Customer-Led Network Revolution

Customer-Led Network Revolution Progress Report 5

Document No: **CLNR-G016**

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Issue Date: **20th June 2013**

LCN Fund Low Carbon Networks

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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 fifth formal 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 In the September 2010 bid, we set out what we would deliver in each learning outcome and the method to do this and we remain on target to achieve this. Over the course of the past six months the project has reached important milestones in terms of both the customer and network trials. The learning now emerging is becoming increasingly beneficial to the development of smart-grid solutions that will ultimately benefit the customers of all GB distribution network operators (DNOs).

1.3 Over the course of the project there have been a number of material changes in external circumstances which mean that additional time is needed to deliver the learning outcomes. These circumstances are the slower than anticipated uptake in heat pumps and electric vehicles, solar photovoltaic (PV) 'rent-a-roof' providers not agreeing to the monitoring, and the difficulties experienced in procuring innovative technologies. In all respects, we have found alternative routes to deliver the learning but we are now forecasting to complete in December 2014, one year later than originally planned. Despite the one-year time extension, we expect to complete the project within the original £31m budget. We are currently preparing a formal change request that will require the approval of Ofgem.

1.4 Notable achievements in the reporting period include:

- Number of customers increased with *ca*. 12,000 now in the monitoring trials and *ca.* 1,000 in the customer flexibility trials.
- Trial participants now include 670 customers trialling time of use tariffs, 340 customers with heat pumps, over 400 with PV and 140 with electric vehicle (EV) charging points.
- *Ca.* 11,000 domestic customers and *ca*. 2,000 small and medium enterprise (SME), industrial and commercial (I&C) customers and distributed generators are now participating in the trials.
- One year's real-time thermal rating data from HV overhead lines collected and analysed.
- Publication of interim learning on load and generation profiles and the effect of interventions such as the time of use trial.
- New route to EV data and learning through agreement with Charge Your Car (North), significantly boosting the number of EV trial participants.
- All six electrical energy storage units, delivered to site, full mechanical installation completed and commissioning strategy review underway, ready for commissioning in the next period.
- Evidence provided to the Energy and Climate Change Committee on the CLNR social science learning emerging from over 220 customer interviews and 900 surveys to explore the implications for the national smart meter roll-out.
- Knowledge dissemination at over 20 conferences and other events.

1.5 Since the last progress report we have moved to a stage where the customer recruitment activities of the project are substantially complete. We have entered an agreement with Charge Your Car (North) which has boost the number of electric vehicle trial participants, and have been offered additional electric vehicle data by Newcastle University from the SwitchEV project. The focus is now shifting to on-going engagement with trial participants, to data collection and analysis, and to planning the dissemination of the learning developed in the period.

1.6 All network equipment has been delivered and the majority of installation works have been completed. This includes all the electrical energy storage (EES) units where we managed the contract successfully through the vendor's bankruptcy protection proceedings. We are now working through the safety and commissioning processes for the installed equipment. This is a significant piece of work and the complexity of transitioning a large number of different and novel pieces of equipment into operation on a live system should not be underestimated.

1.7 The development of the Grand Unified Scheme (GUS) control system has continued during the period and is a highly complex part of the project. We have installed the hardware for the GUS central controller and data warehouse, and we have installed the remote distribution controllers and commenced testing their interfaces to the installed network equipment. Testing of the software is partially complete. Whilst this is taking longer than planned, with completion now forecast by November 2013 as opposed to June 2013, we are managing the impact on the network trials through continued use of pre-trial simulation and emulation and by adopting a phased approach to commissioning the control system and start to the trials.

1.8 With the customer recruitment and equipment installations substantially complete, and all the network equipment procured and installed, most of the risks which may affect future progress are largely related to the successful completion of the commissioning of the GUS control system and all items of network equipment, and to retaining customers and key project staff for the remainder of the project. The table below identifies the risks with the highest current risk rating, and summarises our mitigating actions and contingency plans.

Risk	Current risk assessment	Impact	Mitigating actions	Contingency plan
Installation risk: 1. Network equipment may not operate as specified.	Impact: medium Probability: low Rating: amber Owner: Northern Powergrid	Ability to conduct trials with network equipment.	Preference for market ready products, multiple suppliers, test bed operation, phased roll out.	Where possible, use modelling instead of trialling.
Installation risk: 25. The GUS central control system may not function as required.	Impact: high Probability: low Rating: amber Owner: Northern Powergrid	It may not be possible to conduct the network trials under the control of GUS.	Use testing and commissioning to ensure all required functionality is included and working.	Run the autonomous trials and as many of the collaborative trials as is possible using workarounds, dependent upon the extent of the problem. Using the results of the autonomous trials, model the predicted results of the collaborative trials.

Risk	Current risk assessment	Impact	Mitigating actions	Contingency plan
Installation risk: 44. Some items of network equipment may not integrate correctly with the GUS central control system.	Impact: medium Probability: low Rating: amber Owner: Northern Powergrid	This would affect the number and quality of the network trials that we could execute.	Development and testing of the integration between the various components.	Operate the network equipment manually in the field and visit site to retrieve the data.
Other risk: 48. Academic personnel on fixed term contracts / studentships aligned to original project closedown date may leave before project extension is agreed.	Impact: high Probability: high Rating: red Owner: Durham University	Loss of key knowledge and skills will prevent or delay the work of the project, or adversely affect the quality of the learning outcomes delivered.	In parallel with agreeing the change request, Northern Powergrid to consider contractual arrangements with the university.	Replacement staff to be recruited. This would limit but not entirely mitigate the impact.

1.9 In December 2012 we published an initial dataset and accompanying report on profiles for domestic and small and medium enterprise general load, heat pumps, photovoltaic, electric vehicles and distributed generation. In April 2013 we published additional materials based on our interim results from our customer flexibility studies. This included a dataset and accompanying report on domestic profiles before and after a range of interventions (general load with and without a time of use tariff, and domestic PV, with and without within-premises balancing) and an initial analysis of domestic customers' response to a time of use tariff including the financial impact. At the same time, we published a preliminary report on our initial large-scale demand side response trials and associated market research.

1.10 The learning referred to above was disseminated externally by adding the documents to the CLNR website, e-mail bulletins, news items added to the CLNR website, a piece in the CLNR newsletter, press releases and extensive media coverage, LinkedIn and Twitter, and presentations at speaking engagements. Further, a number of academic papers on the social science and the engineering work of the project have been published.

1.11 Our approach to learning capture includes a review and write up at the end of key stages or activities in the project. For field work, we have found that an additional person on site in a non-operational role can effectively capture information in a way that is just not possible after the event and off site. The dissemination of learning, both externally and within Northern Powergrid, is underpinned by two main principles: delivering information according to the type of audience and maximising the reach by using multiple channels.

2. Project manager's report

2.1 In the past six months we have commenced the trial period for the majority of the customer-facing trials. For the network technology trials we have completed the majority of the installation work and we are now focussing on finalising the installs and commissioning the equipment in order to start the trials. For the GUS control system we have reached the stage where we have completed the hardware installation for both the GUS central controller and data warehouse, and in the field we have installed the remote distribution controllers and commenced testing their interfaces to the installed network equipment. We have conducted factory acceptance tests of the functionality of the GUS central controller software. Whilst this is taking longer than planned, with completion now forecast by November 2013 as opposed to June 2013, we are managing the impact on the network trials through continued use of pre-trial simulation and emulation and by adopting a phased approach to commissioning of the control system and start to the trials.

2.2 While delivering this progress on the project we have been active in sharing the technical and social learning from the project as well as developing the project outputs (such as the design decision support tool).

Learning outcome 1 - existing and future load & learning outcome 2 - customer flexibility

2.3 We have reached a point where recruitment to all the trials is substantially complete. The most significant achievement in terms of recruitment during the reporting period has been to increase the number of EV trial participants from 4 to 140 with monitoring installed and we expect this to increase in the next reporting period so that the total number of EV trial participants will reach 175. This boost in numbers has been achieved through a relationship with Charge Your Car (North).

2.4 The following table details for each test cell the number of customers currently monitored and our forecast for the total number of trial participants when we have completed the remaining installations. In the next reporting period we will close out the recruitment and installation activities.

Trial design				Trial participants			
Test cell	**Customer type**	**Load**	**Intervention**	**Gross target (bid)**	**Net target**	**Currently monitored**	**Forecast total number of participants**
1a	domestic	general	none	9,000	6,000	8,909	8,909
1b	SME	general	none	2,250	1,500	1,800	2,250
2a	domestic	general	none	600	400	139	140
HW		general, with electric hot water immersion heating				81	120
HW+SH		general, with electric hot water immersion heating & storage heating				67	100
2b	SME	general	none	150	100	81	80
3	domestic	heat pump	none	600	400	315	330

Trial design				Trial participants			
Test cell	**Customer type**	**Load**	**Intervention**	**Gross target (bid)**	**Net target**	**Currently monitored**	**Forecast total number of participants**
4	domestic	microCHP	none	20		13	14
5	domestic	PV	none	150	100	156	160
6	domestic	electric vehicle	none	150	100	140	175
7	I&C	CDCM[1]	none	14,000	analysis of pre-existing dataset		17,639
8	DG	DG	none	230	150	160	160
9a	domestic	regular	time of use	600	400	628	628
9b	SME	regular	time of use	150	100	44	44
10a	domestic	regular	restricted hours	600	400	9	75
10b	SME	regular	restricted hours	150	100	3	3
11a	domestic	regular	direct control	600	400	11	75
12	domestic	heat pump	time of use	600	400	12	25
13	domestic	heat pump	restricted hours	150	100	0	0
14	domestic	heat pump	direct control	150	100	16	17
18a	I&C	responsive load	DSR for ancillary services (fast reserve)	5	proof of concept	0	3
18b	DG	responsive generation		5		0	6
19	DG	responsive generation	DSR for ancillary services (voltage support)	5		0	1
20	domestic	PV	automatic within premises balancing	600	400	99	99
			manual within premises balancing			156	160

N.B. 36 of the domestic customers taking part in the above trials will have power quality monitoring equipment (6 heat pump, 6 PV, 6 electric vehicle, 6 microCHP and 12 general load customers) and 28 have been recruited (all except 6 PV customers) with monitoring equipment installed for 2 customers.

[1] Common distribution charging methodology

Completing the recruitment and installation stage

2.5 In the next reporting period we will recruit the remaining participants for power quality monitoring and complete the installation of the monitoring equipment.

2.6 For the PV within premises balancing, we are exploring an opportunity to recruit additional customers through one of British Gas's installation contractor's existing community partnerships.

2.7 We currently have a total of 92 customers with monitoring of electric heating of hot water and storage heating, a subgroup of the general load monitoring trial 2a. We will seek additional trial participants through the same contractor.

2.8 A report on the customer recruitment activities for both residential and SME business customer recruitment has been completed (see 6.9) and this will be published in the next reporting period.

Qualitative data gathering and the social science

2.9 During this reporting period we have completed further face to face research interviews with domestic and SME business customers participating in the trials which take the total number completed to 222.

2.10 A second customer survey for has been designed and will be conducted in the next reporting period. The EV trial participants recruited via Charge Your Car (North) have joined the project quite recently and a survey specifically for these customers has been designed and will be conducted during the next reporting period.

2.11 In addition, we have held a workshop with SME customers to discuss their energy needs and current business practices, and findings will be produced in the next reporting period.

2.12 The exercise to record, process and analyse the social science material is extensive and unprecedented in terms of its size. This information includes audio files, photographs, scanned documents and meta-data. This information will be used in conjunction with consumption data and responses to surveys to ensure that customer's voices and opinions are included in the analysis of the factors affecting energy usage. Cross-referencing data from interviews with energy consumption data will enable us to determine whether the issues that are mentioned by participants have a 'real' effect on energy consumption, or may explain differences between customers in terms of the nature and pattern of their energy use, their response to trial propositions, and their potential to be further engaged in 'smart' energy systems. Similarly, cross-referencing survey data with energy consumption data will provide a more powerful set of insights into how social factors translate into particular patterns and dynamics of energy consumption, and what this in turn reveals about the potential of developing customer flexibility for the future development of smart grids.

Large-scale demand side response

2.13 During the reporting period we have published a report[2] on the first tranche of trials in winter 2011/12 (test cells 18 and 19) and on research into the potential of DSR in the I&C and DG sectors.

[2] CLNR-L014 - Initial report on industrial and commercial demand side response trials

2.14 The pricing structure used in the first trials was based on the STOR methodology, which uses an availability and utilisation component. We have developed contract structures for the second set of trials, informed by the experience of the first trials and by the results of the research referred to above. These new contracts use a daily price concept but not the availability and utilisation structure used by STOR. The structures are as follows:

- A baseline methodology utilising the STOR methodology, which takes the baseline as the power consumption just before the despatch instruction and compares that to the post-despatch consumption level. The difference between the two consumption levels is the delivered DSR.
- A floor methodology, which requires the site to drop consumption below a threshold level.
- A further baseline methodology which is calculated by taking the average consumption from the previous 10 day period for the relevant time periods and comparing that profile with the post DSR instruction load profile.

2.15 This second set of DSR trials for fast reserve (test cell 18) will take place during the next reporting period. The risk that these customers will be located in the areas of the network which are unmonitored is discussed in para 4.20.

2.16 We have discussed the provision of voltage support through the provision of reactive power (test cell 19) with merchant generators and I&C customers with large CHP plants. Although both groups proved receptive to initial conceptual discussions we have focussed primarily on the merchant generators since we have been able to proceed faster than with the I&C customers. The trials for fast reserve (test cell 19) will take place during the next reporting period.

Customer engagement and retention

2.17 We are continuing with relatively high retention rates on the trial.

2.18 About 15 to 25 customers have either requested to leave the heat pump trials or have refused to have equipment installed. We are investigating this with the social landlords through whom the customers were recruited as customer consent to the trials was a pre-condition of receiving a discounted heat pump.

2.19 For the PV trials, 35 customers have requested to drop-out pre installation. To date, there have been no requests to leave the trial

2.20 The high level of interest in time of use tariffs shown by domestic customers at the recruitment stage has been maintained with 628 customers still actively participating in the trial, a figure which is in excess of our original target despite a dropout rate of 14% since recruitment. The vast proportion of dropouts occurred after receipt of terms and conditions and is attributed to customers' realisation that the tariff would not suit their lifestyle.

2.21 In the next reporting period we will start issuing personalised energy reports for trial participants, summarising some of the data we've collected from them as well as providing some trial specific advice. This is just part of our action plan to mitigate the risk that customers drop out of the trials (see risk 42 in section 4).

Equipment

2.22 We have experienced some power line communications issues with up to 50% of the installations that use the MicroWatt Polymeter to monitor consumption (test cell 2 and other test cells which could not accommodate a secondary meter). There has been no loss of data as a copy is maintained locally on the device). With the experience gained by the technology provider we expect to overcome these issues by remedial work on the earlier installations.

2.23 We have been unable to proceed with 20 customers recruited to the heat pump trials for a range of technical reasons including broadband communications issues, insufficient space to install the meter on the heat pump, and potential safety issues associated with exposed wiring.

2.24 To a large extent, we have overcome the issues set out in the last progress report about broadband availability amongst customers with air source heat pumps. A home area network "hub", which uses the GSM network to transmit data directly to British Gas's data management company, has been developed and successfully deployed. This has enabled a far greater number of heat pump installations to be technically ready for the installation of monitoring equipment with a marked increase in heat pump installation rates. The approach provides an alternative where broadband is not a viable communications method and has proved to be reasonably reliable from a data-communications perspective. Data accuracy and transmission quality is high and there is a low failure rate (signal strength too low in only around 8% of installs) and only 11 units of 109 are offline at the time of writing. These are expected to come back online with usually only minor interventions.

2.25 We will be using a smart washing machine as the appliance to provide load reduction from general load domestic customers, via either a restricted hours tariff (test cell 10a) or direct control (test cell 11a). 182 customers have now completed an online eligibility form and a small pilot trial was undertaken before proceeding to a full roll out. We are allowing customers time to gain experience of the smart appliance in standard (non-smart) mode, before loading the smart functionality and providing a user guide on how to interact with the appliance.

2.26 In this pilot phase, repeater plugs were used (where necessary) to extend the range of the ZigBee signal between the smart appliance and the communications gateway connected to the home broadband router. However, due to compatibility issues between the repeater plug and the smart appliances and communication gateway, we suspended use of the repeater, effectively reducing the acceptable maximum distance between the smart appliance and the communication gateway. We have screened participants accordingly and where repeaters aren't required, installations are continuing while we work on resolving this issue. In the event that the repeater issue is not resolved, we will revisit the earlier installations and install a fixed ethernet cable solution. A small number of early installations (fewer than 10) will be removed from the trial.

2.27 GreenCom Networks are developing the smart appliance DSR communications platform for the operation of restricted hours and direct control functionality. Both the smart heat pump and the smart washing machine have been connected to the platform and the restricted hours functionality has been deployed to test appliances. This pilot will allow us to learn about the user experience and interface before the mass roll out of the firmware upgrade. In the next reporting period we will remotely upgrade the installed smart appliances with restricted hours and direct control

functionality, with further customer communication, training and user guides. We will carry out tests of the restricted hours or direct control functionality for each installed appliance.

2.28 We have installed fewer of the micro-CHP units than expected due to the physical size and operating noise levels making it generally difficult retro-fit inside the home except in locations such as an integral garage. Nevertheless, we have successfully achieved 16 out of the target of 20.

Trial analysis

2.29 During the reporting period we issued interim results from trials with domestic, SME and DG customers (6.1, 6.2). In the next reporting period we will also produce an interim report on the load profiles of heat pumps monitored (without any interventions).

2.30 In the next reporting period we will work with statisticians at Newcastle University to develop the methodology associated with constructing ACE49 profiles and will use the data from test cell 1 (residential basic profile) to create an updated representation of domestic load profiles. Following this we will adapt and apply this methodology to the load data from the low carbon technology test cells to create profiles for electric vehicle, PV, heat pump and microCHP usage.

2.31 The analysis of metered data from the customer trials has been used to provide inputs to the modelling of the optimum solutions, and this is an activity that will continue in the next reporting period as more data becomes available from the trials.

Learning outcome 3 – network flexibility

2.32 The work of learning outcome 3 consists of the network technology, the GUS control system, and the network trials. The progress in installing and commissioning the network technology and the control system is summarised in the following table with additional narrative below.

Technology	Equipment	Delivered	Installed	Commissioning Strategy	Commissioned
Urban (Rise Carr, Darlington)					
EES	Rise Carr EES1 Battery 2.5MVA	✓	✓	✓	
EES	High Northgate EES2 Battery 100KVA	✓	✓		
EES	Harrowgate Hill EES3 Battery 50KVA	✓	✓		
EAVC	Darlington Melrose Enhanced Transformer with On Load Tap Changer (OLTC) EAVC2	✓			
EAVC	Rise Carr Primary Sub Station Transformer with On Load Tap Changer EAVC1	✓	✓	✓	
RTTR	Darlington Melrose LV UG Real Time Thermal Rating	✓	✓		
RTTR	Rise Carr Primary Transformer Real Time Thermal Rating	✓	✓	✓	
RTTR	Real Time Thermal Rating underground cable RTTR HV UG	✓	✓	✓	

Technology	Equipment	Delivered	Installed	Commissioning Strategy	Commissioned
Rural (Denwick, Northumberland)					
EES	Wooler Ramsey EES2 Battery 100KVA	✓	✓		
EES	Wooler St. Mary EES3 Battery 50KVA	✓	✓		
EAVC	Wooler Bridge Enhanced Transformer with On Load Tap Changer (OLTC) EAVC2	✓			
EAVC	Denwick Primary Sub Station Transformer with On Load Tap Changer EAVC1	✓	✓	✓	
RTTR	Denwick Primary Transformer Real Time Thermal Rating	✓	✓	✓	
RTTR	Overhead Line (66kV) Real Time Thermal Ratings	✓	✓	✓	✓
RTTR	Overhead Line (20kV) Real Time Thermal Ratings	✓	✓	✓	✓
EAVC	Hedgeley Moor SW Capacitor EAVC4	✓	✓		
EAVC	Hepburn Bell & Glanton Regulators EAVC3	✓	✓	✓	
Heat Pump Cluster (Hexham, Northumberland)					
RTTR	Sidgate Lane Real Time Thermal Ratings Ground Mounted Secondary Transformer	✓	✓	✓	✓
EAVC	Sidgate Lane enhanced automatic voltage control EAVC4 linkbox regulator	✓	✓	✓	
PV Cluster (Maltby, South Yorkshire)					
EES	Mortimer Road EES3 Battery 50KVA	✓	✓		
EAVC	Mortimer Road Enhanced On Load Transformer Tap Changer (OLTC) EAVC2	✓			
Control system					
GUS	GUS Central Controller	✓	✓ Hard-ware		
GUS	GUS Remote controllers	✓	✓ Hard-ware	✓	
GUS	GUS Data Warehouse	✓	✓	✓	
GUS	Integrated demand response system				
Monitoring					
various	3 different types of monitoring equipment at a range of network locations	74	74	✓	71
iHost	iHost data warehouse	✓	✓	✓	✓

GUS control system

2.33 The GUS control system comprises the central controller, the remote distribution controllers (RDCs) and the interfaces between the central GUS and the RDCs. The RDCs interact with the EES, monitoring, RTTR equipment and EAVC (collectively referred to as 'enhanced network devices' or ENDs). The simplified diagram below illustrates how these components interact, and the relationship between the central and the remote elements.

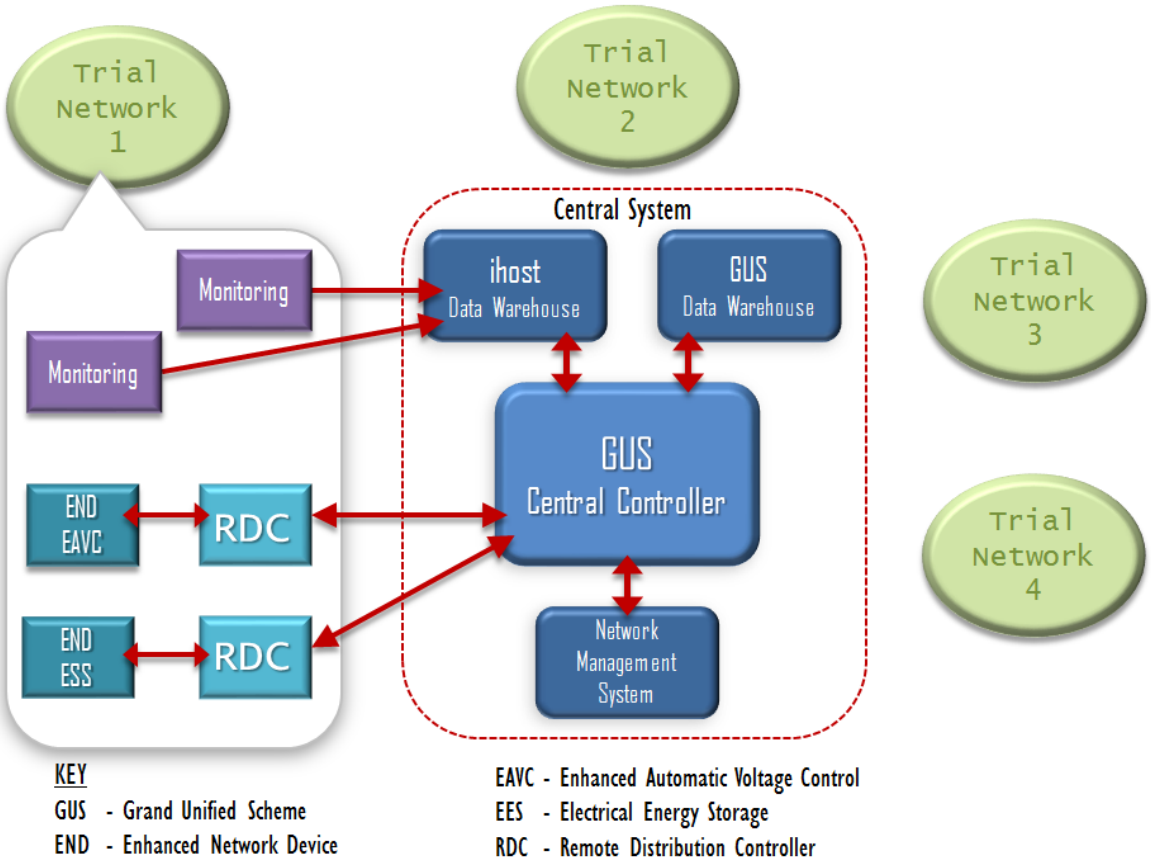

Figure 1 - simplified schematic of GUS and trial networks

2.34 The remote elements are located primarily at the four main trial networks and at various other points of interest on the Northern Powergrid network, such as at a heat pump cluster in South Shields. The main trial networks are:

- Urban network at Rise Carr in Darlington, County Durham
- Rural network from Denwick to Wooler, Northumberland
- Heat pump cluster at Hexham, Northumberland
- PV cluster at Maltby, South Yorkshire

2.35 The GUS control system will provide the capability to remotely control ENDs, thus managing power flows, and voltage and thermal constraints. It will run alongside the existing network management system which manages safety and network configuration.

2.36 At the bid stage, one of the key risks we identified related to the delivery of a functioning integrated demand response system (risk 2) to provide signalling between the central GUS controller and the parties which will call the demand response from the customer. Other active risks relating to the GUS are that the central control system might not function as required (risk 25) and that some items of network equipment may not integrate correctly with the central control system (risk 44). In the reporting period we have made significant progress on the development of these systems. These risks, mitigating actions and contingency plans are discussed in section 4.

2.37 We have successfully completed factory acceptance testing of the data warehouse and in the next reporting period we will proceed to site acceptance testing.

2.38 We have tested the interfaces between the RDC and some of the ENDs. In the next reporting period we will continue the interface testing with the remaining ENDs, and we will configure the transformer RTTR thermal management control software in the RDC.

2.39 Currently the OHL RTTR system is hosted remotely on an external server and we access the system via the web. Northern Powergrid has purchased a dedicated server to run this system and in the next reporting period we will migrate the application to this server within the corporate IT infrastructure. The system will also be integrated into the GUS system. We will complete the integration of the iHost database of monitoring data into the GUS system i.e. with the RDC and with the central controller.

2.40 We will configure alarms on the storage and EAVC equipment to feedback via existing SCADA systems.

2.41 In the next reporting period we plan to undertake phased factory acceptance testing of the software systems for the GUS central controller and for the RDCs, followed by end to end bench testing of the complete control system. Alongside this we will test the interface between the GUS system and the existing network management system, which will include configuring alarm displays and information transfer from the Network Management System (NMS) to GUS.

2.42 We will then progress to a phased site acceptance testing programme for the PV, HP, urban and rural networks.

2.43 It is taking longer than planned to complete the design and build of the GUS control system. Planned completion is now forecast by November 2013 as opposed to June 2013. The impact on the network trials is being managed through continued use of pre-trial simulation and emulation and a phased commissioning of the control system and start to the trials.

Network equipment

2.44 At the bid stage, we identified that one of the key risks to the project was that the network equipment might not operate as specified. Until all the equipment has been commissioned and proven in the trials, this risk remains. This risk (risk 1) is discussed in more detail in section 4.

2.45 All the network equipment has been procured, the majority installed and in the next reporting period we will complete the installation and commissioning process for the equipment. This section on network equipment highlights specific points of interest.

2.46 We have installed extra LV network monitoring equipment to support the enhanced customer monitoring (heat pump cluster) test cell at South Shields.

2.47 Installation of the EES units has been a major activity during the reporting period. Ahead of the installation at the rural network, we wrote to local residents about this and provided information on the project, obtained UK customs clearance, obtained classification and licensing for lifting and transportation of the equipment on UK highways. With the equipment on site, we achieved compliance with CE and TUV standards, and commissioned the ancillary systems (heating ventilation and air conditioning, fire-suppression, battery management systems and emergency stop). In collaboration with A123 Systems, we are now finalising our commissioning strategy to enable the deployment of the EES on the distribution network in accordance with UK model safety rules.

Figure 2 - Rise Carr 2.5MVA batteries and inverters

2.48 One of the main objectives of the network trials is to run fully automated enhanced automatic voltage control (EAVC) on a live electrical network that can be configured to its upper and lower limits so that observations can be made as to how the various pieces of AVC equipment react. This data could then be collected and evaluated. However integrating existing technology voltage control systems with capacitor banks, new on load tap changers and the EES units has been technically complex. The main issues highlighted have been the electrical protection of equipment and of circuits, and safety concerns. To address these issues, we will develop the systems to provide information to display alarm information on the operational Network Management Systems.

2.49 We have found complex technical issues with the control of the switched capacitor EAVC at Hedgely Moor. These relate to the bespoke configuration of the existing MicroTapp AVC (which is not true AVC) and the programmable logic controller integration, which controls the capacitor switching schedule, to enable the MicroTapp to work with the new SuperTapp+AVC. This could compromise

the effective control of a wide area voltage trial out of Denwick primary substation i.e. on the trial rural network. We have engaged external consultants to resolve these issues, but it remains possible that the field trials with AVC and the capacitor bank on the rural network may require rework and consideration.

2.50 We will rewrite the technical specifications used to purchase RTTR, EAVC and EES equipment based on better current understanding of the functional requirements and the experience of installation and integration. This will be accompanied by reports on the design choices, the rationale behind the requirements within the specification documents, an overview of the equipment procured, and the lessons learnt from the design, specification, procurement and installation activities of learning outcome 3.

Network trials

2.51 In this reporting period we have used the VEEEG[3] methodology to identify the field trials that will provide the best learning (see Fig 3). We then considered the feasibility of these trials to finalise the detailed trial design (which comprises up to 150 trials). We have created a detailed schedule for the execution of the trials, taking into account the programme for commissioning the network equipment, and we have started planning the field operational staff required to deliver the commissioning and the trials. In the next reporting period we will complete this planning exercise.

2.52 In preparation for the field trials, we have used data from our monitoring systems to start the pre-trial simulations for the trials that are scheduled to be carried out early in the schedule. In the next reporting period, we will complete the pre-trial simulations for those early trials and we will start the programme of field trials and carry out post-trial analysis.

2.53 In the next reporting period we will complete our planning for operational delivery of the trials a taking into account the commissioning programme for the network equipment.

Learning outcome 4 – optimum solution

2.54 The objective of learning outcome 4 is to develop the optimum solution to resolve network constraints which would otherwise result from the transition to a low carbon economy. For each form of network constraint and each customer type we will consider the optimal solution. We do this by combining the outputs from learning outcomes 1-3 with desktop modelling, simulation and emulation to identify the best solutions. This approach allows us to model combinations which it is not currently feasible or economic to pilot in the field.

2.55 Key to this is the VEEEG[3] methodology which we have developed and which is illustrated in Figure 3.

[3] VEEEG – Validation, Extension, Extrapolation, Enhancement, Generalization

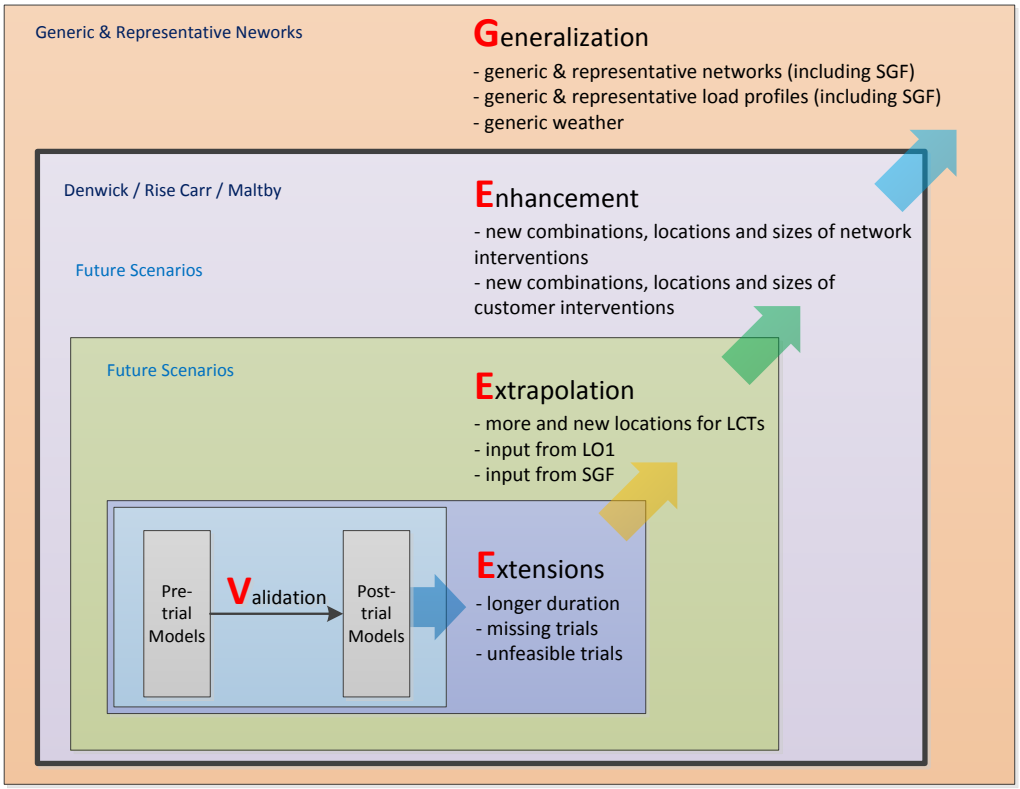

Figure 3 - conceptual representation of the VEEEG methodology

2.56 So far, we have built models of the trial networks and validated these. We have used customer data from learning outcomes 1 and 2, and from other sources, and network monitoring data collected under learning outcome 3 to model load on those networks under a range of scenarios.

2.57 We have also used this data and the models to predict the outcomes of a wide range of network field trials, and the results of this initial work is reported in 6.18. This pre-trial modelling has enabled us to develop the suite of network trials which we predict will deliver the most valuable learning. As we start to work through those trials, we will compare the actual results with the predicted results and adjust the network trials and refine our models accordingly.

2.58 In the next reporting period we will continue to refine our models as additional customer and network data is collected, and to carry out additional modelling of the various network flexibility solutions to predict the results of the network trials. From this we can start to define the optimum solution, which will in turn be incorporated into the Network Planning and Design Decision Support (NPADDS) tool being developed in learning outcome 5.

Learning outcome 5 – most effective delivery

Operational procedures

2.59 We have agreed changes to the Northern Powergrid Operational Procedures Manual which will be included in next scheduled revision of this document. The changes cover electrical energy storage, increased customer generation, customer interfaces and protection.

2.60 We have written sections of the operational procedures for EES and EAVC at secondary substations with OLTC and used these in discussions with Field Operations and Safety to document the operational training requirements for the staff involved in bringing these technologies into service. In the next reporting period we will finalise the operational procedures for these technologies and we will also write the operational procedures for the control room.

Network Planning and Design Decision Support tool (NPADDS)

2.61 We have continued our work developing this prototype tool for network planners and designers. Key to this development has been a series of senior user forums with Northern Powergrid subject matter experts from system design, system strategy, connections and information management, and members of the development team shadowing design engineers.

2.62 NPADDS will support the work of planning engineers within a DNO by providing the ability to:

- Assess LV and HV network areas for different time periods (years);
- Change the load models used for assessments based on scenarios of load growth and LCT take-up;
- Assess multiple network areas and present the data in a logical way;
- Provide a list of proposed solutions that are applicable for the identified constraints from the Transform™[4] solution set.

2.63 We participated in a bilateral knowledge sharing workshop with Western Power Distribution's Project Falcon, to discuss NPADDS and their prototype simulation software tool also currently under development, the Scenario Investment Model (SIM). In this period we have designed and implemented a database compliant with the Common Information Model (CIM), populated it with Northern Powergrid network and load data, integrated the HV load flow engine (IPSA) and upgraded the user interface. Use of the CIM enables NPADDS to integrate with both Debut (for LV analysis) and IPSA (for HV load flows) in a way that means that upgrades to these systems would not require any changes to NPADDS.

2.64 NPADDS can now perform integrated HV and LV load flow assessments. This has the potential to release network capacity which would not be realised if they were treated separately (LV load passed up to HV and corresponding HV volts passed down to LV feeder ends).

2.65 In the next reporting period we will continue to develop NPADDS to assess the impact on networks of the DECC LCT growth scenarios, propose to the system designer conventional and smart solutions from solution templates, perform detailed assessments of EAVC and RTTR schemes, and view and search policy and guidance documentation.

[4] Transform™ is the Smart Grid Forum Workstream 3 model that calculates impacts of different LCT growth scenarios and different investment approaches (i.e. business as usual, smart incremental and smart top-down) on network investment.

Training delivery plans & training material

2.66 Although full training documentation cannot be produced until later in the project, it is essential to create safety operation training and site authorisation records (for a limited number of staff) early enough to be used to install, commission, bring into service and provide on-going operational support for the new technologies being introduced onto the system for the purposes of the trials.

2.67 We have issued staff bulletins to give general orientation on the electrical energy storage units, EAVC at primary and secondary substations, RTTR equipment for transformers, cables and overhead lines. We have worked with the Northern Powergrid training function to create initial plans for future training packages within the current business as usual quality management system.

2.68 In the next reporting period we will continue to working alongside the personnel installing and commissioning the network equipment to capture information such as comments, photo and video for inclusion in training materials. Similarly, when we start to run the network trials, we will work alongside the personnel involved to capture information for training purposes.

2.69 Training delivery plans will be produced for the key stakeholders associated with the delivery of the CLNR network technology solutions and for asset managers. The suite of training materials will include e-learning and we will start developing this in the next reporting period.

Policy guidance documents

2.70 44 key Northern Powergrid policy guidance documents have been split out to individual paragraphs related to RTTR, EAVC, EES and these constituent parts of the policies will be stored in a database with associated metadata such as the policy area to which it relates (e.g. LV, voltage or HV, transformer, rating etc.). This database will be accessed by the NPADDS tool and will be used as a source of information in developing the policy guidance documents.

Impacts on power quality

2.71 A power quality monitor has been installed in the DEI Future Network laboratory in order to obtain 'footprints' from the heat pump, EV charger and PV inverter to inform the later network impact analyses. The first batch of power quality data from customer premises has been collected. In the next reporting period we will start to analyse the network data from the power quality meters installed.

2.72 Over 50 power quality meters have been installed at various points on the rural and urban test cell networks and the PV and heat pump cluster test cell network. All power quality meters referred to here are Class A providing the highest level of confidence in the measurements.

National and international standards

2.73 We have started preparing for how we will engage with the relevant standards bodies so that we can inform them of the outputs of the CLNR project. We have identified the bodies involved in the setting of smart grid standards and a publically available specification (PAS) setting out how use case studies should be presented. Use cases are recognised as the best means for standards groups to be able to consider research results.

2.74 In the next reporting period we will consider the impact of the newly published smart grid standards by the IEC on the technologies and ways of working being trialled by CLNR.

Commercial frameworks

2.75 A baseline report on the existing commercial frameworks has been produced by Element Energy. This report provides a detailed assessment of the legislative framework and commercial arrangements currently operating in the GB electricity market in order to understand what barriers existing arrangements pose to both the deployment of network management and demand response technologies and also innovative commercial offerings, such as time of use tariffs and load control incentives. In the next reporting period we will disseminate this report. We will also continue to review and revise our draft recommendations for commercial frameworks in the light of the learning from the customer and network trials and our on-going work on the development of the optimum solutions.

Future asset specifications

2.76 In the next reporting period we will conclude an investigation into future instrumentation standards for substations including a benefits case comparing smart meter and network instrumentation sources for low carbon network data.

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. In that document we set out what we would deliver in each of five learning outcomes and this has not changed. However, we are preparing a change request for consideration by Ofgem which requests an additional 12 months to complete the project and a restructuring of the budget. If this change request is approved we are confident that, by using the contingency budget and the efficiencies generated from the project to date, it will be possible to deliver the learning outcomes at the required level of quality within the original funding.

3.2. At this stage, the most significant factors affecting our ability to deliver the learning are:

- The issue that a 12 month extension to the project is needed to prevent the duration of the trials being cut short, which would reduce the quantity of data available and thus adversely affect the credibility and relevance of the results. Customer trials have started later than planned as a consequence of the longer recruitment time which was needed to overcome the scarcity of potential trial participants with LCTs. Similarly, the extension would allow additional time for the network trials, mitigating the delayed start caused by delays in obtaining the novel technology.
- The risk that the network equipment and control systems will not operate as planned. Although we have taken and continue to take mitigating action, this risk will remain to some extent until all the equipment is commissioned, operating and proven.
- The risk that key project personnel will leave the project prior to its completion. This risk will continue and its likelihood will continue to grow until the issue of the change request is resolved.

3.3. The change request will explain in detail the circumstances which make the budget restructuring and an extension in the project timescales both necessary and desirable; demonstrates that the scope of the learning and the method to deliver that learning is unchanged; and provides an update on the detailed design of the trials, which has been enhanced since the bid to address the issues encountered and to benefit from the learning and insight gained during the project.

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. The key issues which have affected progress in the reporting period or which may present a challenge in the next reporting period are discussed in section 2.

4.2. We have encountered a number of issues and risks which have resulted in delays to the project, and we will separately submit a change request to Ofgem requesting a one year extension to the project which we consider to necessary to deliver the learning outcomes, and which reflects the additional time that was needed to successfully mitigate the issues and risks encountered. For this reason, we have not highlighted in this section issues and risks causing delay if these can be mitigated such that the whole project can still be delivered within this extra year.

4.3. The table below summarises the current most significant risks and also the status of the risks 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. The full risk register is included in Appendix 2. The project has no procurement risks since all customer and network equipment and installation services have been procured.

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**	M	L	**Amber**	For equipment that does not function as specified, consider simulation or modelling by DEI instead of field trials.
2	Installation	Possible failure to deliver the integrated demand response system	Northern Powergrid	M	M	**Amber**	L	L	**Blue**	Use manual processes instead to send the demand response signal.
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			

Ref	Risk category	Risk	Risk Owner	Unmitigated risk			CURRENT Risk			Contingency Plan
5	Other	Emerging findings indicate a major change of project scope is required	Northern Powergrid	M	M	**Amber**	Risk closed			
25	Installation	GUS Control System not function as designed.	Northern Powergrid	H	M	**Red**	M	L	**Amber**	Run the autonomous trials and as many of the collaborative trials as is possible using workarounds (would depend upon the extent of the problem). However, this would slow the rate at which we can work through those trials. Using the results of the autonomous trials, model the predicted results of the collaborative trials.
42	Customer Recruitment	Risk of customer drop out.	British Gas	M	H	**Red**	M	N	**Blue**	
43	Installation	DSR I&C test cell customers are located in un-monitored Network areas	Northern Powergrid	L	M	**Amber**	L	L	**Blue**	Wherever this is not possible then use simulation from DEI to match signals for DSR to customers and network monitoring.
44	Installation	Network Technology & GUS integration	Northern Powergrid	M	M	**Red**	M	L	**Amber**	In the event that the GUS to END device link does not work then the alternative trials strategy is to operate the END devices manually in the field and collect the trial result data locally.
45	Installation	Major Incident affecting trials equipment	Northern Powergrid	H	N	**Amber**	M	N	**Blue**	Reduce numbers of physical trials. Fill any gaps with simulation.
46	Installation	Timely commissioning of new network technology (Battery Systems and Transformers with OLTC)	Northern Powergrid	H	L	**Red**	L	L	**Blue**	Reduce number of physical trials. Fill any gaps with simulation.
48	Other	Loss of academic personnel	DEI	H	H	**Red**	H	H	**Red**	In the event that the project is extended but that staff /students leave before then, seek to replace personnel.

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

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

4.4. At the time of the bid, we recognised that this was a high-impact risk. Some mitigation was built into the design of the project and the plan for its delivery; a preference for market ready products and, where possible, test bed operation followed by a phased roll out. The trials have been designed to contain different combinations of equipment and network applications in order to avoid the risk associated with single point technical failure.

4.5. Where possible, we have taken action to further reduce the level of risk by identifying additional suppliers of equipment. For example, in the case of network monitoring equipment, we have purchased and installed equipment from three different manufacturers. However, for some items, such as the storage devices, the practicality of this approach is limited by the long lead-time and cost and the availability of the small size storage devices.

4.6. Additional mitigation measures have been incorporated into the solution design for the new technology at our primary sites and our switched capacitor station, where the new install will be of a dual redundant system incorporating traditional upgrade works in tandem with the alternative control system relays and communication system.

4.7. Over the course of the project, our knowledge of the equipment has increased and we have achieved successful bench and witness tests of the individual devices. With the mitigating actions we have taken since the bid, our increasing confidence in the technology and our contingency plan, we have reduced the overall risk rating from red to amber.

Risk 2: Failure to deliver the integrated demand response system

4.8. This risk was identified at the time of the bid. The demand side response platform will link the control system to the aggregators who will call the demand response from I&C/DG customers (test cells 18 &19), and to the British Gas demand response host (Greencom) which will call demand response from domestic customers on the direct control trials (test cells11a and 14). The development of this DSR platform has progressed significantly with agreement from all the parties involved as to how the various systems will interact and testing of automated signalling between the GUS controller and external parties and systems. This risk will remain until the full end to end system has been fully tested, installed, commissioned and proven to function as designed.

4.9. Our contingency plan is to use manual intervention if this risk materialises and the demand response signals cannot be automated.

Risk 3: Insufficient numbers of customers are recruited

4.10. 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 which meant that we successfully overcame this such that we can deliver the learning outcomes set out in the bid. This risk is therefore closed. Our management of this risk has been discussed in previous progress reports and will be covered in more detail in the change request.

Risk 4: British Gas withdraws from the project

4.11. This risk was identified at the time of the bid. With the collaborative working relationship with British Gas and the evident high level of commitment to the project, this risk has been closed.

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

4.12. 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.

Risk 25: GUS control system not functioning as designed

4.13. The GUS control system with its blend of central and distributed control forms an important technical component in the coordination of individual network components and in facilitating network-to-customer communications. If the control system does not work as designed, it may not be possible to conduct the full suite of the network trials and customer intervention trials.

4.14. To reduce the probability of this risk materialising, we are working through the GUS system development and a commissioning strategy to confirm the functionality of the GUS product to successfully deliver the trials and the learning outputs This work is being taken forward by a cross-party working group NPg, closer collaborative working arrangements with Siemens with weekly conference calls, and reports to provide increased senior level visibility of progress and issues

4.15. Our contingency plan, in the event that this risk materialises is to run the autonomous trials and as many of the collaborative trials as is possible using workarounds, dependent upon the extent of the problem. However, workarounds would slow the rate at which we can work through the trials. Using the results of the autonomous trials, we will model the predicted results of the collaborative trials.

4.16. With the mitigating actions and contingency plan described above, we have reduced the risk rating from red initially to amber currently.

Risk 42: Customer dropout

4.17. There is a risk that customers drop out of the trials with the impact that the data sets collected will be smaller and cover a shorter time period. The probability and the impact are both generally greater in the intervention trials of learning outcome 2 than in the profiling trials of learning outcome 1 since the former require a greater degree of engagement from customers who are being asked to adopt new propositions. The impact would also be greater in test cells where the numbers of trial participants are relatively low.

4.18. To reduce the probability of this risk, we have initiated a review of customer journeys and communications and issued an update / refresh communication to confirm the customer's position on vouchers, start dates, and installations. We are developing and will deliver an on-going 'in-life' communications programme to maintain customers' interest and commitment to the trials. In the event that customers drop out, we will continue to run the trials with the customers remaining i.e. we will not initiate a recruitment programme to replace the customers: our focus is on retention.

4.19. With the mitigating actions described above, and the generally low level of participants leaving the trial, we assess this risk as having been reduced from red to blue.

Risk 43: trial participants for large scale demand response trials are located in un-monitored areas

4.20. I&C and DG customers will be contracted to provide large scale DSR (test cells 18 and 19), but there is a risk that they may not be located in the network areas where we have installed monitoring (or may not remain contracted for sufficient time to warrant the time and cost of installing monitoring devices those areas of network. The impact of this is that DSR would not be called from a customer who was located on a specific area of network where we were signalling an artificial network constraint.

4.21. To mitigate this risk, we targeted recruitment at the areas where monitoring has been installed and at other areas where Northern Powergrid are forecasting loads approaching the substation firm capacity (e.g. Claywheels, Bottisford and Goole). This risk has materialised in that the recruited trial participants will not be in these areas, as customers connected to these primary substations did not wish to participate. Accordingly we have now executed our contingency plan which is to use data from the already monitored network locations to generate the signals required to call DSR from customers. We will still be able to demonstrate an end-to-end DSR processes, albeit that the simulated network constraint and the response requested from/delivered by a customer will be in different geographic locations. Modelling will then be used to combine the need and the response as if they were on the same area of network in order to evaluate its success.

Risk 44: Network technology & GUS integration

4.22. There is a risk that certain elements of the installed network equipment may not communicate or integrate correctly in every instance with the GUS control system & data warehouse. This would reduce the quality and quantity of the field trials.

4.23. We are reducing the probability of this risk through testing of the GUS system in its development and through bench testing of the GUS system and END devices. In the event that the GUS to END device link does not work to its full potential, our contingency plan is to operate the END devices manually in the field and collect the trial result data locally. The risk rating has been reduced from red to amber.

Risk 46: Commissioning new network technology (battery systems & transformers with OLTC) at all sites

4.24. The risk that approval from Northern Powergrid's Safety and Protection departments will not be forthcoming to connect the battery systems to the electrical network in time for the trials to commence.

4.25. Working parties and Safety and Guidance operations documents have been written to satisfy Northern Powergrid's Safety and Operations departments and issued for their approval.

Risk 48: Loss of academic project personnel

4.26. Some of the academic staff working on the project are on fixed term contracts of employment which are aligned with the original project end date and there is a risk that some of these may leave before the end of the project since their contracts of employment cannot be extended to reflect a later project end date until this funding is secured by the University. A similar situation applies to PhD students working on the project. Although we are preparing change request for Ofgem which would, if approved, provide the funding stream to the University, which would then be in a position to extend contracts and studentships, there is a risk that these staff and students will leave before the change request process is concluded. This would have a significant impact on the project in terms of quality of the learning outcomes and delay.

4.27. In parallel with the change request, we are considering reducing the probability of this risk by Northern Powergrid executing contractual arrangements which would assist in retaining staff and students. The rating of this risk will remain red until mitigating action has been executed.

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 SDRC date due to material external circumstances. In response to this, we will submit a change request explaining the impact of these external circumstances on the project and requesting a 12 month extension to complete the learning outcomes, including the remaining SDRC deliverables and activities.

5.2. The progress against each SDRC is set out in the table below:

SDRC type	SDRC description	SDRC date	Status
Dissemination activities	1st Regional stakeholder panel meeting held by end March 2011	31-Mar-11	completed on time
Dissemination activities	Project website up and running by end May 2011 and updated in line with project developments	31-May-11	completed on time
Dissemination activities	1st Industry stakeholder forum held by end May 2011	31-May-11	completed on time
Project milestone	Commence installation and commissioning of network equipment relating to learning outcome 3 – September 2011	30-Sep-11	completed on time
Dissemination activities	2nd Regional stakeholder panel meeting held by end March 2012.	31-Mar-12	completed on time
Dissemination activities	2nd Industry stakeholder forum held by end May 2012	31-May-12	completed on time
Dissemination activities	1st Distributor project review meeting held by end July 2012	31-Jul-12	completed on time

SDRC type	SDRC description	SDRC date	Status
Project milestone	Complete installation and commissioning of network equipment relating to learning outcome 3 – December 2012	31-Dec-12	Running late due to issues with procurement and manufacture of network technology due to a variety of external factors which have been discussed in previous progress reports. This is one of the reasons for the project requesting a one year extension. This will be discussed in more detail in the change request.
Data sets	Demand profiles grouped by customer type by end 2012	31-Dec-12	Interim results published on time. A further publication of results will allow the development of profiles based on data collected over a longer time period. The customer trials are running behind the original plan due to a number of external factors which have been discussed in previous progress reports. This is one of the reasons for the project requesting a one year extension. This will be discussed in more detail in the change request.
Data sets	Demand profiles grouped by low-carbon technology type by end 2012	31-Dec-12	
Data sets	Output profiles of existing generation types by end 2012	31-Dec-12	
Data sets	Output/ demand profiles before and after a range of interventions by end April 2013	30-Apr-13	
Data sets	Network data showing performance of selected network technologies by end September 2013	30-Sep-13	Running late due to the delays in procurement of novel technology
Integration of network technologies	Provide an understanding of, and disseminate by end September 2013 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	30-Sep-13	
Dissemination activities	3rd Industry stakeholder forum held by end December 2013	31-Dec-13	on track
Dissemination activities	2nd Distributor project review meeting held by end December 2013	31-Dec-13	on track
Dissemination activities	3rd Regional stakeholder panel meeting held end December 2013.	31-Dec-13	on track

SDRC type	SDRC description	SDRC date	Status
Analysis of load profile data	Publish analysis of load profile data by end 2013	31-Dec-13	Running late due to other preceding aspects of the project running late
Analysis of generation profile data	Publish analysis of generation profile data by end 2013	31-Dec-13	
Commercial models arrangements	Undertake, and disseminate by end 2013 to other distributors, a critical review of how commercial models and arrangements between distributor and supplier may evolve to facilitate customer-side response	31-Dec-13	Running late due to other preceding aspects of the project running late
Project milestone	Project close down report produced – December 2013.	31-Dec-13	Running late due to other preceding aspects of the project running late

6. Learning outcomes

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

Initial Load Profiles from CLNR Intervention Trials

6.1. In December 2012, we released an initial report and datasets on residential and SME load and generation profiles[5] (available on the CLNR website). The data collected from these customers was intended to baseline the general load case as well as examine new electrical load and generation types. The report contained learning captured to date on six test cells:

- Test Cell 1a - General domestic load
- Test Cell 1b - General SME load,
- Test Cell 3 - Domestic heat-pumps
- Test Cell 5 - Domestic solar PV
- Test Cell 6 - Domestic EV
- Test Cell 8 - Distributed generation customers

6.2. In April 2013, we released an interim analysis of trials involving residential customers subject to demand intervention[6] (available on the CLNR website). A demand intervention is a means by which a customer's behaviour can be influenced or modified through technical, social or economic means,

[5] CLNR-L010 - Initial Load and Generation Profiles from CLNR Monitoring Trials
[6] CLNR-L012 - Initial load profiles from CLNR intervention trials

with the aim of achieving a change in their pattern of electricity consumption, with the intention of creating additional network headroom. The test cells studied in the report included:

- Test Cell 1a: Basic profiling of regular domestic smart meter customers (recapping the profiles from the December 2012 paper)
- Test Cell 5: Enhanced profiling of PV
- Test Cell 9a: Pure time-of-use tariff for domestic general load customers
- Test Cell 20 auto: Automated within-premises balancing (domestic PV customers interacting with an automatic water hearing system powered from the PV array)
- Test Cell 20 manual: Manual within-premises balancing (domestic PV customers who have received an in-home display to help them manage the use of their PV output

6.3. The interim report provides summary statistics for periods of peak winter load and peak PV, to give a most useful "first look" at the data from a network design perspective. The preliminary analysis suggests:

- Customers on time of use tariffs use less energy in the early evening, but exhibit a new peak in demand (which may be higher than the unmodified peak) immediately afterwards;
- Customers with solar PV and no other interventions tend to use more energy through the day when the solar PV is generating, which may marginally offset consumption in the early evening peak;
- In-home displays of the availability of excess PV output, used in the PV within-premises balancing trial, seem to make little difference to customers' behaviour;
- Automating load switching to use PV generation within the home (in this case for water heating) seems to shift consumption into the day, and is more likely to deliver network benefits by reducing consumption in the early evening peak, even in winter, and by reducing net export in summer.

Large scale demand side response

6.4. We have published an initial report7 on the demand side response trials on ancillary services fast reserve service (test cell 18) and ancillary services voltage support service (test cell 19) and findings from an initial I&C customer survey.

SME Trials

6.5. We have designed and launched four SME test cell propositions: disaggregated load monitoring, time of use, restricted hours and direct control. Results from an online survey and in depth interviews have yielded some initial findings on SME participation. Reasons for wanting to take part were:

[7] CLNR-L014 - Initial report on industrial and commercial demand side response trials

- Enthusiasm for environmental projects
- Wanting to save money
- Having an interest in the results of the monitoring trial
- Participation is viable only if it is not intrusive to the business

Reasons against taking part were:

- Don't like the idea of equipment being installed
- Concerns about the size/impact of the monitoring/interrupting equipment
- Already involved in a green project or doing other energy saving projects and don't want overlap
- No decision power on the matter e.g. landlord/serviced properties, part of larger organisation, or dealing with electricity through broker
- The take up of the interventions is limited by businesses being closed between the relevant hours of 4-8pm or not using much energy at those times or having few or no non-essential items to provide load management.

Recruitment and site survey findings to date have proved valuable in understanding the SME receptiveness to the propositions. Findings include:

- It is relatively easy to recruit to disaggregated load monitoring due to the fact that there is no intervention in the client's business routines.
- The low uptake of the time of use tariff is due to the peak pricing hours (4pm-8pm) coinciding with SME operating hours.
- The capacity to accept the restricted hours and direct control propositions is limited by most loads being critical or essential to operations in the SME sector.

Heat pumps

6.6. The vast majority of heat pumps installed are in the social housing sector, with only 8 in privately owned homes. Despite the significant funding available, the subsidised heat pumps have not proved as popular as expected with home owners. Whilst it is hard to draw any conclusions from this dataset at this stage, it could imply lower take up of this technology in the private market once the renewable heat incentive (RHI) for domestic ASHPs is made available. In order to achieve the 8 installations in private properties, we had to conduct approximately 85 detailed site surveys and quotations.

6.7. A total of 18 of the heat pumps installed on the trials have smart (DSR-capable) configuration units with large thermal store. It would appear that the size, weight, access restrictions, installation disruption and costs have proved to be very significant barriers to uptake. Apart from any technical learning that will come from operating these systems in DSR modes, it seems reasonable to conclude that significant innovation in this technology is still needed to achieve widespread uptake. This is particularly so in the case of thermal storage where more compact solutions (e.g. phase change materials) will be required to deliver significant levels of load shift in peak.

6.8. Given the amount of internal space needed to accommodate even the smaller size thermal stores (300 litres) for these systems, the British Gas team extended recruiting and surveying larger premises to off-grid locations nationwide. Unfortunately, surveys often revealed that these larger properties often had such significant heat losses that even the larger systems were insufficient to meet a property's calculated peak demand.

Trial recruitment

6.9. We engaged Sustainability First to capture the learning and review the notable successes and key challenges encountered on recruitment to the residential and SME trials. The report[8] reviews recruitment, including the design of the process as well as identifying and communicating with customers, installation and the availability and design of low carbon technology, and the project's approach to partnership, project management and bid design.

6.10. The report concludes that, despite many early-stage challenges, the way in which recruitment has been completed is a significant achievement and should deliver robust trial findings, suitable for detailed quantitative and qualitative analysis. It comments on CLNR's pioneering role and the successful way in which the team has successfully brought together the working arrangements necessary for eventual delivery of an effective electricity demand side response.

6.11. The report points out that all trials, particularly large multi-partner trials, face challenges in terms of technology, IT, customer recruitment, development of partner relationships, and sourcing products from suppliers. In addition, large-scale trials take time to integrate alongside the main business, to secure resources, and to negotiate contracts and that it would therefore be unrealistic to expect that all such challenges could be avoided in future major trials no matter how detailed the pre-planning. It therefore recommends a degree of 'development-stage' flexibility in future projects and openness to learn through iteration.

6.12. It summarises lessons for the current trial, discussing the challenges of working within 'real world' constraints as well as the importance of leveraging the value of the substantial outlay on recruitment. It poses some key follow-on questions, to further understand some of the recruitment successes, particularly in the areas of DSR and smart metering.

6.13. The report also concludes with some lessons for the future, such as the value of 'aiming high' and the recognition that we can be braver with customers in terms of what kinds of propositions they will understand and accept, but makes the point that the operations, particularly the installation of new and innovative technologies should not be underestimated.

Social science

6.14. We have produced a number of working papers which document the social science work to date and which will serve as references for other similar projects and industry. These working papers include research methodology papers, customer engagement evidence reviews and supporting materials, initial findings from the EDRP (Energy Demand Research Project) and the Irish CER (Commission for

[8] This report will be published on the CLNR website – July 2013

Energy Regulation) trials and initial descriptive statistics from the SME survey. This work will be published in the form of peer reviewed papers and CLNR publications.

6.15. The most substantial piece of research reports interim findings from the face-to-face interviews conducted in 2012. The high level analysis suggests that customers can be flexible in four ways:

- Time Flexibility:
  - Same-Day flexibility: changing the time of day a practice is conducted, moving it within a 24 hour period
  - Inter-Day flexibility: changing the day on which a practice is conducted, or moving it by more than 24hrs.
- Location flexibility: changing where a practice takes place, such as showering at a family member's home or at work.
- Process flexibility: changing how a practice is performed and as a result changing the electrical characteristic of the practice. For example, cooking on a gas hob rather than a microwave.
- Practice abstention or curtailment: doing a practice less often or for shorter periods of time. For example doing less cooking altogether, or taking shorter showers.

6.16. Certain everyday activities are found to be more flexible than others. Customers report the variability of flexibility as follow:

- Most flexible (laundry, dish washing, chores, refrigeration, heat storage (hot water tanks))
- Possibly flexible (cooking, showering)
- Inflexible (lighting, child bathing, meal times)

6.17. A number of factors have been found to enable flexibility:

- Dual fuel customers have more options (but less electrical load)
- Non 9-5 work pattern
- Active use of timers on white goods
- Engagement with the In Home Display (IHD) enables flexibility
- Experiencing the 'workings' of the grid makes people more willing to be flexible
- Effective, trusted communication

Learning outcome 3 (network technology) and learning outcome 4 (optimum solution)

6.18. An initial pre-trial network analysis was conducted on the urban network to predict its capability to accommodate LCTs following the deployment of EES2 (100kW/200kWh electrical energy storage (EES) located at the LV busbars of a HV/LV substation) to manage power flows at the secondary transformer. We found that this increased the allowable penetration rates of multiple LCTs, and that this was further increased by the addition of real time thermal rating (RTTR). This involved the development of a thermal model which was used to determine the RTTR of the secondary transformer. The model uses the ambient temperature to calculate the winding hot-spot temperature and the top oil temperature.

6.19. We have analysed one year's data from the 20kV overhead line RTTR test sites on the rural network. At each site, we observed a good correlation between ambient temperature and solar radiation values, as might be expected. There was a limited correlation between wind speed and wind direction at each of these test sites, and these parameters are highly dependent on the local terrain and environment. The calculated ratings provided increased capacity over the currently used P27 ratings for a significant period of time, particularly in the period where the P27 summer rating applies. However, a sizeable proportion of calculated ratings in the winter period were lower than the P27 ratings in the period where the winter ratings apply.

6.20. We have analysed the initial data from the two 66kV overhead line RTTR test sites on the rural network. At the lowest percentile values of the calculated ratings there is a high degree of similarity between the calculated ratings and the P27 ratings, and this begins to diverge around the 2nd and 3rd percentile values. The below table shows initial findings related to the percentage of calculated ratings in each rating period which are greater than the P27 rating. Further work is required to understand why the calculated ratings are higher at the Tower 49 site.

% of time that calculated rating is greater than P27 rating	***P27 rating period***		
	Summer	***Spring/Autumn***	***Winter***
Tower 49	99.8%	97.8%	96.5%
Tower 131	97.9%	86.3%	79.3%

6.21. The above works will be published in peer reviewed publications and/or CLNR briefing notes.

Learning outcome 5 - most effective delivery

6.22. A paper "A Network Planning and Design Decision Support Tool for Integration of Low Carbon Technologies and Solutions" was presented at CIRED 2013. The paper introduces the concepts underpinning the NPADDS tool being developed in the CLNR Project.

6.23. A paper "Capacity value of distributed generation for network capacity planning" was also presented at CIRED 2013. The paper describes the initial analysis of the existing planning rules regarding the use of distributed generation in the light of the CLNR objective to recommend updates to ETR130.

Overview of overall approach to capturing the learning and disseminating

6.24. Our approach to capturing learning includes a review and write up at the end of key stages or activities in the project, for example, the report on recruitment referred to in 6.9. For field work, an additional person on site as an observer can capture information in a way that is just not possible after the event and off site, discussing and noting activities and issues, and taking photographs and video footage.

6.25. Our approach to disseminating learning is underpinned by two main principles: delivering information according the type of audience and maximising the reach by using multiple channels. Our external contacts are segmented into 5 'clusters' to allow content to be adapted to be appropriate to each audience, and the same content is promoted via a number of external and internal channels such as press releases, email-shots, LinkedIn, Twitter, Northern Powergrid staff briefs, 'announcements' on the CLNR SharePoint site.

External dissemination

6.26. External dissemination uses a variety of channels: in person, via published materials including reports, presentations and videos, and via social media. There are over 800 contacts on the CLNR communications database, 180 members of the CLNR LinkedIn group and 340 followers on the CLNR twitter account, @CLNRUK. The CLNR YouTube channel, CLNRUK has 9 videos with over 7,000 viewings in total.

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

06/12/2012	Social Media	Launch of the CLNR LinkedIn Group
06/12/2012	Social Media	Launch of CLNR YouTube Channel
17/12/2012	Publication	Building, Design & Construction Magazine 'Meeting the Customer's Needs' Article
18/12/2013	Progress Report	*CLNR progress report 4
21/12/2012	Direct Publication	*CLNR-L010 - Initial Load and Generation Profiles from CLNR Monitoring Trials Report
21/12/2012	Direct Publication	*CLNR-L011 - Dataset accompanying CLNR-L011
21/12/2012	E-Comms	Email to CLNR contacts with links to the SDRC report
16/01/2013	Social Media	Launch of CLNR Twitter site
18/01/2012	Publication	Utility Week – LCNF Projects Consumer Engagement Article
28/01/2013	Press Release	PR – Durham to Cardiff in an EV

31/01/2013	Event	Smart Grid GB conference
31/01/2013	Video	LCNF Project Update video on YouTube
01/02/2013	Stakeholder	North East Energy Leadership Council Meeting
01/02/2013	Stakeholder	Infrastructure North Publication
06/02/2013	Conference	UK Energy Storage Operators Forum
14/02/2013	Knowledge Sharing	CLNR & WPD Project Falcon
15/02/2013	Event	North East LEP Independent Economic Review
19/02/2013	Media	CLNR on BBC Look North
20-23/02/2013	Academic Conference	Society for Anthropological Sciences Annual Meeting 2013 - Long Live Pollyanna! Making the Most of Patchy Datasets in Academic-Corporate Partnerships
01/03/2013	Publication	The Environmentalist Magazine Article 'Smarter Connections'
25/02/2013	E-Comms	Email to targeted CLNR contacts with links to social media sites
27/02/2013	Knowledge Sharing	NPADDs overview presentation – Ofgem
04/03/2013	Stakeholder	IET Northumbria Network – The Smart Grid
07/03/2013	Conference	National Skills Academy for Power Conference
19/03/2013	Video	Monitoring Modern Distribution Networks video on YouTube
19-21/03/2013	Conference	The Future of Utilities Conference
20/03/2013	Knowledge Sharing	BELCO (Bermuda Electric Light Company) meeting
25/03/2013	Press Release	PR - £54m smart grid project helping UK prepare for a greener future (trade, national, regional press)
04/04/2013	Publication	Utility Week Green Deal Article
09/04/2013	Academic Conference	Association of American Geographers, Enrolment and Exclusion – Flexibility Capital and The Politics of Smart Electricity Demand Management

14/04/2013	Stakeholder	Professor Harriett Bulkeley, Durham University gives evidence to the House of Commons select committee on the UK smart meter rollout
16/04/2013	Conference	Smart Grid GB - Seizing the Smart Grid Opportunity
16/04/2013	Conference	Cleveland Institute of Engineers Conference
17/04/2013	Conference	Sustainability Live 2013
22/04/2013	Newsletter	CLNR Spring Newsletter
23/04/2013	Press Release	PR – CLNR Partners with Charge your Car Ltd
23/04/2013	Publication	Newcastle Journal NESCO Supplement
30/04/2013	Direct Publication	*CLNR-L015 - Initial time of use tariff analysis report
30/04/2013	Direct Publication	*CLNR-L014 - Initial report on industrial and commercial demand side response trials
30/04/2013	Direct Publication	*CLNR-L012 - Initial load profiles from CLNR intervention trials report
30/04/2013	Direct Publication	*CLNR-L013 - Dataset accompanying CLNR-L012
30/04/2012	E-Comms	Email to targeted CLNR contacts with links to the 30/04/2013 SDRC publications
06/05/2013	Media	Newcastle Journal 'Sparking a Change' Article
06/05/2013	Academic Conference	Institute for advanced studies on science, technology and society 12th Annual Conference: Fostering active network management through SMEs practices
06/05/2013	Academic Conference	Institute for advanced studies on science, technology and society 12th Annual Conference: Smart Grids and the flexibility of everyday life
07/05/2013	Stakeholder	Durham University Research Showcase
11/05/2013	Stakeholder	Baywind AGM
13/05/2013	Publication	Cornwall Energy, Energy Spectrum Article
16/05/2013	Stakeholder	UKERC Conference: GB Electricity Demand: Realising the Resource
21/05/2013	Stakeholder	*CLNR Regional Stakeholder Forum.

Internal dissemination

6.28. As with external dissemination, the dissemination within Northern Powergrid uses a variety of channels and formats. This includes communications with staff from key functions involved in delivering the project or who are involved in the development and approval of key deliverables, as well as communications for staff in specific functions and for staff in general.

6.29. 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 use Northern Powergrid's operational and safety seminars and specially prepared materials for control and field operations staff focussing mainly on the new technologies that staff might see to enable them to recognise, understand and safely operate the equipment. Members of the CLNR team also participate in or hold events with the management team or with specific functions (such as call centre, network trading, design etc.). Some of these cover the whole breadth of the project, whereas others focus on specific areas e.g. with design staff, we focus on potential changes to policy and the development of NPADDS.

6.30. Internal dissemination activities in the reporting period include the following:

03/12/2013	Internal Comms	Staff brief to Northern Powergrid employees - 'Coming soon to a venue near you' (CLNR model tour of NPg offices)
03/12/2012	NPg User Forum	Commercial arrangements user forum
04/12/2012	NPg User Forum	Pre-trial analysis (VEEEG) user forum
11/12/2012	CLNR Model	CLNR model demo at EATL London office launch
12/12/2012	Conference	Northern Powergrid Management Conference
13-19/12/2012	CLNR Model	CLNR model demo at NPg Castleford Office
19/12/2012	Conference	Northern Powergrid Commercial Conference
29/01/2013	Stakeholder	LO4 LO5 User Forum at NPg Penshaw Office
29/01/2013	NPg User Forum	NPADDs user forum with system design
20/02/2013	Internal Comms	Staff brief to Northern Powergrid employees- 'CLNR on the BBC'
22-15/03/2013	CLNR Model	CLNR model demo at NPg Shiremoor Office
25/03/2013	Internal Comms	Staff brief to Northern Powergrid employees- 'Monitoring modern distribution networks'
18/03/2013	Internal Comms	Staff brief to Northern Powergrid employees-'Installation of innovative energy storage devices is underway' (EES installations in NE & Yorkshire)

03/04/2013	Stakeholder	NPADDS Strategic View update for network planners at NPg Castleford offices
04/04/2013	Stakeholder	LO4 LO5 User Forum at NPg Penshaw offices
03/04/2013	NPg User Forum	NPADDs - Strategic review with system planning
04/04/2013	NPg User Forum	NPADDs - Full user forum
18/04/2013	Stakeholder	CLNR model demo at DEI's SME 'Smarter Energy Practices' Workshops
19/05/2013	Conference	NPADDS presentation and demo at Northern Powergrid's Designers Conference in York
19/04/2013	Conference	Northern Powergrid Asset Management Conference
22/04/13	Internal Comms	Staff brief to Northern Powergrid employees- 'Latest news from the Customer-Led Network Revolution' (CLNR Newsletter)
14/05/13	Conference	Northern Powergrid Operational Seminar - Newcastle
15/05/13	Conference	Northern Powergrid Operational Seminar - Durham
17/05/13	Conference	Northern Powergrid Operational Seminar – Hull
22/05/13	Conference	Northern Powergrid Operational Seminar - Wetherby
24/05/2013	Internal Comms	Staff brief to Northern Powergrid employees- 'Switch on to the Customer-Led Network Revolution' (Regional Stakeholder Event)
28/05/13	Conference	Northern Powergrid Operational Seminar – Northallerton
29/05/13	Conference	Northern Powergrid Operational Seminar – Wetherby
30/05/13	Conference	Northern Powergrid Operational Seminar – Rotherham

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 43.5MtCO_2 benefits, to GB consumers over the period 2020 – 2050. This was based 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 which we will be submitting would 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. The only difference is that they will be delivered 12 months later than had been anticipated under the original timetable. However, given the methodology used to assess the original business case, a delay of this length would not impact on the estimate of benefits. This is because no benefits were assumed to flow until 2020, given the conservative assumptions that were used about the speed of roll-out of low carbon technologies. Since the learning from CLNR will be complete by the end of 2014 we consider there is sufficient time to ensure the learning could be implemented in advance of 2020. Consequently, if we were to rerun the analysis with the same inputs there would be no change in the benefits reported.

7.3. We recognise that it will also be important to update 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 the EA Technology's Transform™ model). We plan to undertake this exercise and include the results as part of the project closedown report.

8. Progress against budget

8.1. The project budget is currently 66% spent and we forecast that the budget is sufficient to deliver the full scope of the project even with the project closedown forecast to be one year later than the original plan.

Costs £m	Costs to Date (May-13)	Project Direction plus agreed £1.1m transfer*	Revised budget	Variance of revised budget against project direction plus agreed transfer £m	%	Variance in forecast relative to previous report Previous forecast	£m	%
Box 6 (Employment costs)	2.112	3.480	4.584	1.104	32%	4.561	0.023	1%
Box 7 (Equipment costs)	10.055	12.125	12.095	-0.03	0%	11.560	0.535	4%
Box 8 (Contractor costs)	8.051	10.297	12.332	2.035	20%	11.155	1.177	10%
Box 9 (Customer and user payments)	0.170	0.768	0.462	-0.306	-40%	0.586	-0.124	-27%
Box 10 (Other costs)	0.088	4.364	1.561	-2.803	-64%	3.173	-1.612	-103%
Total costs	**20.475**	**31.034**	**31.034**	**0.000**	**0%**	**31.035**	**-0.001**	**0%**

*A £1.1m transfer of costs from box 8 to box 7 has been agreed by Ofgem since the project direction.

8.2. Note that most of the £2.8m reduction in 'other costs' is due to the reallocation of £2.2m of contingency from 'other costs' to costs in other budget categories

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 within Appendix 1: Audit of Memorandum Account Transactions.

9.2. Confidential Appendix A: Memorandum Account Transactions lists the transactions between 1 November 2012 and 31 May 2013.

10. Intellectual Property Rights (IPR)

10.1. No IPR have been registered or royalties earned in this reporting period, and we forecast the same for the next reporting period.

11. Other

11.1. Further supporting information has been included within the report as appendices, which are as follows:

- Appendix 1: Deloitte audit statement – memorandum account transactions
- Appendix 2: Project risk register
- Appendix 3: SDRC evidence – LO1 output and demand profiles
- Appendix 4: SDRC evidence - Output / demand profiles before and after a range of interventions
- Appendix 5: SDRC evidence - regional stakeholder panel
- Appendix 6: Social science dissemination planned for the next reporting period
- Appendix 7: Engineering dissemination planned for the next reporting period

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. The financial sections of the report are prepared by a chartered accountant.	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 will 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 2012 and was included in the fourth progress report.	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 a chartered accountant.	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.

Step	Rationale
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.
The report is reviewed by all members of the project board and approved by the executive board. Both the project board and the executive board include representatives from each project partner including Northern Powergrid. 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.

Signature

John Barnett

Commercial Director

20 June 2013

Appendix 1: Deloitte audit statement – Memorandum account transactions

Deloitte.

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14 June 2013

Dear Sirs

Northern Powergrid (Northeast) Limited ("the Company") – Customer-led Network Revolution Project ("the Project"): Memorandum Account Transactions Report of Factual Findings

We have performed the following procedures as agreed by Northern Powergrid (Northeast) Limited ("the Company") and OFGEM on the schedule of information provided by the Directors of the Company ("the Schedule") in accordance with our engagement letter dated 7 May 2013, a copy of which is attached. The procedures were performed solely for the purpose of assisting the Company with their compliance with Clause 3.82 of the LCN Fund Governance Document.

Scope of our work and factual findings

The procedures performed and the results were as follows:

Procedures	Results
Obtain a schedule of all the memorandum account transactions for the Project for the six month period ended 31 May 2013.	We obtained the Company's schedule for the 6 month period ended 31 May 2013. The total value of transactions running through the fund for this 6 month period totals £5,550,625.
Ensure that the schedule includes interest and confirm that this has been calculated according to the rate project funds would earn on the open market (i.e. in a separate bank account).	As the funds related to the project are held within the Company's current account, the schedule shows interest which has been calculated on a daily basis by reference to the closing balance of funds related to the Project, and the interest rate applying to the main current account. We obtained confirmation of the interest rates used from the Company's treasury function and compared the rate received with that receivable on similar bank accounts. We have gained confirmation that the transactions are related to the Project by the testing below.

Deloitte.

Procedures	Results
Select a sample of 25 transactions from the schedule and perform the following:	
1. Agree the details of the transaction to supporting documentation;	All selected transactions have been agreed to relevant documentation. This documentation included invoices, timesheets and payroll reports.
2. Agree the transaction to the bank account of the Company; and	All selected transactions have been agreed to bank statement.
3. Confirm that the transaction relates to the Project.	All selected transactions have been confirmed as relating to the project, this has been completed through agreement to invoice or timesheet for business rationale.

The scope of our work in preparing this report ("Report") was limited solely to those procedures set out above. Accordingly we do not express any opinion or overall conclusion on the procedures we have performed. You are responsible for determining whether the scope of our work specified is sufficient for your purposes and we make no representation regarding the sufficiency of these procedures for your purposes. If we were to perform additional procedures, other matters might come to our attention that would be reported to you.

Our Report should not be taken to supplant any other enquiries and procedures that may be necessary to satisfy the requirements of the recipients of the Report.

The procedures we performed did not constitute a review or an audit of any kind. We did not subject the information contained in our Report or given to us by the Directors to checking or verification procedures except to the extent expressly stated above. This is normal practice when carrying out such limited scope procedures, but contrasts significantly with, for example, an audit. The procedures we performed were not designed to and are not likely to reveal fraud.

The audit work of Deloitte LLP on the financial statements of the Company was carried out in order to report to the Company's members as a body in accordance with the statutory obligations under Chapter 3 of Part 16 of the Companies Act 2006 and is subject to a separate engagement letter. The audit work was undertaken to state to the Company's members those matters required to be stated in an auditor's report and for no other purpose. The audits of the Company's financial statements were not planned or conducted to address or reflect matters in which anyone other than such members as a body may be interested.

In particular, the scope of the audit work was set and judgements made by reference to the assessment of materiality in the context of the audited accounts taken as a whole, rather than in the context of the Report contemplated in this letter. Deloitte LLP have not expressed an opinion or other form of assurance on individual account balances, financial amounts, financial information or the adequacy of financial, accounting or management systems.

Deloitte LLP do not accept or assume responsibility to anyone other than the Company and the Company's members as a body, for their audit work, for their audit report or for the opinions they have formed. To the fullest extent permitted by law, Deloitte LLP do not accept or assume responsibility or liability to anyone by virtue of this engagement or our Report in relation to our audits of the Company's financial statements.

Deloitte.

Use of Report

Our Report has been prepared solely for your exclusive use and solely for the purpose of assisting the Company with their compliance with Clause 3.82 of the LCN Fund Governance Document. Our Report is not to be used for any other purpose, recited or referred to in any document, copied or made available (in whole or in part) to any other person without our prior written express consent. We accept no duty, responsibility or liability to any other party in connection with the Report or this engagement.

Yours faithfully

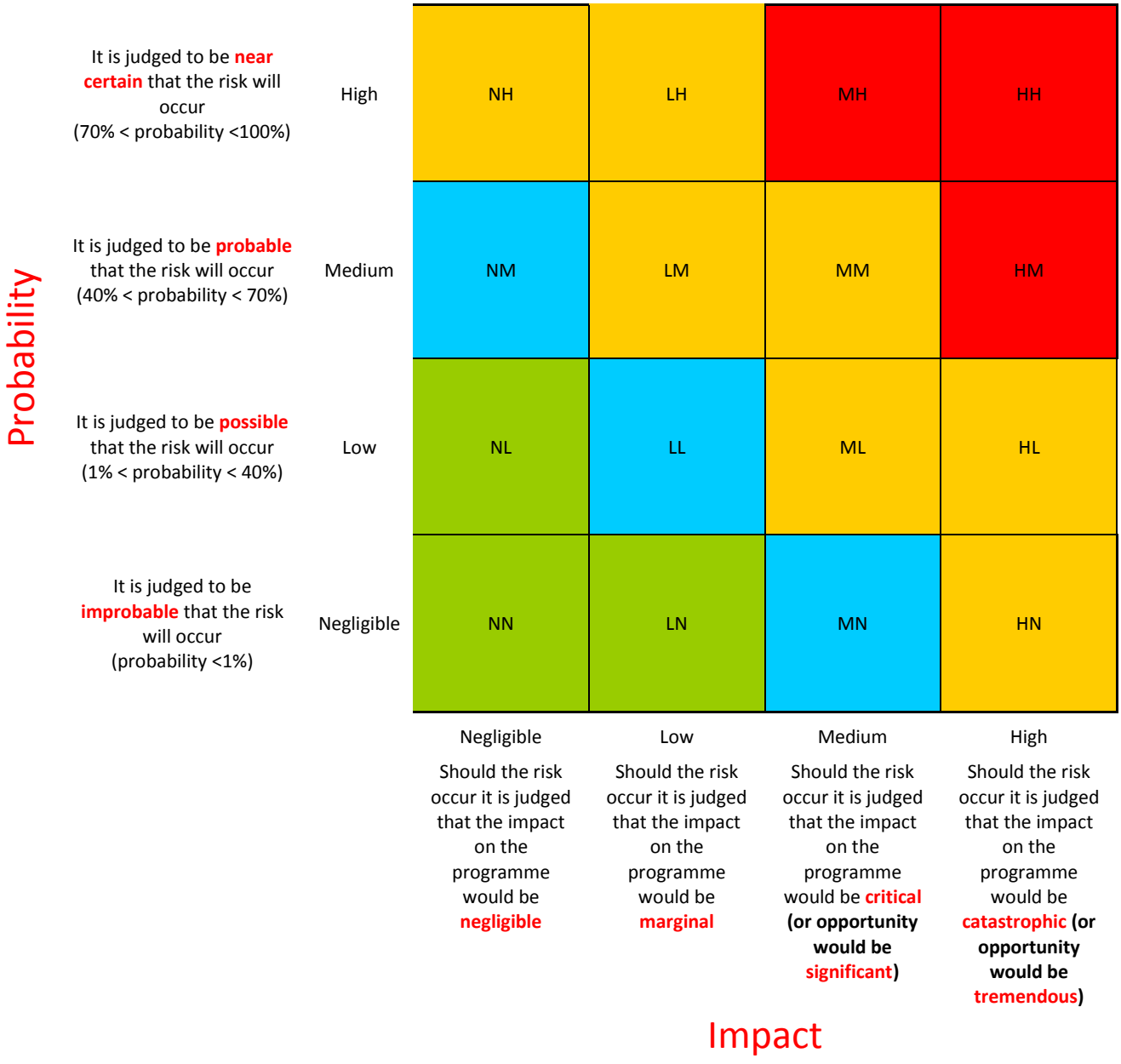
Deloitte LLP

Deloitte LLP
Chartered Accountants
Newcastle Upon Tyne, United Kingdom

Appendix 2: Project risk register

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.



The following pages are an extract of the project risk register for all active risks

.

Ref	Risk category	Risk Definition & Summary Description	Risk Owner	Unmitigated risk			Risk Mitigation Response	CURRENT Risk			Contingency Plan
				I	P	R		I	P	R	
1	Installation	**Title: Network Equipment may not operate as specified** **Impact:** If items of network equipment (EAVC, RTTR and storage) fail to operate as specified, this would affect our ability to conduct the field trials with said equipment. This would prevent the operation of or invalidate the results of certain test cells.	Northern Powergrid	H	L	**Red**	Preference for market ready products, multiple suppliers, test bed operation and phased rollout. Trials have been designed to contain different combinations of equipment and network applications in order to diversify the overall risk of single point technical failure.	M	L	**Amber**	For equipment that does not function as specified, consider simulation or modelling by DEI instead of field trials.
2	Installation	**Title: Possible failure to deliver the integrated demand response system** **Impact:** Failure to deliver the system (and/or it does not operation as required) would affect our ability to conduct automated end to end trials for domestic /SME direct control trials and I&C/DG DSR (test cells 18 &19).	Northern Powergrid	H	M	**Red**	Development and testing of the automated signalling between the various components.	M	L	**Amber**	Use manual processes instead to send the demand response signal.
25	Installation	**Title: GUS Control System not function as designed.** **Impact:** The control system will form an important technical component in the coordination of individual network components and in facilitating network-to-customer communications. We envisage a hybrid approach using both forms of control architecture, and have observed that there is no single vendor offering an off-the-shelf turn-key solution to integrate all elements of the control system from network component to individual customers in this manner. If the control system does not work as designed it will not be possible to conduct the full suite of network trials under the control of GUS, so the learning outcomes of LO3, and consequently the outputs in LO4 and LO5, will be compromised.	Northern Powergrid	H	M	**Red**	We are working through the GUS system development and a commissioning strategy to confirm the functionality of the GUS product to be installed meets the requirements of all project partners to successfully deliver the trials and the learning outputs. A new cross-party working group has been set up by NPg and closer working with Siemens has been initiated, with weekly conference calls, reports and increased senior level project visibility.	M	L	**Amber**	Run the autonomous trials and as many of the collaborative trials as is possible using workarounds (would depend upon the extent of the problem). However, this would slow the rate at which we can work through those trials. Using the results of the autonomous trials, model the predicted results of the collaborative trials.

Ref	Risk category	Risk Definition & Summary Description	Risk Owner	Unmitigated risk			Risk Mitigation Response	CURRENT Risk			Contingency Plan
42	Customer Recruitment	**Risk of customer drop out** Some domestic and SME customers have complained of inadequate communications and as result they are disengaged and considering withdrawal from the project. If trust and engagement is not established and maintained, there is a risk that customers drop out of the trials. The impact would be that the data sets collected will be smaller and cover a shorter time period. The probability and the impact are both generally greater in LO2 than in LO1 since a greater degree of engagement is required since customers are being asked to adopt new propositions. The impact will also be greater in test cells where the numbers of trial participants are relatively low.	British Gas	M	H	**Red**	To reduce the probability of this risk, BG and BGB should initiate an internal review of customer journeys and communications and in the short term issue an update / refresh communication to confirm customer position in regard to vouchers, start dates, installs. LO1 Customers need: Update on Voucher, trial status, installation status. LO2 Customers need: the above plus a reminder of proposition. Installers need: Clear, detailed instructions about each installation and how it relates to the customer and the trial, proposition, test cell. In the longer term, develop and deliver an ongoing 'in-life' communications programme to maintain customer interest and commitment to the trial.	M	N	**Blue**	
43	Installation	**DSR I&C test cell customers are located in un-monitored Network areas** I&C and DG customers will be contracted to provide DSR, but there is a risk that these may not be located in the network areas where we have installed monitoring (or may not remain contracted for sufficient time to warrant the time and cost of installing monitoring devices those areas of network).	Northern Powergrid	L	M	**Amber**	We will target recruitment at the areas where monitoring has been installed and at other areas where Northern Powergrid are planning investment plan (Claywheels, Bottisford and Goole).	L	L	**Blue**	Wherever this is not possible then use simulation from DEI to match signals for DSR to customers and network monitoring.
44	Installation	**Network Technology & GUS integration** Risk that certain elements of the installed network equipment may not communicate / integrate in every instance with the GUS control system & data warehouse. This would reduce the quality and quantity of field trials delivered.	Northern Powergrid	M	M	**Red**	We are working through the GUS system development and bench testing of the Control Systems and END devices in order to reduce the risk and impact of occurrence.	M	L	**Amber**	In the event that the GUS to END device link does not work then the alternative trials strategy is to operate the END devices manually in the field and collect the trial result data locally.

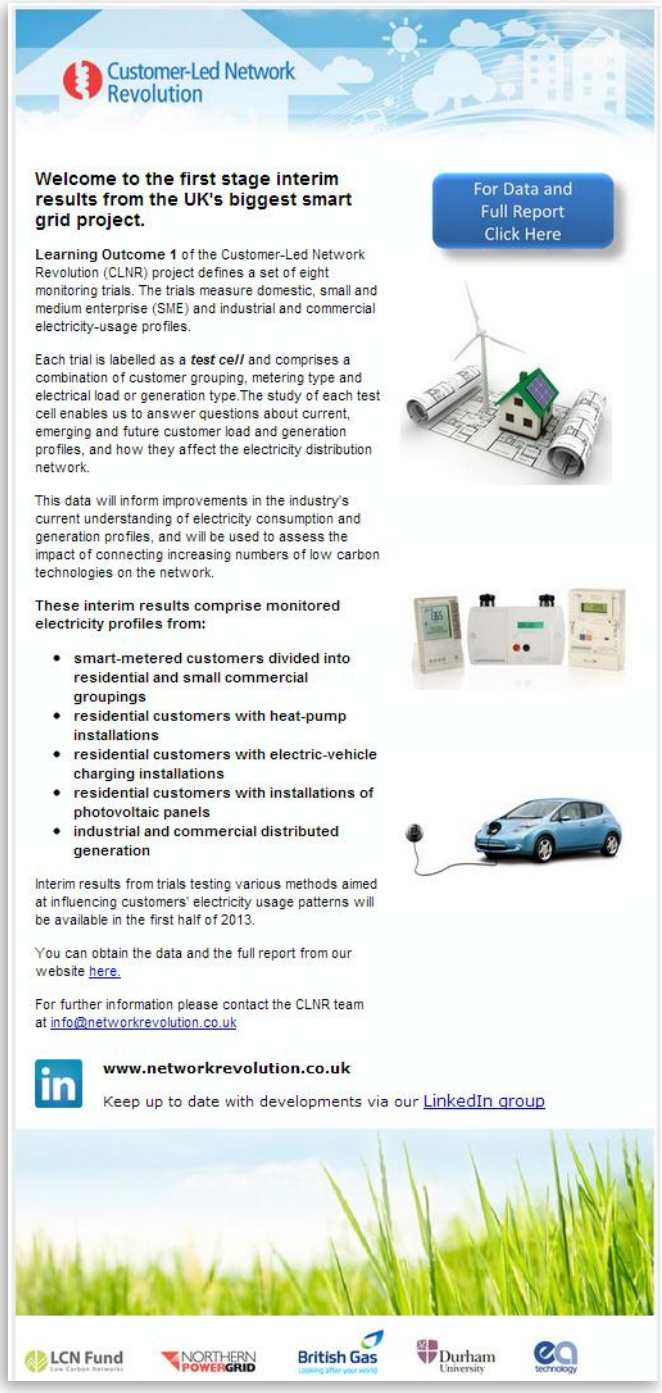
Ref	Risk category	Risk Definition & Summary Description	Risk Owner	Unmitigated risk			Risk Mitigation Response	CURRENT Risk			Contingency Plan
45	Installation	**Major Incident affecting trials equipment** A major incident other extreme event affecting the NPg trial network will adversely affect the lead up to or execution of the network trials, causing delay.	Northern Powergrid	H	N	**Amber**	Liaise with Control Operations and develop an alternative strategy to deliver the network trials, by switching resources to other unaffected network areas, or reduce trials.	M	N	**Blue**	Reduce numbers of physical trials. Fill any gaps with simulation.
46	Installation	**Commissioning New Network Technology (Battery Systems and Transformers with OLTC) at all sites.** Risk that approval from Northern Powergrid Safety and Protection departments will not be forthcoming to connect the battery systems to the electrical network in time for the trials to commence.	Northern Powergrid	H	L	**Red**	Working parties and Safety and Guidance operations documents have been written to satisfy Northern Powergrid's Safety and Operations departments	L	L	**Blue**	Reduce numbers of physical trials. Fill any gaps with simulation.
48	Other	**Title: Loss of academic personnel Impact:** Project is delayed and quality of learning is adversely affected.	DEI	H	H	**Red**	In parallel with agreeing the change request, Northern Powergrid to consider contractual arrangements with the university which may enable DEI to extend fixed-term contracts for academic staff and PhD studentships which would otherwise expire prior to the December 2014	H	H	**Red**	In the event that the project is extended but that staff /students leave before then, seek to replace personnel.

Appendix 3: SDRC evidence – Learning outcome 1 output & demand profiles

On December 21st 2012, the Customer-Led Network Revolution published the interim results from its load and generation profile monitoring trials.

The results took the form of a report CLNR-L010 - Initial Load and Generation Profiles from CLNR Monitoring Trials and an accompanying dataset which were uploaded to the project library on the CLNR website.

An email was sent to 201 selected contacts from the CLNR mailing list that we identified as most likely to be most interested in these results.



Customer-Led Network Revolution

Welcome to the first stage interim results from the UK's biggest smart grid project.

For Data and Full Report Click Here

Learning Outcome 1 of the Customer-Led Network Revolution (CLNR) project defines a set of eight monitoring trials. The trials measure domestic, small and medium enterprise (SME) and industrial and commercial electricity-usage profiles.

Each trial is labelled as a ***test cell*** and comprises a combination of customer grouping, metering type and electrical load or generation type.The study of each test cell enables us to answer questions about current, emerging and future customer load and generation profiles, and how they affect the electricity distribution network.

This data will inform improvements in the industry's current understanding of electricity consumption and generation profiles, and will be used to assess the impact of connecting increasing numbers of low carbon technologies on the network.

These interim results comprise monitored electricity profiles from:

- **smart-metered customers divided into residential and small commercial groupings**
- **residential customers with heat-pump installations**
- **residential customers with electric-vehicle charging installations**
- **residential customers with installations of photovoltaic panels**
- **industrial and commercial distributed generation**

Interim results from trials testing various methods aimed at influencing customers' electricity usage patterns will be available in the first half of 2013.

You can obtain the data and the full report from our website here.

For further information please contact the CLNR team at info@networkrevolution.co.uk

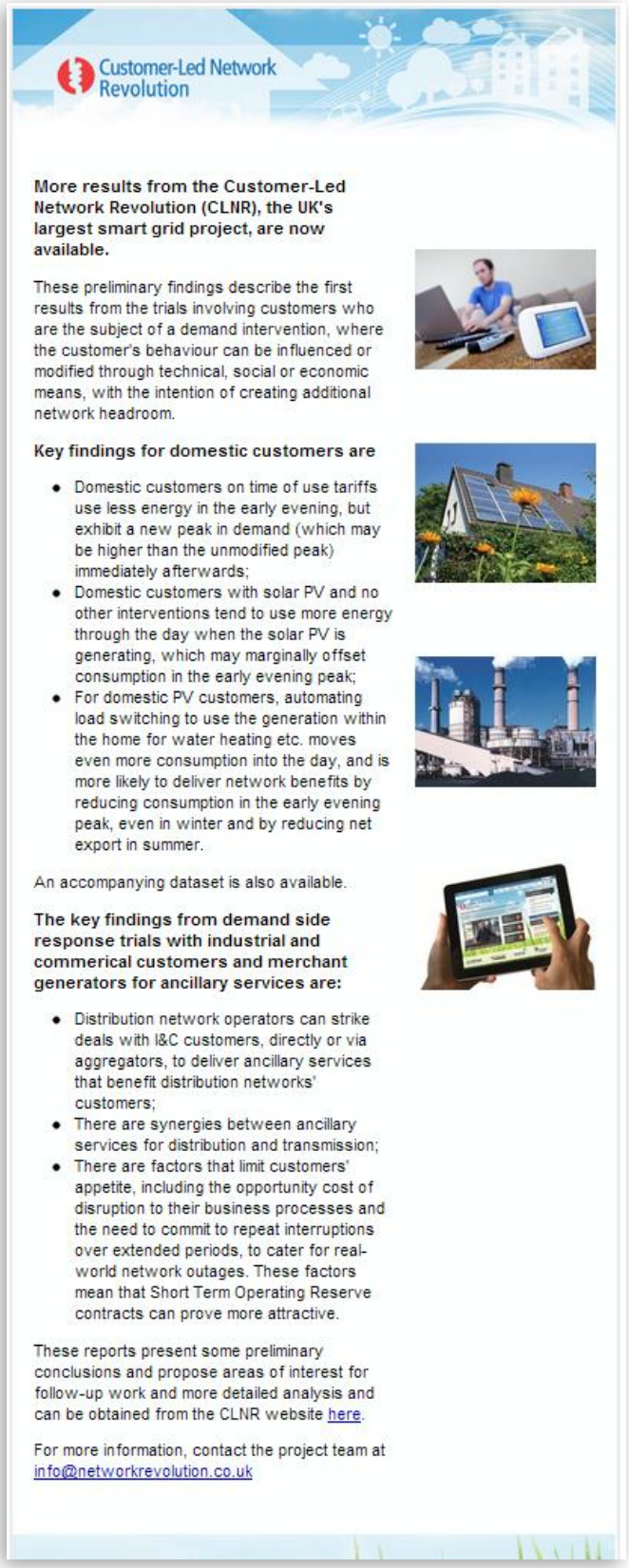
www.networkrevolution.co.uk

Keep up to date with developments via our LinkedIn group

LCN Fund · Northern Powergrid · British Gas · Durham University · ea technology

The key findings and results from the trials were formed into a press release which was circulated to our press list made up of trade, regional and national contacts and received significant press coverage across multiple platforms. They also formed the basis for an article which appeared in the CLNR Spring 2013 newsletter.

Appendix 4: SDRC evidence - Output / demand profiles before and after a range of interventions



Customer-Led Network Revolution

More results from the Customer-Led Network Revolution (CLNR), the UK's largest smart grid project, are now available.

These preliminary findings describe the first results from the trials involving customers who are the subject of a demand intervention, where the customer's behaviour can be influenced or modified through technical, social or economic means, with the intention of creating additional network headroom.

Key findings for domestic customers are

- Domestic customers on time of use tariffs use less energy in the early evening, but exhibit a new peak in demand (which may be higher than the unmodified peak) immediately afterwards;
- Domestic customers with solar PV and no other interventions tend to use more energy through the day when the solar PV is generating, which may marginally offset consumption in the early evening peak;
- For domestic PV customers, automating load switching to use the generation within the home for water heating etc. moves even more consumption into the day, and is more likely to deliver network benefits by reducing consumption in the early evening peak, even in winter and by reducing net export in summer.

An accompanying dataset is also available.

The key findings from demand side response trials with industrial and commerical customers and merchant generators for ancillary services are:

- Distribution network operators can strike deals with I&C customers, directly or via aggregators, to deliver ancillary services that benefit distribution networks' customers;
- There are synergies between ancillary services for distribution and transmission;
- There are factors that limit customers' appetite, including the opportunity cost of disruption to their business processes and the need to commit to repeat interruptions over extended periods, to cater for real-world network outages. These factors mean that Short Term Operating Reserve contracts can prove more attractive.

These reports present some preliminary conclusions and propose areas of interest for follow-up work and more detailed analysis and can be obtained from the CLNR website here.

For more information, contact the project team at info@networkrevolution.co.uk

On April 30th 2012, the Customer-Led Network Revolution published the interim results on profiles before and after interventions.

The results took the form of a series of reports and datasets that were uploaded to the website project library;

CLNR-L012 - Initial Load Profiles from CLNR intervention trials

CLNR-L013 - Dataset to accompany CLNR-L012

CLNR-L014 - Initial report on industrial and commercial demand side response trials

CLNR-L015 - Interim time of use tariff trial analysis

An email was sent to a total of 465 selected contacts from the CLNR mailing list. On this occasion, we included key findings from the report in the email carrier to encourage recipients to click through to the full report.

The key findings and results will provide content for a series of planned press releases focusing on demand side response, solar PV users and time of use tariffs and form the basis for an article in the next CLNR newsletter.

Appendix 5: SDRC evidence – Regional stakeholder panel

On Tuesday 21st May 2013, the Customer-Led Network Revolution held a regional stakeholder knowledge sharing event entitled 'Switch on the Customer-Led Network Revolution' fulfilling the Successful Delivery Reward Criterion of holding a regional stakeholder forum by December 2013 .

The event took place at the Centre for Life in Newcastle upon Tyne. 59 delegates attended on the day, from organisations including; Ofgem and ENA, UK DNO's and energy suppliers (WPD, SSP, Npower) academic institutions (Imperial College London, Durham, Newcastle and Northumbria Universities) and important regional stakeholders like Narec DE Ltd, Newcastle and Durham City Councils and local community action groups.

The event focused primarily on the 'Customer-Led' aspect of the project and consisted of the following presentations:

- Professor Phil Taylor, academic lead on the CLNR project: Introduction and overview.
- Northern Powergrid: 'Towards a smarter powergrid' with input on business planning
- British Gas: Recruitment and on-going customer engagement
- Northern Powergrid: Demand side response with domestic and I&C customers
- NEA & Durham University: Insights into consumers' energy flexibility and behaviours

The presentations were followed by round table discussions where delegates were encouraged to explore the issues raised in greater detail and ask questions of the expert panel. The agenda for the day can be found at the end of the report.

The presentations given on the day can be viewed here.

A video about the event, featuring interviews with delegates and key stakeholders can be found on the CLNR YouTube channel.

Event Feedback

In order to better understand the outcomes of the event and to inform future event planning, delegates were given two opportunities to provide valuable feedback.

1. On the day delegates were provided with qualitative evaluation forms that asked specific questions about the individual presentations, it was also intended that these would also act as an aide memoire to inform the roundtable discussions. 13 delegates completed the forms on the day, representing a reasonable 22% response rate. Northern Powergrid also took the opportunity to have delegates comment on the business plan. Delegates were asked whether they thought Northern Powergrid had the right approach for dealing with the growth of low carbon technologies and feedback has been shared within Northern Powergrid.

2. After the event delegates were asked to complete an online survey which rated the individual presentations and format of the day.

The remainder of this appendix comprises of pertinent feedback from the qualitative and quantitative evaluation forms.

Overall, the feedback presented illustrates the event was successful in what it set out to achieve. The high number of attendees and the wide range of organisations represented ensured a range of topics were discussed during the networking opportunities. The comments received from delegates showed that they had a good interest in the subject and will be engaging with the CLNR agenda in the future. In terms of the overall design of the programme some delegates did state they would have appreciated more time to hear about some of the social science outcomes.

It is also apparent that many delegates found the round table discussions of particular interest and would like to see extended discussions in future events. Some delegates suggested holding the discussions several times so that delegates could attend more than one discussion, and another delegate commented on the need for extended discussions around the future of the project.

Attendance

Delegates were asked how they found out about the event. The comments below suggest that delegates found out about the event from a range of sources:

"LinkedIn CLNR group"
"Email from NEA"
"Several contacts at my university passed on the details"
"Invited by British Gas who are our contractors for a whole building retro-fit approach on a group of our largest public buildings"
"Email from a colleague, and it was mentioned to me by one of the project partners"
"Via Newcastle Science City after attending their monthly network event"

Networking opportunities

The format of the day was designed to encourage and maximise dialogue between delegates. Delegates were asked what issues they discussed during their networking opportunities.

"Discussed roles and organisations; need for the (CLNR) project, the trials, energy storage systems, difficulties for consumers, fuel poverty"
"The renewable heat network opportunities at Local Authorities"
"Opportunities to work together more closely in the future. The Council could potentially help with access to energy users for future research. We could also offer the energy efficiency works on our own 1000 buildings and the awareness and behaviour change work with our own staff as free data for future research.
"Battery storage, network monitoring, data extraction issues & project timescales"
"The need to tackle behaviour with regards to energy use and not just technical solutions"
"Network structure & the most appropriate places to have power storage, it's capacity and size"
"We discussed customer behaviour, and more specifically the incentives that can motivate customers to change their consumption habits"
"Social science findings, issues related to fuel poverty, network issues"

Speaker presentations

Delegates were asked to indicate which presentation was of most interest and benefit to them. The answers were mixed. The Northern Powergrid presentation was mentioned considerably within the delegates' comments, although delegates also commented positively on the other presentations.

"Demand side response because of most relevant to environmental management work I am involved with in industry"
"Durham University & NEA was most relevant to my work - gave insights into domestic use, customer attitudes etc. Useful info on approach to trials, findings etc. The roundtable discussion was interesting and a useful format"
"They were all really useful"
"Roundtable discussing smart grids"
"NEA & Durham University - relates closely to my work"
"The presentation from Northern Powergrid on DSR, as an academic researcher working in electrical power research"
"Roundtable discussions with Northern Powergrid, access to key people and the ability to ask specific questions"
"The British Gas session was really interesting as they provided us with findings and figures"
"BG Customer recruitment, interesting to see the levels of effort and approach to this element of the programme"

General comments relating to the event

"Very interesting, the presentations were appropriate and the logistic were good"
"Very good, I liked the presentations which were focused on the results of the work. I think there should be more of them in the future as more results come out"
"NPg seem to be leading the way in terms of preparing for a future where low carbon technologies are optimised. Other DNOs will follow. The collaborative nature of the work is one of its strengths. Looking forward to more results"
"I was aware of the project but it was interesting to start to see some of the initial trial findings coming out"

Informing future CLNR events

Delegates were asked to identify any subjects they felt should have been covered by the event, and any they would like to see addressed in future events.

"Extended roundtable discussion please. Focus on energy saving measures for domestic consumers particularly those living in fuel poverty"
"I would have liked to attend more than one of the round table discussions; maybe they could have happened twice?"
"We need to understand how these projects fit into the overall strategy of Northern Powergrid and how smart grids across all projects is to be implemented and user / technical requirements"
"I'd be interested in a more detailed discussion about the future, the remainder of the existing research and potential future programmes after that.
"I would like to see the benefits cases that are being proved as part of the project presented"
"I would like to hear more about the social science findings as they emerge"
"More focus on social science elements - not enough time to present the social science definitely rushed a little"

Qualitative evaluation forms (completed on the day)

Northern Powergrid: A smarter powergrid

What new and useful insights did you gain?

"How the network was designed and how demand has changed"
"Project information, size and technology installed"
1. Scale of customer involvement 2. Variance involved within project i.e. heat pumps, EV's etc.
"Level of details of the CLNR project and data being collated"
"Interesting to know what is happening locally, as opposed to national projects – different DNO's, different smart grid projects"

Was there anything you would want to challenge or disagree with?

"Disagree that solar PV grid parity will lead to extensive installation. A number of factors influence decision making and equality of economics only removes one factor"

British Gas: Recruitment and customer engagement

What new and useful insights did you gain?

1. Smart heat pumps being deployed in trials 2. The extent of the trial variations
"The different trials being undertaken, how customers were recruited and what motivates them"
"I would like to see all consumption data from the trials with open access on the internet; it's too valuable not to share."
1. Supplier / DNO relationship 2. Time of Use tariff structures 3. Direct control strategies
"Interesting to see some details on trials being run and the complexity"
"Very useful presentation in terms of cluster take up"
"Greater detail on the range of domestic trials"
"The efficiency of storing electricity in hot water"
"Interesting explanation of complexity of trials"

Was there anything you would want to challenge of disagree with?

"Dumping PV excess power into 'useful' hot water – how useful is it? Not the best use."
"How will these various new DSR tariffs work with tariff changes on EMR proposals"
"To what extent is the impact of DSM educating consumers and resulting in efficiency rather than flexibility. The consumption data suggests this by providing reduction and not just a straight profile shift."
"Surely Marks & Spencer vouchers attract a particular kind of demographic? How can different economic groups be represented?"

Northern Powergrid: Demand side response

What new and useful insights did you gain?

1. Technologies employed 2. Findings of study showing effect of GUS
"Please share the data online about network performance, also changing climates – warmer summers?"
"Structure of I&C/domestic contracts"
"Number and range of trials, central control and decentralised"
"Interested to know more about I&C DSR project, development of GUS and using aggregators"

Durham University & NEA: Insights into consumers' energy flexibility & behaviour

What new and useful insights did you gain?

"Interim findings and homes in transition"
"Insights into the work being done on data and behaviours were very interesting. Good scale of project, gave an excellent set of 'believable' results"
"Interesting customer interviews"
"Interim behavioural analysis"

Was there anything you would want to challenge of disagree with?

"Dissemination of reports needs to be made more visible"
"What was the user group? City or country based, single/partners/ family etc. Economic circumstances"

Are there any issues or topics you would like to see covered at future events?

"Case studies of installations including user data"
"Really interested in the behavioural change aspect and initial findings on flexibility – I'd be really interested to know more about this as it comes through"
"More technical details and results of trials"
"Greater details about the commercial / financial impact analysis shift from technical focus to BAU transition"
"More on system robust design, redundant capacity, load balancing"

Invitation and agenda

Customer-Led Network Revolution

Switch on to the Customer-Led Network Revolution … and help us to create a smarter powergrid.

Knowledge Sharing Event, 21st May 2013, Centre for Life, Newcastle upon Tyne.

Encouraging consumers to adopt greener energy practices is a major challenge. The Customer-Led Network Revolution (CLNR), the UK's leading smart grid project, has recruited more than 12,000 domestic, industrial and commercial customers from across the North East & Yorkshire to take part in its low carbon trials: join us at our regional knowledge sharing event to find out how.

Part-funded by Ofgem's Low Carbon Networks Fund and led by Northern Powergrid, together with partners British Gas, Durham University and EA Technology, the CLNR project involves the trialling of innovative smart grid technology at key locations across the Northern Powergrid electricity network and the creation of thousands of smart enabled homes and businesses, equipped with smart meters, solar panels, heat pumps and electric vehicle charging points.

Learning from the CLNR project will help network operators like Northern Powergrid to find cost-effective ways to manage the introduction of low carbon technologies, whilst ensuring customers continue to receive a safe, secure and affordable supply of electricity both now, and in the low carbon future.

Please join us at our 'Customer-Led' knowledge sharing event, where key members of the project team will present the latest findings from the project. Find out:

- How we recruited 12,000 domestic and business customers to take part in our on-going trials in the region
- How consumers' behaviour has adapted in response to interventions and incentives like time of use tariffs and demand side management
- What's next for the CLNR project and how you can shape and benefit from the learning coming out of the project

To register your interest in the event complete the booking form

LCN Fund Low Carbon Networks · Northern Powergrid · British Gas · Durham University · ea technology

Customer-Led Network Revolution

Event Programme

12.15 Registration & lunch

13.00 Welcome & general housekeeping
Jim Cardwell, Head of Regulation & Strategy, Northern Powergrid

13.05 An introduction to CLNR by Professor Phil Taylor, Director of NIReS & lead academic on the CLNR project

13.15 Northern Powergrid
Dr Liz Sidebotham, CLNR Communications & Compliance Manager

- The challenge of a low carbon future
- Sustainable networks

13.45 British Gas
Stavros Sachinis & Allan Rowe, LCNF Project Managers

- Customer recruitment & engagement
- Lessons learned & findings to date

14.15 Refreshment break

14.30 Northern Powergrid
Preston Foster, CLNR Project Manager

- Demand side response
- Findings to date

14.45 Durham University & National Energy Action
Dr Gareth Powells, Research Associate (Durham) & David Lynch, Senior Research & Policy Advisor (NEA)

- The social science approach
- Findings to date

15.20 Refreshment Break

15.30 Roundtable discussions

1. A 'smarter' powergrid – Northern Powergrid
2. Customer recruitment & engagement – British Gas
3. Consumer behaviour & flexibility – Durham University & NEA

16.10 Conclusions
Jim Cardwell, Head of Regulation & Strategy, Northern Powergrid

- How you can shape future planning & research
- What's next for the CLNR project?

16.30 Close

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Appendix 6: Social science dissemination planned for the next reporting period

Social science dissemination activities in the next reporting period include:

- Presentation at The Nordic Environmental Social Science Conference 2013, Copenhagen, 11-13 June 2013,
- The Co-evolution of Energy Provision and Everyday Practice: Rigidity, Disruptions and Systemic Challenges in the Installation of Air Source Heat Pumps in the North of England
- Prospecting for Flexibility: Findings from a Collaborative Enquiry into Smart Electricity Systems Presentation at Energy Systems in Transition, Karlsruhe, Germany, 9th-11th October 2013
- Governing Power, Conducting Demand: Reconfiguring Social Practices for the Smart Grid

Durham University will submit papers to academic peer reviewed journals. The working titles for these papers are:

- Diagrams of Power: Politics and the Co-Production of the Smart Grid, planned to submit to Environment and Planning, A.
- Electricity Markets and the Geographies of Smart Energy (Originally Presented at Royal Geographical Society2012) planned to submit to Energy Policy.
- Smart Grids and the Flexibility of Everyday Life (following initial presentation at IAS STS 2013 (12th Annual Conference, Institute for Advanced Studies of Science, Technology and Society) in July 2013) planned to submit to Energy Policy.
- Fostering active network management through SMEs practices (following initial presentation at IAS STS 2013 (12th Annual Conference, Institute for Advanced Studies of Science, Technology and Society) in July 2013) planned to submit to Energy Policy.
- Governing Power, Conducting Demand: Reconfiguring Social Practices for the Smart Grid (originally presented at EST conference, 2013) planned to submit to Environment and Planning, A.

Enrolment and Exclusion – Flexibility Capital and The Politics of Smart Electricity Demand Management (originally presented at AAG 2013) planned to submit to Economy and Society.

Appendix 7: Engineering dissemination planned for the next reporting period

In the next reporting period the dissemination of the engineering activities will include the following academic conferences and journals:

- ISGT Oct 2013 – Impact of EVs on LV networks
- Jialiang Yi, Development and evaluation of a decentralised DSR voltage control strategy using UK Smart Grid Trials, Keywords: EES, DSR, and Collaborative Voltage Control. Circulation Date: 03/13. Revised version to be submitted to Elsevier, Electric Power Systems Research June 2013.
- Pádraig Lyons, Programmatic Smart Grid Trial Design Development and Analysis Methodology, Keywords: Planning. Circulation Date: 01/13. Conference: CIRED 2013, June 10 – 13, 2013.
- Daniel Liang, Coordinated Voltage and Power Flow Control in Distribution Networks, Keywords: Full System. Circulation Date: 01/13. Conference: CIRED 2013, June 10 – 13, 2013.
- Simon Blake, Voltage regulation to support customers under faulted network conditions, Keywords: RTTR. Circulation Date: 01/13. Conference: CIRED 2013, June 10 – 13, 2013.
- Simon Blake, Using Electrical Energy Storage to Support Customers Under Faulted Network Conditions, Keywords: EES. Circulation Date: 02/13. Conference: CIRED 2013, June 10 – 13, 2013.

In the next reporting period we will publish the content of the 'working papers' (currently internal CLNR document) produced during this reporting period:

- Daniel Liang, DEI-CLNR-DC108 - CLNR Initial Trial Analysis – EES2 Autonomous and Single + GUS Power-flow Trials at Rise Carr, Keywords: Autonomous Power-flow Control, Single + GUS Power-flow control. Circulation Date: 04/13.
- Peter Davison, DEI-CLNR-DC113 HV OHL Denwick RTTR Sites Annual Analysis, Keywords: RTTR. Circulation Date: 04/13.
- Peter Davison, DEI-CLNR-DC114-EHV OHL RTTR Preliminary Analysis, Keywords: RTTR. Circulation Date: 04/13.
- Pádraig Lyons, DEI-CLNR-FTA009-Overview of Network Flexibility Field Trial Analysis, Keywords: Planning. Circulation Date: 12/12.
- Pengfei Wang, DEI-CLNR-TN008 CLNR Initial Trial Analysis - Autonomous and Single + GUS Trials at Denwick, Keywords: Autonomous Voltage Control, Single + GUS Voltage Control. Circulation Date: 12/12.
- Peter Davison, DEI-CLNR-TN009-Evidence for relocation of RTTR OHL HV equipment, Keywords: RTTR. Circulation Date: 02/13.
- Pádraig Lyons, DEI-CLNR-TN010-External VEEEG Planning Technical Note, Keywords: Planning. Circulation Date: 12/12.