



Customer-Led Network Revolution

Progress Report 8



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AUTHOR

Liz Sidebotham, Northern Powergrid

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1. Executive summary

- 1.1 The Customer-Led Network Revolution (CLNR) project is assessing the potential for new network technology and flexible customer response, to facilitate speedier and more economical take-up by customers of low-carbon technologies and the connection to the distribution network of increasing amounts of low carbon or renewable energy generation. This eighth and final formal 6-monthly progress report sets out the progress on delivering the learning outcomes relating to understanding existing and future load, customer flexibility, network flexibility, the optimum mix of solutions and the most effective delivery routes to implement those solutions.
- 1.2 We remain on target to deliver the required project outputs, within the original project budget, and are on track to achieve project completion at the end of 2014 before moving into a three-month closedown phase in quarter one 2015. We forecast finishing under budget despite deploying extra customer trials analysis resources and reforecasting the costs associated with closedown. The December 2014 completion is one year later than originally planned due to delays experienced in recruiting customers and delivering the innovative customer and network technology. This was the subject of a formal change request which underwent consultation with the other distribution network operators and was approved by Ofgem in September 2014.
- 1.3 Additional sources of funding have been obtained to provide value to the CLNR project by enhancing the quality of the outputs at no cost to the customers funding the project. Most notably, British Gas contracted with DECC and £2.2m was invested in subsidising heat pump installations in the absence of a renewable heat incentive.
- 1.4 Also, our academic partners have combined other grants with the LCN funded activity. Early in the project a £0.5m Durham University grant helped to establish much of the modelling simulation capability in a smart grid laboratory that has been so important to delivering both the baseline and additional outputs from the project. More recently, a £2m grant for Newcastle University from the Department for Culture, Media & Sport is creating a national centre for Big Data and Cloud Computing. This will support the hosting of the legacy data from CLNR post project closedown that we expect to be an important national resource for the next decade. Both grants are leveraging value from CLNR, were not committed at bid, and are at no cost to customers funding the project.
- 1.5 The majority of recent activity has been on final analysis of trial data and creation of conclusions and outputs to inform DNOs on changes that could be made to standard working practices. We have kept a close watch on quality in addition to delivering to time and have contracted an additional party to assist in delivering quality outputs from the customer trials on time.
- 1.6 Notable achievements in the reporting period include:
- Completion of the programme of *ca.* 200 network trials of the electrical energy storage (EES), enhanced automatic voltage control (EAVC) and demand side response (DSR) interventions and of the grand unified scheme (GUS) active network management (ANM) system.
 - Network trial data was published in October 2014 demonstrating the performance of the various network technologies trialled for the project, making the data available to other DNOs and researchers.

- Completion of the programme of decommissioning for the customer trials.
- Publication in August 2014 of load and generation profiles based on data from our trials with more than 12,000 UK electricity customers, with profiles for various subgroups such as customers with PV or heat pumps or on time of use tariffs.
- Publication in October 2014 of [Review of the Distribution Network Planning & Design Standards for the Future Low Carbon Electricity System](#), which drew upon the published load and generation profiles. This report explores the challenges posed by the increasing integration of distributed generation from solar PV and wind farms, as well as the impact of electricity-intensive low-carbon loads including electric vehicles and heat pumps on current industry planning and design standards. It makes recommendations to update UK electricity industry network planning standards ACE 49, ETR 130 and G59.
- Completion of the development of the prototype NPADDs (Network Planning and Design Decision Support) tool and the suite of guidance documentation for distribution network operators (DNOs) including policy recommendations, equipment specifications, equipment application guides and lessons learnt reports.
- Shared key learning from the project at industry forums and conferences including Smart Grid Forum workstreams, the Energy and Climate Change Select Committee on electricity demand-side measures, and the Low Carbon Networks Innovation conference. We also focused on communication with our stakeholders, continuing the programme of monthly e-news bulletins, sent to our 900+ mailing list subscribers.

- 1.7 With the network and customer trials and the analysis and development of outputs virtually complete, the risk profile has naturally decreased as we approach project completion such that there are no active risks remaining.
- 1.8 With the progress highlighted above we are set to deliver a wide range of outputs of practical use, such as real evidence to validate the scale of demand shifting that can be achieved, the factors which affect customers' participation, and protocols for integration of smart grid solutions in industry-scale control systems. Our work is delivering significant learning about how and why customers responded to the arrangements trialled, which is critical to developing and scaling up such interventions in the future. The network models, the customer trial data and the research into customers' energy practices are delivering rich socio-technical learning.
- 1.9 We continue to disseminate the learning from the project within Northern Powergrid, and to external audiences via our CLNR website, e-news bulletins, project newsletters, PR and social media campaigns, speaking engagements and participation in industry forums and conferences. A number of peer reviewed academic papers have also been published in the period.
- 1.10 Our approach to learning capture includes a review and write-up on completion of key stages of the project. Dissemination of learning, both externally and within Northern Powergrid, is underpinned by two main principles; communicating in a way appropriate to the target audience and maximising reach and impact by using multiple channels.

2. Project manager's report

- 2.1 With the network trials and the customer-facing activities completed, we are in the final stages of completing our reports and the tools needed to integrate the solutions into business as usual, such as training materials, prototype design tool and lessons learned reports. Despite later than planned completion of the customer trials and network trials, we are set to complete this work by the end of 2014.

Learning outcome 1 (existing and future load) and learning outcome 2 (customer flexibility)

- 2.2 We have completed all planned customer trials and have decommissioned all equipment in customer premises.
- 2.3 The complexity in manipulating and analysing high volumes of customer data led to some activities running behind plan. Despite this we published load and generation profiles in August 2014, and this work informed our recommendations for updates to planning standards.
- 2.4 We added to the existing analysis team at Durham Energy Institute with additional expertise to enable us to hold to the plan to complete the project at the end of 2014. To execute this, we established a contract, scope of works and information security arrangements that meant that this party could work effectively on the analysis while not requiring access to customers' personal data.

Learning outcome 3 (network flexibility)

- 2.5 Learning outcome 3 seeks to understand to what extent the network is flexible and the cost of developing this flexibility. It involved trialling a selection of network technologies and the grand unified scheme (GUS) control system through a series of large-scale field trials. The main objective of the network trials was to evaluate the capability of the network interventions and control systems to mitigate voltage and power-flow issues arising from the large scale deployment of low carbon technologies load and generation.
- 2.1 In this reporting period, we completed the extensive programme of around 200 trials of network technology solutions (different permutations of enhanced automatic voltage control and electrical energy storage) and customer flexibility solutions under the control of the GUS, initiated via real-time monitoring and thermal rating inputs, and deploying the interventions singly and in combination. We have carried out trials of combinations of voltage control and energy storage and thermal rating in a series of full closed loop control trials at selected network locations from 230V up to 66kV, urban and rural, and with clusters of PV or of heat pumps.
- 2.2 All of our six electrical energy storage (EES) battery systems have completed their operational trials in real and reactive power flow and voltage control trials in conjunction with the control system. We have also successfully completed the first preventative maintenance cycle.
- 2.3 All the enhanced automatic voltage control (EAVC) equipment installed on transformers, regulators and switch capacitors and all the thermal rating equipment on overhead lines, underground cables, primary and secondary transformers are in service and have completed their operational trials in conjunction with the control system.

- 2.4 The control system remains in service and has completed its pre-planned sequence of operational trials in conjunction with the network devices deployed on our test networks. Interestingly the seasonal weather changes and electrical loading of the network post clock change are of significant interest, and although analysis is complete on the network trials the system remains in operation to further validate the effectiveness of its coordinated control.
- 2.5 We have successfully proven the system's ability to identify constraints and have completed a series of DSR calls with our contracted domestic and I&C customers.
- 2.6 To share our experience with other DNOs, we have prepared a series of lessons learned reports for the various network technologies based on our experience of systems selection, purchase development, installation and commissioning.

Learning outcome 4 (optimum solutions)

- 2.7 Learning outcome 4 seeks to develop the optimum solutions to resolve future network constraints which could result from the transition to a low carbon economy. We are considering optimum solutions for representative customer groupings and networks, and these solutions are informing network design and are being encapsulated in the prototype tool for network designers, NPADDS. The library of learning includes the analysis of the trials (the Benefits), the analysis of the cost to implement the solutions and subsequently the Cost Benefit Analysis.
- 2.8 We are currently finalising our optimum solutions paper which will outline a merit order of solutions to network constraints, taking academic learning and placing it firmly in an industrial context. Non-CLNR solutions are also being considered, to create a comprehensive merit order of solutions and forge a coherent, wide-ranging view of how to design future networks. It considers opportunities and solutions and explains why in practice, DNOs might take a certain policy stance. The conclusions are being structured so that they can be easily incorporated into relevant policy documents, and they have also informed the coding of the NPADDS design tool to ensure that it is consistent with policy.

Learning outcome 5 (most effective delivery)

- 2.9 The objective of learning outcome 5 is to provide a framework for transition of the technologies and interventions trialled by CLNR into business as usual (BAU). For DNOs, this will include:
- the provision of prototype design software tools;
 - material for training courses;
 - new operational procedures to define safe working practices for new technologies;
 - design policy guidance;
 - equipment specifications and equipment application documents; and
 - recommendations to update national design standards.
- 2.10 For the wider industry, this includes possible new commercial models and policy recommendations as well as an assessment of the value of these solutions to the customer.
- 2.11 In this reporting period we have made good progress on completing all of these outputs, and are set to complete them by the end of 2014.

3. Consistency with full submission

- 3.1. The high level solution being demonstrated and the high level method being trialled in the project remain the same as set out in the full submission. Ofgem approved our request for changes to the time and financial aspects of the project, granting an additional year to complete the project and a restructuring of the detail of the budget within the same overall budget.

4. Risk management

- 4.1 This section provides an update on the key risks which affect, or might affect the delivery of the learning outcomes as described in the full submission.
- 4.2 The risk profile of the project has naturally diminished as we approach the project completion to the extent that there are no active risks at this stage. A number of risks were identified at the bid stage in box 26 of the full submission proforma. These are summarised in the following table and then discussed in more detail below.

Ref	Risk category	Risk	Risk Owner	Unmitigated risk			CURRENT Risk			Contingency Plan
				I	P	R	I	P	R	
1	Installation	Network Equipment may not operate as specified	Northern Powergrid	H	L	Red	Risk closed			
2	Installation	Possible failure to deliver the integrated demand response system	Northern Powergrid	M	M	Amber	Risk closed			
3	Customer recruitment	Insufficient Customers Recruited for Test Cells	British Gas	H	H	Red	Risk closed			
4	Other	British Gas withdraws from the project	Northern Powergrid	H	L	Red	Risk closed			
5	Other	Emerging findings indicate a major change of project scope is required	Northern Powergrid	M	M	Amber	Risk closed			

H = high, M = medium, L = low, N = negligible

Risk rating from high to low is red – amber – blue – green (see Appendix 1)

Risk 1: Network equipment (EAVC, RTTR and storage) fails to operate as specified

4.3 Over the course of the project, our knowledge of the network equipment has increased and we have progressed through successful bench and witness tests of the individual devices, installation, commissioning and operation in the field trials. With the network trials complete, this risk has been closed.

Risk 2: Failure to deliver the integrated demand response system

4.4 This risk was identified at the time of the bid. The demand side response platform successfully trialled the link between the control system and the aggregators who called the demand response from I&C/DG customers (test cells 18 & 19). In addition the British Gas demand response host (Greencom) called demand response from domestic customers on the direct control trials (test cells 11a and 14). Accordingly, we have closed this risk.

Risk 3: Insufficient numbers of customers are recruited

4.5 This risk was identified at the time of the bid. Although there were a number of external factors which made recruitment of large numbers of customers more difficult than we had envisaged, we took a number of actions to successfully overcome these, and so we closed this risk. Our change request discussed in more detail the issues encountered and our mitigating actions. The 'change request supporting addendum' discussed the quality of the learning and explains that for those test cells where we have much lower numbers than originally planned, we are able in the majority of these cases to deliver meaningful results due to the advanced modelling which extrapolates data from the field trials.

Risk 4: British Gas withdraws from the project

4.6 This risk was identified at the time of the bid. With the collaborative working relationship with British Gas and the evident continued high level of commitment to the project, we have closed this risk.

Risk 5: Emerging findings indicate a major change of scope is required

4.7 This risk was identified at the time of the bid. This risk has been closed since its probability is low and naturally diminishes with time. Indeed, with equipment designed, purchased and installed and customers recruited, should this risk materialise making any major changes of scope would not deliver benefits from the investment already made. Furthermore, giving due consideration to the findings from other studies would only serve to enhance the learning delivered from CLNR.

5. Successful delivery reward criteria (SDRC)

5.1. We are set to achieve all the deliverables and activities referred to by the SDRC, although some of these will be later than the original SDRC dates due to the material changes in external circumstances, as set out in our change request. Ofgem approved revisions to some SDRC dates. Our progress against each revised SDRC is set out in the table on page 8:

Ref	SDRC	Status
1	Commence installation and commissioning of network equipment relating to learning outcome 3 – September 2011	Completed on time
2	Complete installation and commissioning of network equipment relating to learning outcome 3 – December 2013	Completed on time
3	Project close down report produced – December 2014	On track - a draft version will be available in December 2014 and a final version submitted to Ofgem at the end of the closedown phase at end Q1 2015
4	Project website up and running by end May 2011 and updated in line with project developments	Completed on time
5	Industry stakeholder forum held on an annual basis, by end May 2011, May 2012 and December 2013	Completed on time
6	Distributor project review meetings held by end July 2012 and December 2013	Completed on time
7	Regional stakeholder panel meeting held on an annual basis by end March 2011, March 2012 and December 2013	Completed on time
8	Demand profiles grouped by customer type - interim by end 2012, finalised August 2014	Interim results published on time.
9	Demand profiles grouped by low-carbon technology type - interim by end 2012, finalised August 2014	Substantially (but not fully) completed on time 14 of the 19 datasets (covering ca. 95% of trial participants) and a guide to the datasets were published on the website and disseminated via email on 29 August 2014. See Appendix 2.
10	Output profiles of existing generation types - interim by end 2012, finalised August 2014	
11	Output/ demand profiles before and after a range of interventions - interim by end April 2013, finalised August 2014	
12	Network data showing performance of selected network technologies by end October 2014	Completed on time. This consisted of 14 datasets and a guide available on the project library . See Appendix 3
13	Publish analysis of load profile data by end October 2014	Completed on time. Issued as a report available on the project library . See Appendix 4
14	Publish analysis of generation profile data by end October 2014	
15	Provide an understanding of, and disseminate by end December to other distributors, how advanced voltage control, thermal ratings and storage may be integrated to enable more low-carbon technologies to be accepted on the network. Provide a view of the costs associated with these arrangements	On track for completion on time
16	Undertake, and disseminate by end December 2014 to other distributors, a critical review of how commercial models and arrangements between distributor and supplier may evolve to facilitate customer-side response	On track for completion on time

6. Learning outcomes

- 6.1 We have been sharing our learning throughout the project, and the knowledge sharing in the last 6 months is set out in section 6.7 below.
- 6.2 Given the scale of the project and the sheer quantity of learning being delivered we have been thinking carefully about how best to share this with our key stakeholders in a way which is digestible while still making all the detailed learning available. We have developed an approach which builds on the formal closedown report to Ofgem, while recognising the diverse interests of our stakeholders. Alongside the closedown report, we are preparing three additional reports, one focussing on domestic and SME customers, one focussing on I&C and DG customers, and another focussing on distribution network operations. These reports draw together and summarise the very many detailed outputs from the project. The closedown report, the three summary reports and all the detailed outputs will be made available on the [CLNR website project library](#).

Overview of overall approach to capturing the learning and dissemination

- 6.3 Our approach to capturing learning from the project includes a review and write up on completion of each of the key stages of the project. We use both workshop style sessions and learning capture in the field. For the latter, we deployed an additional person on site to observe, discuss and note down activities and/or issues and take photographic and video evidence.
- 6.4 Our approach to disseminating learning, both externally and within Northern Powergrid, is underpinned by two main principles; delivering information in a manner appropriate to the type of audience and maximising the reach by using multiple channels. Our contacts are segmented into six 'clusters' allowing us to tailor messaging and use communications channels which are appropriate to each audience.



External dissemination

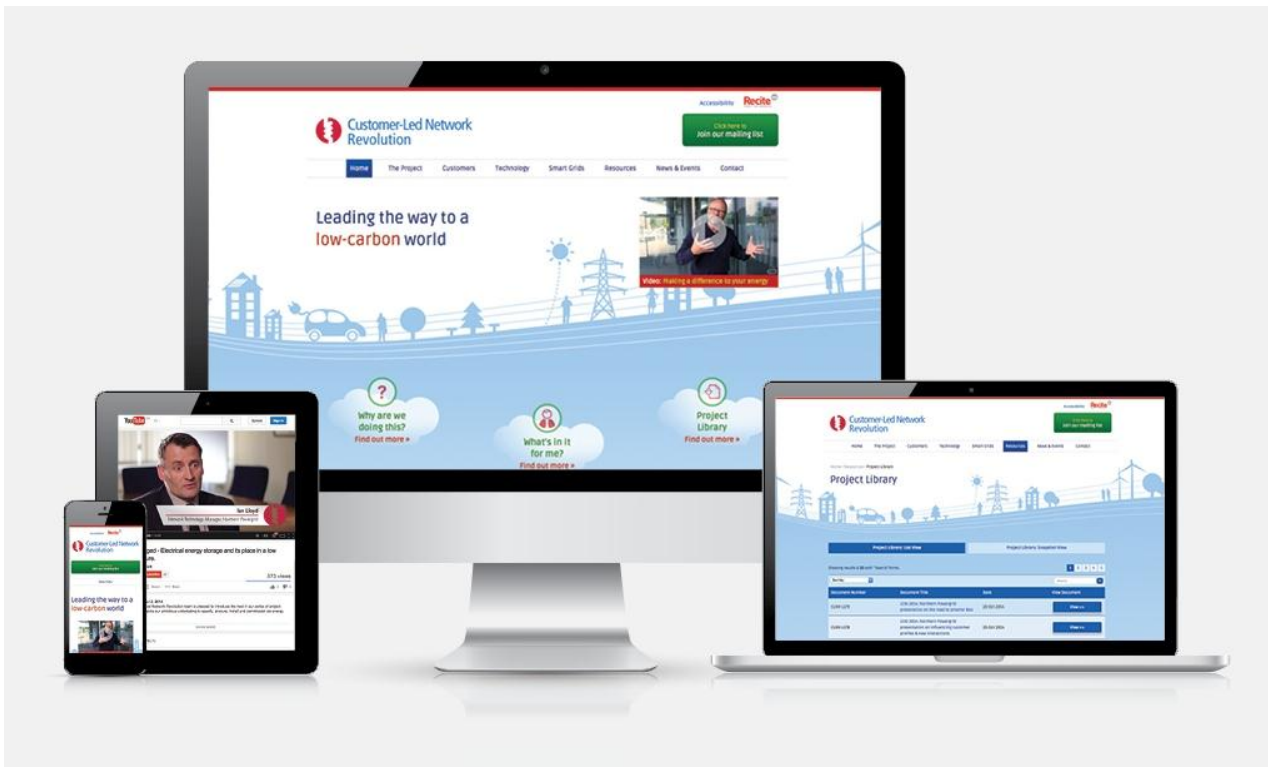
6.5 Our external communication and dissemination strategy utilises a number of different channels and mediums including speaking engagements, website, newsletters, published materials (reports, briefing notes), press releases, email and social media campaigns. We have 900+ opt-in mailing list subscribers who receive priority updates on the release of new reports and learning, as well as a monthly e-news bulletin, featuring the latest news and updates from the project. We have focused on our social media activities in the period, growing our number of [Twitter](#) followers to 558 at the time of writing and membership of our LinkedIn group to 224. More importantly we began to see our stakeholders using social media to share and disseminate learning on our behalf.



We produced three new project videos in the which are listed below with their number of views at the time of publishing. All videos produced for the project are available to view on our [CLNR YouTube channel](#).

Electrical energy storage and its place in a low carbon future	921 views
EAVC: Voltage control for smart grids	147 views
Energy storage installation at Rise Carr: Time lapse video	174 views

6.6 The CLNR website is our primary resource for sharing the learning from the project and in July 2014 we refreshed and updated the site to better support the sharing of knowledge with our industry colleagues and stakeholders. We made major improvements to the website’s project library; visitors are now able to search and filter reports and datasets and share them via email and social media. Links to related report content and videos are also provided. In addition, the website is now compatible with tablet and smartphone technology, offering people access to information and services while on the move.



CLNR uses multiple communication channels to share learning with industry colleagues and stakeholders including the CLNR website, YouTube, Twitter and LinkedIn

6.7 The following communications and dissemination activities have taken place during this reporting period. Materials marked * have been added to the CLNR website's [project library](#) for access by a wider audience.

Date	Type	Description
01 June 2014	External media	Customers will change routines in return for lower electricity bills
01 June 2014	Feature Article	The Newcastle Chronicle Newspaper: 'Families willing to change daily routines if it cuts bills, North East study shows'
02 June 2014	Feature Article	Bdaily Magazine: 'Consumers demonstrate changeable habits in North East smart grid project'
02 June 2014	Feature Article	Solar Power Portal: 'UK PV owners have a greater understanding of how they consume energy'
03 June 2014	Academic Conference	Joint workshop between Durham University and Lund University, Sweden, titled 'What makes the smart grid social?'
05 June 2014	Feature Article	Electrical Engineering Magazine: 'Meeting government targets; CLNR at the forefront of research into how UK electricity networks can rise to the challenge of cutting UK carbon emissions.'

06 July 2014	Feature Article	Modern Power Systems Magazine: 'Battery storage on trial in the North East'
11-12 June 2014	Industry Conference	CIREC 2014 Workshop: Challenges of implementing Active Distribution System Management
17 June 2014	Government	IPPR Roundtable on Demand Side Response with Shadow Energy Minister Tom Greatrex MP
17 June 2014	Knowledge Sharing	Took part in the Power 2020 debate: Does the UK have the skills & innovation to deliver an energy revolution?'
19 June 2014	Knowledge Sharing	Presentation to the DNO Stakeholder Engagement Best Practice Group on Low Carbon Knowledge Sharing
20 June 2014	Progress report	Progress Report 7*
26 June 2014	Internal	VEEEG/NPADDS Optimal Solutions Meeting
27 June 2014	Video	Release of our video 'Energy storage and its place in the low carbon future'*
27 June 2014	Email Campaign	Monthly CLNR e-news bulletin sent to 700+ opt-in mailing list subscribers
01 July 2014	Web	Launch of the new CLNR website with its improved project learning library
03 July 2014	Stakeholder	Presented key findings and insights from CLNR domestic trials to the NEA Fuel Poverty Forum *
07 - 13 July 2014	Industry Conference	Durham University host the 13th International Conference on Probabilistic Methods Applied to Power Systems.
09 July 2014	External media	Could energy storage help meet UK decarbonisation targets?
09 July 2014	Academic Briefing Note	DEI Briefing Note: Smart grids in the city *
10 July 2014	Feature Article	Electric, Light and Power Magazine: UK Smart Grid project releases data on consumer energy consumption
22 July 2014	Stakeholder	International students from Newcastle University visit CLNR
25 July 2014	Internal	VEEEG/NPADDS Optimal Solutions Meeting
27 July 2014	Knowledge Sharing	Presentation to the IEEE Power & Energy Society General Meeting 2014, Washington USA.
31 July 2014	Email Campaign	Monthly CLNR e-news bulletin sent to 700+ opt-in mailing list subscribers
31 July 2014	External media	GUS goes live on CLNR test networks
13th August 2014	External media	CLNR Customer Case Study: Solar PV with automatic in-premises balancing
15 August 2014	Industry Conference	NEA Annual Conference, Scarborough, UK
23 August 2014	Industry Conference	Presentation to the IMechE Conference: Energy Storage, An Integrated Approach

29 August 2014	Email Campaign	Email campaign to promote release of customer trials results, links to the dataset and a guide to the load and generation profiles
29 August 2014	CLNR Publication	CLNR Customer Trials: A guide to the load and generation profiles*
29 August 2014	CLNR Publication	Dataset (TC1a): Basic Profiling of Domestic Smart Meter Customers*
29 August 2014	CLNR Publication	Dataset (TC1b) – Basic Profiling of Small and Medium Sized Enterprise (SME) Customers*
29 August 2014	CLNR Publication	Dataset (TC2a): Enhanced Profiling of Domestic Smart Meter Customers*
29 August 2014	CLNR Publication	Dataset (TC3): Enhanced Profiling of Air Source Heat Pump Customers on a Flat Tariff*
29 August 2014	CLNR Publication	Dataset (TC4): Enhanced Profiling of Micro-CHP Customers on a Flat Tariff*
29 August 2014	CLNR Publication	Dataset (TC5): Enhanced Profiling of Solar Photovoltaic (PV) Users*
29 August 2014	CLNR Publication	Dataset (TC6): Enhanced Profiling of Electric Vehicles (EV) Users*
29 August 2014	CLNR Publication	Dataset (TC9a) – Smart Meter Customers on Time of Use Tariffs*
29 August 2014	CLNR Publication	Dataset (TC10): Smart Washing Machine (WWG) Restricted Hours Trial*
29 August 2014	CLNR Publication	Dataset (TC11a): Smart Washing Machine Direct Control Trial*
29 August 2014	CLNR Publication	Dataset (TC12): Air Source Heat Pump (ASHP) Customers on Time of Use Tariffs*
29 August 2014	CLNR Publication	Dataset (TC14): Air Source Heat (ASHP) Customers on Direct Control Trials*
29 August 2014	CLNR Publication	Dataset (TC20 Auto): Solar PV Users with in-premises balancing for Automatic Hot Water Charging*
29 August 2014	CLNR Publication	Dataset (TC20 IHD): Solar PV Users with In-Premises Balancing using In-Home Displays*
02 September 2014	Government	Evidence from CLNR trials given to the Energy & Climate Change Committee on electricity demand-side measures*
11-12 Sept 2014	Internal	CLNR Roadshows: Visiting selected Northern Powergrid sites to talk to staff about what we've learnt and how it could affect future business practices
16 September 2014	Industry Conference	ENA Licenced Network Operators Knowledge Sharing Day
16 September 2014	External media	Are solar owners in the dark about the value of their generated power?
22 September 201	Feature Article	Solar PV Magazine: Solar customers may be better off using self generated power
22-23 September 2014	Internal	CLNR Roadshows: Visiting selected Northern Powergrid sites to talk to staff about what we've learnt and how it could affect future business practices

25 September 2014	Internal	VEEEG/NPADDS Optimal Solutions Meeting
29 September 2014	External media	Smart grid project releases important new data on consumers energy consumption
30 September 2014	Email Campaign	Monthly CLNR e-news bulletin sent to 700+ opt-in mailing list subscribers
29-30 September 2014	Internal	CLNR Roadshows: Visiting selected Northern Powergrid sites to talk to staff about what we've learnt and how it could affect future business practices
01 October 2014	Feature Article	Renewable Energy Installer Magazine: 'In the dark on self consumption'
06 October 2014	Feature Article	Utility Week: 'New data highlights future energy needs from network operators'
07 October 2014	Feature Article	The Journal Newspaper: 'Energy efficiency will be the priority for future UK governments'
07 October 2014	Feature Article	Electric Light & Power Magazine: UK Smart Grid project releases data on consumer energy consumption
10 October 2014	External media	Filming for a feature on CLNR to be aired on Bloomberg News
12 October 2014	Academic Journal	Academic paper: Design and analysis of electrical energy storage demonstration projects on UK distribution networks, as published by the Applied Energy Journal
13 October 2014	Regulation	Smart Grid Forum (WS6) Presented findings from CLNR's domestic DSR trials
14 October 2014	Stakeholder	Major Energy Users Council (MEUC) Annual Conference, Bradford, UK
16 October 2014	Regulation	Smart Grid Forum (WS6): Presented findings from CLNR's I&C DSR trials
20-23 October 2014	Industry Conference	Low Carbon Network Innovation Conference (LCNI), Aberdeen, Scotland
25 October 2014	Video	Release of our Rise Carr Energy Storage Installation Time Lapse Video
29 October 2014	Internal	VEEEG/NPADDS Optimal Solutions Meeting
30 October 2014	Academic Journal	Academic Paper: 'Defining and evaluating the capacity value of distributed generation' as published by IEEE Transactions on Power Systems*
30 October 2014	Feature Article	Smartmeters.com: 'UK smart grid project publishes new consumer data'
31 October 2014	Email Campaign	Email campaign to promote the release of the network trials data and the industry planning standards review report; links included.
31 October 2014	CLNR Publication	Review of the Distribution Network Planning and Design Standards for the Future Low Carbon Electricity System*

31 October 2014	CLNR Publication	Dataset: Distribution Substation, Electrical Energy Storage 100kVA 200kWh Autonomous Powerflow Management Trial*
31 October 2014	CLNR Publication	Dataset: Primary Substation, Electrical Energy Storage 2.5MVA 5MWh Autonomous Powerflow Management Trial*
31 October 2014	CLNR Publication	Dataset: PV Test Cell, Distribution Substation, Electrical Energy Storage 50kVA 100kWh Autonomous Voltage Trial*
31 October 2014	CLNR Publication	Dataset: Rural Distribution Transformer, Thermal Dataset*
31 October 2014	CLNR Publication	Dataset: Urban Distribution Substation Transformer, Thermal Dataset*
31 October 2014	CLNR Publication	Dataset: Primary Substation Transformer, Thermal Dataset*
31 October 2014	CLNR Publication	Dataset: Real-Time Thermal Rating for Extra High Voltage Overhead Tower Lines*
31 October 2014	CLNR Publication	Dataset: Real-Time Thermal Rating for High Voltage Overhead Lines*
31 October 2014	CLNR Publication	Dataset: Enhanced Automatic Voltage Control for Low Voltage Network Regulator*
31 October 2014	CLNR Publication	Dataset: Distribution Substation Tapchanging Transformer *
31 October 2014	CLNR Publication	Dataset: GUS Voltage Control of Tap Changers and Energy Storage*
31 October 2014	CLNR Publication	Dataset: Real-Time Thermal Rating for Low Voltage Underground Cables*
31 October 2014	CLNR Publication	Dataset: Real-Time Thermal Rating for High Voltage Underground Cables*
31 October 2014	CLNR Publication	Dataset: Real-Time Thermal Rating for Extra High Voltage Underground Cables*
31 October 2014	CLNR Publication	CLNR Network Trials - A guide to the datasets *
03 November 2014	External media	New results and recommendations from the CLNR project
11 November 2014	External media	Could energy storage prove to be a 'silver bullet'?
17 November 2014	CLNR Publication	Micro-CHP Trial Report
18 November 2014	Internal	NPADDS User Group sign off meeting
27 November 2014	Email Campaign	Monthly CLNR e-news bulletin sent to 700+ opt-in mailing list subscribers

Internal dissemination

- 6.25 As with external dissemination, our internal communication and dissemination strategy utilises a variety of appropriate channels and formats. This includes weekly and monthly reports for the project team and project board members respectively, staff briefs sent to the entire Northern Powergrid organisation and workshops with staff from key functions involved in delivering the project, and those involved in the development and approval of key deliverables.
- 6.26 We run workshops with staff from the functions who will lead the transition into business as usual, topics covered to date include EES, EAVC, RTTR, NPADDS, GUS and commercial arrangements.
- 6.27 In September 2014 we led a series of short workshops open to all Northern Powergrid staff, intended to raise awareness and engagement within the internal organisation. These ‘taster’ sessions covered three key areas of the project (grand unified scheme, energy storage and DSR and were extremely well received with 110 colleagues from across the business attending the sessions. 97% of attendees who completed a feedback forms told us they were *‘glad they had attended’* and many requested further workshops. We plan to run further workshops in 2015 to share what we’ve learned about consumer energy practices and the rise in LCTs.
- 6.28 We hold user forums to ensure that the outputs of the project including policies, equipment specifications, commercial propositions, training materials and design tools will be fit for purpose. We attend Northern Powergrid operational and safety seminars and have produced special materials for control and field operations staff that will allow them to recognise, understand and safely operate the any new network equipment they encounter. Members of the CLNR team have also participated in or led events with the management team and with specific business functions (such as customer contact centre, network trading, design etc.). Some of these events will cover the whole breadth of the project, helping us to raise awareness, whilst others focus on specific topics which could affect their day to day roles, e.g. with design staff we focused on potential changes to policy and on the development of NPADDS.

7. Business case update

- 7.1. The business case presented in the full submission proposal was based on delivering an estimated £14.3bn of net financial benefits, including 43.5MtCO₂ benefits, to GB consumers over the period 2020 – 2050. This was based on the solutions being delivered by the project being applicable to 80% of GB networks and being adopted such that the uptake of low carbon technologies can be accelerated by one year.
- 7.2. The change request did not result in a change to the estimate of this benefits case. This is because the proposed project changes are expected to deliver the originally intended learning and customer benefits, as described in the original proposal.
- 7.3. We recognise the importance of updating the business case to reflect more recent forecasts of input data and to utilise the more sophisticated tools now available to evaluate the benefits that we expect to be delivered by this project (such as EA Technology’s Transform™ model). We have undertaken this exercise and we will finalise the results and include them in the project closedown report.

8. Progress against budget

- 8.1. We are on target to deliver the project within the original total budget of £31.0m.
- 8.2. Additional sources of funding have been obtained to provide value to the CLNR project by enhancing the quality of the outputs at no cost to the customers funding the project. Most notably, British Gas contracted with DECC and £2.2m was invested in subsidising heat pump installations in the absence of a renewable heat incentive.
- 8.3. Also, our academic partners have combined other grants with the LCN funded activity. Early in the project a £0.5m Durham University grant helped to establish much of the modelling simulation capability in a smart grid laboratory that has been so important to delivering both the baseline and additional outputs from the project. More recently, a £2m grant for Newcastle University from the Department for Culture, Media & Sport is creating a national centre for Big Data and Cloud Computing. This will support the hosting of the legacy data from CLNR post project closedown that we expect to be an important national resource for the next decade. Finally, a £2m smart grid laboratory was installed at Newcastle University with joint funding from the university and Siemens. This included a fully operational lab-based set up of the active network management system implemented on CLNR and provided enhanced capability to model scenarios in the laboratory. These additional contributions are leveraging value from CLNR, were not committed at bid, and are at no cost to customers funding the project.
- 8.4. The table below sets out the current forecast of costs to the end of the closedown phase and variances against the budget approved as part of the change request and against the forecast in the June 2014 progress report.
- 8.5. Relative to that previous position, there has been a further drawdown of £494k from the contingency budget. The majority of this, £320k is due to engaging consultancy resources to analyse the customer trial data which is within the Box 8 Contractor Costs. The other significant change at a box level is a £426k increase in Box 7 Equipment Costs. This is due to a process of truing up the accounts as we approach the end of the project, both recording late invoicing and ensuring costs are correctly allocated.
- 8.6. The changes in box totals relative to the amended schedule are set out in the table below and none of these exceed the mandated 10% threshold for requiring prior approval.

Cost Category	Costs to date to 30-Nov-14	Approved budget	Current Forecast	Variance of current forecast against revised budget		Change in current forecast (relative to June 2014 progress report)		
				£m	%	Jun-14	Change	
	£m	£m	£m	£m	£m	%		
Box 6 (Employment costs)	4.220	4.375	4.257	(0.118)	-3%	4.376	(0.118)	-3%
Box 7 (Equipment costs)	13.019	12.665	13.091	0.426	3%	12.664	0.427	3%
Box 8 (Contractor costs)	11.719	12.193	12.495	0.302	2%	12.194	0.301	2%
Box 9 (Customer and user payments)	0.361	0.499	0.355	(0.144)	-29%	0.499	(0.144)	-29%
Box 10 (Other costs) ¹	0.696	1.301	0.836	(0.465)	-36%	1.301	(0.465)	-36%
Total costs	30.015	31.033	31.034	0.001	0%	31.034	(0.001)	0%

9. Bank account

- 9.1. Deloitte conducted a review of the transactions on the memorandum account for the reporting period. The outcome of this review was successful and no significant issues were noted. The report received from Deloitte can be viewed in Confidential Appendix C.
- 9.2. Confidential Appendix A: Memorandum Account Transactions lists the transactions between 1 June 2014 and 30 November 2014.
- 9.3. Deloitte conducted a review of the financial tracking and reporting system. The outcome of this review was successful and no significant issues were noted. The report received from Deloitte can be viewed in confidential Appendix D.

10. Intellectual Property Rights (IPR)

- 10.1. No IPR have been registered or royalties earned in this reporting period. All reports associated with the closedown report will be made freely available at no charge.

11. Other

- 11.1. Further supporting information has been included within the report as appendices, which are as follows:
- Appendix 1: Project risk rating system
 - Appendix 2: SDRC evidence – output/demand profiles
 - Appendix 3: SDRC evidence – network data
 - Appendix 4: SDRC evidence – analysis of load and generation profile data

¹ Most of the reduction in 'other costs' is due to the reallocation of £494k of contingency from 'other costs' to cover costs in other budget categories.

12. Accuracy assurance statement

12.1 The approach taken to ensuring the accuracy of the information contained in this report is based on building in quality to the whole process/lifecycle of the progress report and the data and information contained therein. This quality assurance is provided by the following processes and controls:

- The integrity of the underlying systems and professional competence of the staff involved.
- Referencing existing 'within project' reports, records and materials to avoid errors or omissions.
- Independent checking of the financial aspects of the report, by Northern Powergrid staff where appropriate and by external auditors where mandated (i.e. the Project Bank Account transactions).
- Regular scheduled review of the project financial data with the senior Northern Powergrid financial staff including the Finance Director.
- Review by project board members who represent a wide range of interests and competencies and include representatives from all four project partners.
- Approval by the executive board, providing senior management endorsement by all four project partners in addition to the Accuracy Assurance Statement from a Northern Powergrid board director

12.2 The key steps in this approach are:

Step	Rationale
Content has been contributed by project personnel according to their areas of responsibility and expertise.	This provides confidence in the capability of the responsible staff to produce a meaningful and accurate report.
External auditors have certified Northern Powergrid's accounting arrangements for the project as being satisfactory, and revisit this on an annual basis (i.e. the provision of the annual report to Ofgem to confirm compliance with the requirements set out in the Bank Accounts section of the Project Direction). The most recent annual audit was undertaken in December 2014 and is included as Appendix 1b.	This provides confidence that sources of data for the financial aspects of the report are indeed reliable.
Responsibility for preparing the financial sections of the report has been allocated to the project accountant who is an accounting professional.	This provides confidence that the financial aspects of the report are professionally prepared.
The schedule of memorandum account transactions is audited by Northern Powergrid's external auditors.	Required by the Project Direction, this provides confidence in this aspect of the report.
As part of our quality assurance process, we will check that the actual expenditure figures in 'Progress Against Budget' reconcile with records in Northern Powergrid financial systems and this check will be carried out by a person other than the person who has prepared this information for inclusion in the report.	This reduces the possibility of human error.

Step	Rationale
The report is reviewed by all project partners and approved by the project executive board. Members of the Executive Board are at director level in their respective organisations.	This ensures that the report is comprehensive and balanced.

12.3 Sign off: I confirm that the processes in place and steps taken to prepare this report are sufficiently robust and that the information provided is accurate and complete.



John Barnett
Commercial Director, Northern Powergrid
19 December 2014


Appendix 1: Project risk rating system

The following matrix illustrates the risk rating system used, i.e. the probability and impact of a risk combine to give a risk rating of red, amber, blue and green.


Probability	<p>It is judged to be near certain that the risk will occur (70% < probability < 100%)</p>	High	NH	LH	MH	HH
	<p>It is judged to be probable that the risk will occur (40% < probability < 70%)</p>	Medium	NM	LM	MM	HM
	<p>It is judged to be possible that the risk will occur (1% < probability < 40%)</p>	Low	NL	LL	ML	HL
	<p>It is judged to be improbable that the risk will occur (probability < 1%)</p>	Negligible	NN	LN	MN	HN
			Negligible	Low	Medium	High
			Should the risk occur it is judged that the impact on the programme would be negligible	Should the risk occur it is judged that the impact on the programme would be marginal	Should the risk occur it is judged that the impact on the programme would be critical (or opportunity would be significant)	Should the risk occur it is judged that the impact on the programme would be catastrophic (or opportunity would be tremendous)
					Impact	

Appendix 2: SDRC evidence – output/demand profiles

Demand profiles grouped by customer type	Interim by end 2012, finalised August 2014
Demand profiles grouped by low-carbon technology type	
Output profiles of existing generation types	
Output/ demand profiles before and after a range of interventions	Interim by end April 2013, finalised August 2014



Latest results from the Customer-Led Network Revolution
New datasets give insight into consumers load and generation patterns



The Customer-Led Network Revolution has released new results from its trials with over 12,000 electricity customers. This is a key milestone for the project. The published data relates specifically to Learning Outcome 1 and Learning Outcome 2 of the project and offers important insights into current, emerging and future load and generation patterns, as well as the potential for customer flexibility.

Analysis of the data and further outputs to assist network operators to change their working practices are due for release throughout the remainder of 2014. By releasing the supporting data now, we are offering researchers and other interested parties the opportunity to begin working with the data.

Learning Outcome 1: Current and Future Load

The CLNR project has collated data from thousands of domestic and small and medium enterprise (SME) customers, through a range of enhanced monitoring and metering arrangements. Industry-leading research into customers with solar PV, electric vehicles and heat pumps has also been carried out to better understand the impact of these low-carbon technologies on the electricity network.


We have used this data to create new profiles, these will help inform the industry's current understanding of electricity consumption and generation profiles across a range of customer and demographic groups, whilst helping to assess the impact of potentially disruptive new low-carbon loads.

Learning Outcome 2: Customer Flexibility

The project is also seeking to establish the extent to which customers can be flexible with their electricity usage. This could provide a cost-effective solution to help shift demand out of peak periods and support the drive to create a sustainable, low-carbon energy sector.

The CLNR project has trialled new commercial propositions and interventions with different domestic and SME customers, as well as automated schemes with solar photovoltaic (PV) users. The learning from these trials is helping uncover the extent to which customers will accept different propositions for flexibility, from time of use and restricted hours tariffs to direct control.

All of the customers trials datasets and a guide to the datasets have been published on the CLNR website's project library. You can contact the CLNR team with any questions about these latest results at info@networkrevolution.co.uk



Customer-Led Network Revolution
Web: www.networkrevolution.co.uk E-mail: info@networkrevolution.co.uk

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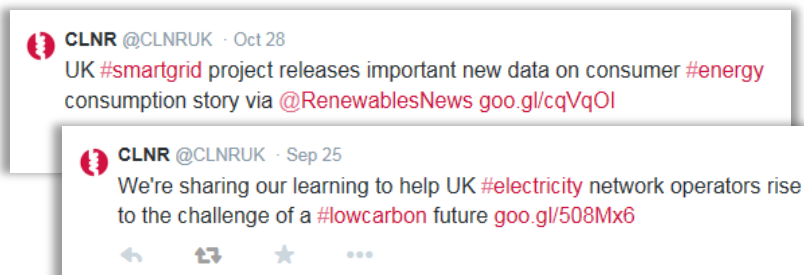
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On the 29 August 2014, we published data from our trials with more than 12,000 UK electricity customers, marking an important milestone for the project.

The results took the form of a comprehensive list of datasets and an accompanying guide which were uploaded to the CLNR website's [project library](#), successfully fulfilling our SDRC criteria. For a full list of datasets published, with hyperlinks, see the table in section 6.7

We sent a dedicated email to 510 selected DNO, energy, academic and policy maker contacts from our CLNR mailing list and promoted the release of these new results via various communications channels including internal staff briefs, [PR](#) and social media.

The results from our customer trials were also shared at the 2014 Low Carbon Networks Innovation conference in Aberdeen ([see presentations here](#)). LCNi is the UK's largest smart grid event and showcases the critical innovation work taking place across our networks. The conference was an opportunity to explore the findings from the flagship Tier 2 LCN Funded projects, including CLNR, and evaluate how these projects could influence changes to future energy policy.



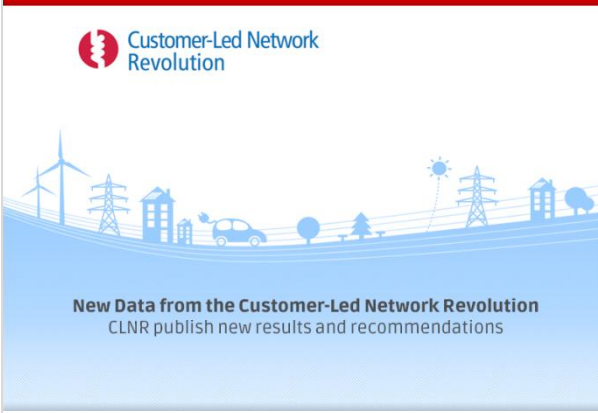
CLNR @CLNRUK · Oct 28
UK #smartgrid project releases important new data on consumer #energy consumption story via @RenewablesNews goo.gl/cqVqOI

CLNR @CLNRUK · Sep 25
We're sharing our learning to help UK #electricity network operators rise to the challenge of a #lowcarbon future goo.gl/508Mx6


Appendix 3: SDRC evidence – network data

Network data showing the performance of selected network technologies

End of October 2014



New Data from the Customer-Led Network Revolution
CLNR publish new results and recommendations



New datasets have been released by The Customer-Led Network Revolution (CLNR) project today, showing the performance of various network technologies trialled on the project, alongside new proposals and updated information that will inform network planning standards.


Over a four year period, the CLNR project has been assessing the effectiveness of a range of novel network technologies. The aim of these network trials was to explore smarter alternatives that could utilise existing assets more efficiently and defer or avoid the need for network reinforcement.

Over a four year period, the CLNR project has been assessing the effectiveness of a range of novel network technologies. The aim of these network trials was to explore smarter alternatives that could utilise existing assets more efficiently and defer or avoid the need for network reinforcement.

The technologies trialled include **Electrical Energy Storage**, **Real-Time Thermal Rating** and **Enhanced Automatic Voltage Control** at both primary and secondary substations. In other studies these technologies have been deployed individually and at higher voltages, however data from the large-scale CLNR trials provides new learning for network operators into the effectiveness of these technologies when deployed in combination and in conjunction with customer response and at lower voltage levels.

The datasets have been published on the CLNR website's [project library](#) and are accompanied by a [guide](#).

In addition, a new report has been released that draws upon load and generation profiles published earlier this year and that makes recommendations to update industry standards, including ACE49, ETR 130 and G59. Such updates would enable network operators to improve the planning and design of low voltage networks, better assessing the contribution that distributed generation makes to system security. In turn, this will help keep the cost of new connections and network reinforcement as low as possible, ensuring quality, security of supply and value for money to customers. The full report is available to view, share or [download here](#).



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Web: www.networkrevolution.co.uk E-mail: info@networkrevolution.co.uk

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On 31 October 2014, we published data showing the performance of the various network technologies trialled for the project.

The results took the form of a comprehensive list of datasets and an accompanying guide which were uploaded to the CLNR website's [project library](#), successfully fulfilling our SDRC criteria. For a full list of datasets published, with hyperlinks, see the table in section 6.7.

A dedicated email was sent to 276 selected DNO and academic contacts from our CLNR mailing list, alerting them to the release of the new datasets and reports. We also promoted them via an internal staff briefs, [PR](#) and social media.

Appendix 4: SDRC evidence – analysis of load and generation profile data

Publish analysis of load profile data	End of October 2014
Publish analysis of generation profile data	End of October 2014

On 31 October 2014, we published an important new report which drew upon the load and generation data profiles we published earlier in the year, to make recommendations to update UK electricity industry network planning standards ACE 49, ETR 130 and G59.

The report entitled [Review of the Distribution Network Planning & Design Standards for the Future Low Carbon Electricity System](#) explores the challenges posed by the increasing integration of distributed generation from solar PV and wind farms, as well as the impact of electricity intensive low carbon loads including electric vehicles and heat pumps on current industry planning and design standards. We signalled the release of this new analysis via an email campaign, social media and a dedicated press release, targeted at UK trade press and published on the CLNR website.

