thus helping with network balancing.

‘Voltage support’ is pitched at customers with large combined heat and power (CHP) plants and merchant generators. These customers are being asked to alter their generating operation to either support or reduce voltage, to assist with voltage control and reducing losses on the network. This proposition will be trialled during Winter 2013/14.

Preston says; “Our experience has shown us that Distribution Network Operators (DNOs) like Northern Powergrid can strike deals with customers, directly or via aggregators, to deliver ancillary services that will financially benefit customers and help DNOs manage the network. We’ve also seen synergies between ancillary services for distribution networks and transmission networks; this suggests that both DNOs and the National Grid could contract with customers to offer them a wider range of DSR options.

“There are factors that limit customers’ appetite for DSR, including the cost of disruption to their business and the potential need to commit to repeated responses over an extended period of time. The contract we would really like to trial is based on network outages after a fault, and we therefore included the provision for interrupting the flexible part of a customer’s load during peak periods for up to ten consecutive days. These factors mean that Short Term Operating Reserve (STOR) contracts with National Grid could prove a more attractive option for many customers.

“This is the first time Northern Powergrid has trialled DSR with industrial and commercial customers. However, these early successes have given the project team the confidence that there is potential to implement these services more widely and we’re already looking to build on the learning we’ve gathered so far and recruit more customers for the Winter 2013/14 trials.”



To read our I&C DSR study [click here](#).



CLNR's emerging energy citizens

Interesting trends are starting to emerge that show people like the idea of taking more ownership over their energy use.

Tackling Time of Use



Keiran Allen
British Gas

Keiran Allen from British Gas, comments: “Our time-of-use tariff, which incentivises customers to use electricity at off-peak times, is proving especially popular as it gives householders the option to choose when they use electricity and see the difference in their bills.”

Those taking part in this trial received smart meters, which are progressively replacing standard gas and electricity meters across the country. These meters send energy readings directly to the supplier, putting an end to estimated bills and meter readings. They come with a handy in-home display that shows how much energy is being used, as it's used, and its cost in pounds and pence, giving homeowners greater insight, and therefore control, over their energy use.

Keiran continues: “We had to recruit a range of different customers to get a broad demographic cross section for this trial, so we could understand how different people would interact with the tariff. The Off Peak Saver 3-Rate Tariff required customers to have a smart meter, so we needed to find people who either already had a British Gas smart meter or were eligible for one. In many cases, customers were just as excited about the prospect of getting a smart meter as the tariff! So that became a really good recruitment driver.

“As well as trying to understand whether domestic customers can shift more of their electricity use out of the peak period (4-8pm), the aim of our domestic trials of demand side response is to test customer acceptability, technology performance, connectivity and overall reliability. Customer acceptability is particularly important – if the activities we are trialling prove to be too disruptive, customers will simply override the measures or opt out altogether. Although the overall goal is clearly to shift customers' most



electricity intensive activities out of the 4-8pm peak, we also want to see whether customer flexibility can deliver benefits on a national scale; whether time-of-use tariffs could be used to alleviate pressure on the National Grid.

“The preliminary data from the Off Peak Saver 3-Rate Tariff trials so far, alongside anecdotal evidence from Durham University, indicates that there is a meaningful change in behaviour and that the tariff and smart meter are viewed very favourably by our customers.

Switching on to smart appliances

Another method of shifting loads which is being trialled by the project is the automated response of ‘smart appliances’ and equipment (such as washing machines and air source heat pumps) which can ease the strain on the powergrid by reducing their electricity use in peak hours.

Kieran adds: “With the design and operation of the smart washing machines and smart heat pump systems, customer choice, comfort and convenience have been key design principles.

“The customer always has the ability to turn off demand side response. Customers on our smart washing machine trial receive a message on the machines front screen to tell them when a demand side response event is about to happen or when a cheap period of electricity is coming up. It’s down to them to decide whether they want to reschedule their washing to avoid a DSR event or take advantage of a cheaper rate.

Demand side response events associated with the smart heat pumps shouldn’t even be noticed by customers. An innovative design feature of the system enables a large tank of hot water to store heat and disperse it during an ‘event’. It means the heat pump system can be turned off without compromising on heating; customers shouldn’t even notice an event has taken place.”

‘With the design and operation of the smart washing machines and smart heat pump systems, customer choice, comfort and convenience have been key design principles.’

What is a smart meter?



Homes and businesses in the UK are already benefiting from the one million smart meters installed by British Gas, as part of a programme which will see all suppliers replace current gas and electricity meters with smart meters by 2020. British Gas has taken the lead on the roll-out – required by the UK Government – meaning it is bringing the benefits of smart meters to its customers early.

Smart meters automatically send meter readings back to your energy supplier, putting an end to estimated bills and meter readings. Using a smart ‘energy monitor’ (or in-home display) customers can see how much gas and electricity they’re using and its cost in pounds and pence.

The smart meters provided by British Gas also come with personalised reports that show past energy use by the hour, day, week or month, giving a guide of how that use might breakdown between things like lighting, heating and cooking, and providing personalised tips on how to make savings.

Smart meters will play a central role in enabling time-of-use tariffs and the use of smart appliances like washing machines that can identify the cheapest time of day to do a load of washing.





Putting CLNR on the map

Sharing the knowledge gained as the project progresses, we have been passing on our findings to industry peers and stakeholders at a number of high-profile events in the UK and Europe.

We presented a total of six academic papers at CIRED in Stockholm, a prestigious international conference and leading forum for the electricity distribution community and at ISGT 2013 we discussed the impact of electric vehicles on the LV network.

In the past few months we have been invited to speak at the National Skills Academy in London, at SmartGrid GB's 'Seizing the smart grid opportunity' conference, Sustainability Live and at the UK's Energy Storage Operators Forum (ESOF).

Our CLNR knowledge sharing events have also proved a big success, with impressive turn outs at both our regional stakeholder event in Newcastle and our national event in London where we shared the latest findings from our customer trials.

Our interactive CLNR smart grid model has also been making an appearance at locations across the UK, including a visit to Ofgem's head office in London. Dan Hollingworth of EA Technology who designed the model, said: "We wanted to come up with a simple way of demonstrating how the network works, how demands on the network affect the grid and how the solutions we're trialling can be applied to reduce network pressure.

"The smart grid concept can be difficult to understand for those not in the industry, but the network model makes it accessible to all, by simply and visually explaining what the CLNR project is trying to achieve."



Watch videos from our CLNR knowledge sharing events at www.youtube.com/CLNRUK

CLNR partners with Charge Your Car

The CLNR project joined forces with Charge Your Car – the UK’s largest regional network of EV charge points – to boost the number of EV users taking part in our trials.

Working with Charge Your Car enables us to monitor the typical energy consumption of EV drivers and gather valuable data about when and where owners charge their vehicles.

Chris Thompson of Northern Powergrid said: “We’re delighted to have secured a partnership with Charge Your Car, which gives us fantastic access to a whole community of electric vehicle drivers and will see an additional 150 EV charging points being installed in homes throughout the North East of England.

“It’s clear that EVs and other electricity dependent low carbon technologies pose emerging challenges for the energy industry, and that’s why through this project we’re committed to finding the most cost-effective methods to meet the demands of a low carbon future, while making sure consumers can keep their energy prices as low as possible.”

Dr Colin Herron, director of Charge Your Car North Ltd, added: “Subsidies for EV charging points in homes and businesses will certainly encourage more electric transport.

“With sales of electric vehicles increasing year on year, it’s important that we work together now to make sure we can support the accelerated uptake of EVs and the low carbon future.”

Forthcoming Events

13-15th
November
2013

LCNF Conference 2013
Brighton, UK

2nd
December
2013

CLNR Knowledge
Sharing Event
Results from our
Network Trials
Darlington, UK

To book a space contact
info@networkrevolution.co.uk



The logo consists of a red circle containing a white stylized lightning bolt or electrical plug symbol.

Customer-Led Network Revolution

For enquires about the project
contact info@networkrevolution.co.uk

www.networkrevolution.co.uk

