



Customer-Led Network
Revolution

Initial Report on Industrial and Commercial Demand Side Response Trials

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Document Purpose

The purpose of the Customer-Led Network Revolution project is to generate five specific Learning Outcomes.

Learning Outcome 2 is to determine the extent to which customers are flexible in their load and generation, and the cost of that flexibility?

This document describes the preliminary results from the demand side response (DSR) trials with industrial and commercial (I&C) customers in the Customer-Led Network Revolution (CLNR) project.

It must be noted that this report is an interim document. Readers should not rely on this data to support investment and other decisions. The full report on the DSR trials will be published as part of the CLNR project closedown report.

Key Findings

Test cell 18 - Ancillary services fast reserve service

1. The DNOs can build effective relationships with both the aggregators and direct with I&C customers for the purpose of providing DSR.
2. The DNOs are effectively in a competitive market for DSR primarily with the National Grid short-term operating reserve (STOR) products. The two network requirements are potentially complementary and a joint DNO/ Transmission System Operator (TSO) and even Transmission Operator (TO) product may create value for all stakeholders.
3. The I&C contract template attached in Appendix A is only one example of a DSR contract. Each network scenario or network requirement may alter certain parameters.
4. The time required to finalise the legal framework for DSR products is material.
5. The DSR contracts delivered a 77% success rate when participants were instructed to deliver DSR. So when customers are engaged, the operation of the arrangements is entirely feasible.
6. Locating customers that are willing to offer the level of DSR that we consider is required by the network as an adequate insurance product (i.e. for four hours in a day over a maximum 14-day period - potentially more than 14 days in some circumstances) will reduce the number of customers that can participate in these schemes. A solution to this issue is to use a portfolio of customers to deliver the DNO's requirements, each contributing towards the total requirement.
7. The knowledge transfer process from the project to the operational teams for business as usual implementation will involve a significant resource commitment.

I&C customer engagement research

8. When targeting a tight geographic area the initial customer drop-out rates are high due to issues with contacting the sites, contacting the right person at the site and the size of site load.
9. When contact is made with the right person in the business there is a low level of awareness of what DSR is amongst customers.
10. When the concept of DSR is explained to customers a large proportion of customers want to understand more about the practical opportunities.
11. The requirement for customers to invest time and resources to develop their DSR capability did not represent a barrier.
12. Remote control access and control of customers' assets was not a barrier to the operational stage of the DSR implementation process.

13. Even if customers show a positive interest in the DSR concept there may still be issues with some sites as further investigations identified limited flexibility to alter their load profiles.
14. The implementation of DSR from generation substitution is the most successful entry point for new I&C customers wishing to participate in DSR schemes as it provides a new revenue stream while minimising the number of changes and new risk to their business operation. Following this first step, customers can then engage in developments that may be more intrusive to their core processes such as load management. Energy efficiency is also a good entry point for customers new to DSR.
15. The lead times from making initial contact with a customer to finalising a DSR contract can range from 12 to 24 months.
16. The project has trialled two customer engagement models 1) via the aggregator and 2) direct with I&C customers. A third hybrid option where the DNO owns the initial customer contact and only passes 'warm' leads to the aggregators may be a more efficient model.

Test cell 19 - Ancillary services voltage support service

17. Both the merchant generators and I&C customers with generating assets are receptive to discuss voltage support services.
18. The merchant generators are also open to discussions about non-firm connection agreements although as would be expected the developers would want to understand the details and risks in detail before making any commitments.
19. This product is unlikely to provide a material new revenue stream for the merchant generators. However, the value of this product for the merchant generators will be as a mechanism to enhance the connection options for new DG sites.

Summary

The purpose of the Customer-Led Network Revolution project is to generate five specific learning outcomes.

- **Learning Outcome 1:** understanding of current, emerging and possible future customer (load and generation) characteristics;
- **Learning Outcome 2:** to what extent are customers flexible in their load and generation, and what is the cost of this flexibility?
- **Learning Outcome 3:** to what extent is the network flexible and what is the cost of this flexibility?
- **Learning Outcome 4:** what is the optimum solution to resolve network constraints driven by the transition to a low carbon economy?; and
- **Learning Outcome 5:** what are the most effective means to deliver optimal solutions between customer, supplier and distributor?

To achieve each learning outcome a series of trials has been designed, each of which examines a discrete combination of customer propositions and network technologies.

This report relates to Learning Outcome 2 and covers two generic demand side response product types; ancillary services fast reserve and voltage support, which we refer to as test cells 18 and 19 respectively:

- **Test Cell 18:** The fast reserve service is a direct control proposition which requires industrial and commercial (I&C) customers to adapt their energy usage patterns upon request to create a controllable power flow.
- **Test Cell 19:** The voltage support provision service is a proposition for merchant generators or I&C customers with sufficiently controllable generation to contribute to wide-area voltage control; the generator may be required to alter its mode of operation to support or reduce volts by modulating real and (particularly) reactive power.

This report describes the process undertaken to operate the physical trials for both test cells and the learning captured. In summary the stages undertaken and the purpose of each stage were as follows:

- **Assessment of the network requirement** – this is the start point for the trial. Without a clear network requirement the following stages have no foundation. For test cell 18 a ‘post fault’ requirement was developed, where a specific customer response would support the network. For test cell 19 a flexible voltage support proposition has been developed for the network;
- **Market channel assessment** – the report describes the various options considered to engage with customers that could provide the response designed by the network assessment stage;
- **Contract structures** – A new agreement for test cell 18 was constructed to formalise the DSR requirements. This agreement is attached in Appendix A. A term sheet has been developed for test cell 19; this will form the basis of the new agreement for the autumn 2013 trials;
- **Winter 2012 test cell 18 trial description and results** – we contracted DSR from three I&C customers with two aggregators and operated our first physical DSR trials;
- **Customer engagement research** – in addition to the physical trials a research exercise was undertaken. This involved engaging with I&C customers in 10 primaries supplying 251 I&C sites, 92 of which have a maximum demand greater than 200kW. The objective of the exercise was to evaluate the appetite of this customer segment to provide DSR. The key learning identified was, when targeting a tight geographic area the initial customer drop-out rates are high due to issues associated with contacting the sites, contacting the right person at the site and the suitability of the load to participate in DSR; and
- **Preparation for the autumn 2013 trials for test cell 18 & 19** – the report describes the 2nd trials which will cover both test cells.

Next steps

The forthcoming autumn 2013 trials will cover both test cell 18 and 19. The key development items for the autumn 2013 trials are to:

- Assess the process of acquiring fast reserve service at specific geographic locations;
- Engage directly with I&C fast reserve service providers;
- Enhance the communication despatch protocols between the DNO and the aggregators for fast reserve services. The CLNR grand unified scheme (GUS) will issue DSR instructions direct to the aggregators and potentially directly to I&C customers;
- Build a larger fast reserve service portfolio to test response from a broader cross section of the I&C customer base; and
- Run the first physical trials for the voltage support service.

Glossary of Terms

CLNR	Customer-Led Network Revolution
DG	Distributed Generation
DSR	Demand-Side Response
DLE	Distributed Load Estimate
DNO	Distribution Network Operator
GUS	Grand Unified Scheme
EDCM	EHV Distribution Charging Methodology
EAVC	Enhanced Automatic Voltage Control
I&C	Industrial and Commercial
RTTR	Real-Time Thermal Rating
MW	Megawatt
MWh	Megawatt Hour
STOR	Short Term Operating Reserve
TO	Transmission Operator
TSO	Transmission System Operator

1. Introduction

This document is an interim report covering learning outcome 2 (LO2), customer flexibility or DSR and covers test cell 18 and 19. The report presents an initial view of data collected from I&C customers and merchant generators who are taking part in the ancillary services fast reserve and voltage support trials.

Trials were run in the winter of 2011/12 and further trials are scheduled for later in 2013. The report structure outlined below will describe the methodology utilised for test cell 18 and 19, the results from the operational trials (to date) and the interim learning.

Test cells 18 and 19 cover two generic product types labelled ancillary services fast reserve and voltage support:

- The ancillary services fast reserve service is a direct control proposition which requires industrial and commercial (I&C) customers to adapt their energy usage patterns upon request to create a controllable power flow, either increasing generation or reducing load or reducing generation or increasing load. For both energy balancing and network balancing, the means by which off-take is reduced is largely irrelevant. The driver may be either a signal from Enhanced Automatic Voltage Control (EAVC), Real-Time Thermal Rating (RTTR) or both depending on local distribution voltage and thermal network circumstances.
- The ancillary services (voltage support) provision service is a proposition for merchant generators or I&C customers with sufficiently controllable generation to contribute to wide-area voltage control; in conjunction with EAVC schemes; the generator may be required to alter its mode of operation to support or reduce volts by modulating real and (particularly) reactive power.

As DSR providers for both of these products are diverse, these tests will largely be proof of the commercial concept, that it is economically viable for all parties to strike contracts for response. To increase learning for distributors, we will seek to engage distributed generation (DG) and I&C customers with enough response capacity to drive a measurable response at extra high voltage (EHV) (i.e. 5-10 MW), to close the loop on primary EAVC and RTTR schemes. The CLNR bid targeted 15 customers within test cells 18 and 19.

2. Test cell 18 - Ancillary Services Fast Reserve

This report describes the process undertaken to operate the physical trials for test cell 18 and the learning captured. In summary the stages undertaken and described below were as follows:

- Assessment of network requirements
- Market channel assessment
- Contract structures
- Winter 2012 trial description and results
- Customer engagement research
- Autumn 2013 trials
- Learning

2.1. Assessment of network requirements

Network requirement for a 'fast reserve' post fault DSR product

All distribution network operators (DNO) design their networks to provide the required level of security under network fault conditions. The objective of the I&C flexible response is to address operational constraints that arise after network failure if the network is loaded more fully to cater for the increase in connection of low carbon technologies. This response is only required when the network has incurred a fault, the requirement is therefore an on-demand response rather than a day-in, day-out response. The following sections describe the network fault scenario and how the I&C flexibility product would support the operations of the network.

Network constraint

The network constraint which requires intervention is a heavily-loaded primary substation. The supplies to these nodes are designed with N-1 redundancy, i.e. they're intended to support full demand even with one incoming circuit out of commission. Those incoming circuits are the most reliable on the network, because they are used to secure supplies to large numbers of customers. On a fully loaded primary, these circuits are each carrying half their rated capacity when running in parallel at the time of system maximum demand but could be lightly loaded the majority of the time. They could therefore offer more capacity if customers were to agree to moderate their requirements under single circuit outage conditions if this happened to also coincide with the period of peak demand.

Customer role

The role of customers is to offer load reduction / generation, thereby "shaving" peak demand, when a circuit is lost due to a fault at a time when unconstrained peak demand would be at its highest (typically, November-February). This facility could extend the asset life by deferring

network reinforcement. The reduction in demand would be scaled back to the capability of the remaining assets. Generally a reduction of 10% of peak demand is sufficient (approx. 2MW – 4MW). In the course of normal operations, all the incoming circuits are in commission, so the demand response will not be required. Planned outages would be confined to the period between March and October, to avoid activation of the demand response for planned work.

The I&C flexibility product is, in effect, an insurance policy to be claimed against if a network fault occurs at the time of peak demand.

Network evaluation process

Having defined the concept for the ‘fast reserve’ post fault DSR product, the next stage was to simulate the asset management planning process to understand how this new tool would be incorporated into existing business processes.

Northern Powergrid undertakes network load forecasting annually in order to identify locations where there is a risk that forecast demands will exceed the substation firm capacity. These Distribution Load Estimates (DLEs) provide a high level indication of the potential future demand on the EHV distribution network and form the starting point for the assessment of potential load related reinforcement expenditure. The results are formally documented and published to the business and contain a year-on-year estimate of the electrical demand on each of the Primary and Supply Point Substations together with an indication of where the existing, or forecast demands may exceed the capability (firm capacity) of a substation.

The process of producing the DLEs includes the following:

- A detailed review of each Primary and Supply Point substation demand profile;
- An assessment of the current maximum demand;
- Application of any necessary data normalisation;
- Forecasting of underlying network load growth;
- Forecasting the impact of known large load changes;
- Forecasting the impact of known large generation changes;
- Identification and assessment of embedded generation in service; and
- Analysis and initial investigation of potential issues.

Load profile analysis

Once the primary substations at or nearing firm capacity have been identified through the DLEs, analysis of the load profile is required in order to ascertain whether DSR can provide an alternative to network reinforcement. Figure 1 shows the average monthly power consumption at a primary substation.

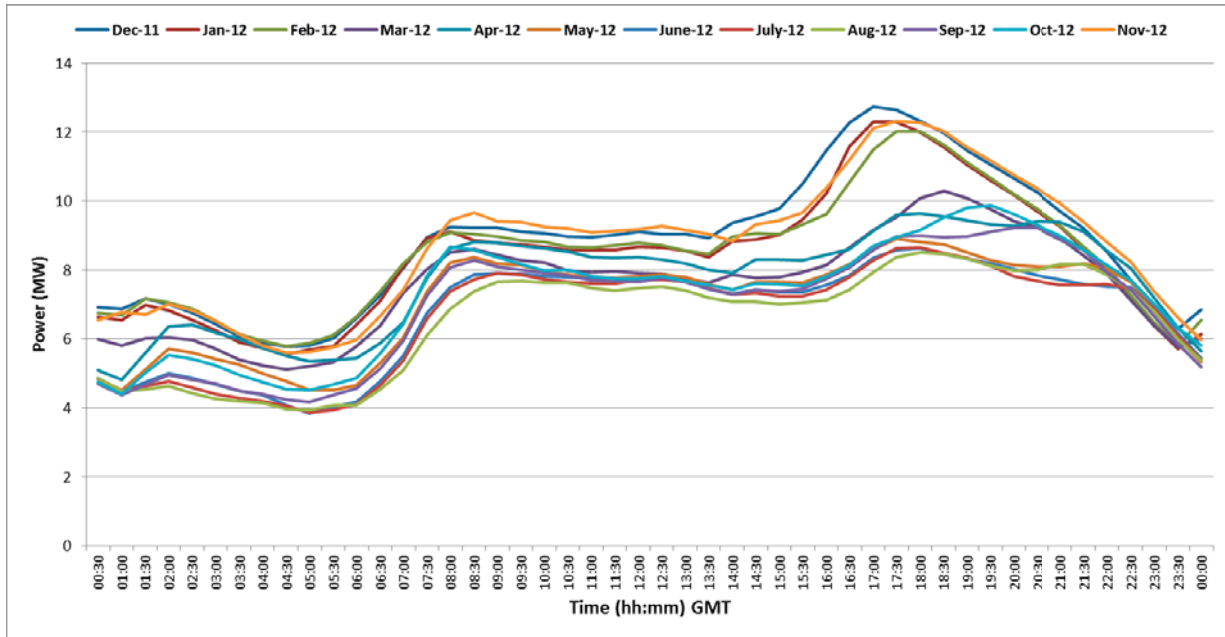


Figure 1 – Average monthly power consumption per half hour for primary substation

It can be seen from the profile for this particular primary substation, DSR could provide a solution to reduce the peak demand and would be required from November through to February between 15:00 and 19:00. However, there are some profiles that have no seasonal shapes, these substations may have high load factors, in these situations DSR is unlikely to be an economic alternative as the DSR product cannot target specific seasons or potentially times during the day. In these situations conventional asset reinforcement is more likely to be required.

Customer matching requirements

Once it has been identified that DSR is a real alternative to network reinforcement, analysis needs to be carried out to establish whether the customers located on that part of the network have a load shape which could offer DSR for the selected primary substation. Figure 2 shows a comparison of the load profile of a primary substation and a potential DSR provider for December 2011 to February 2012.

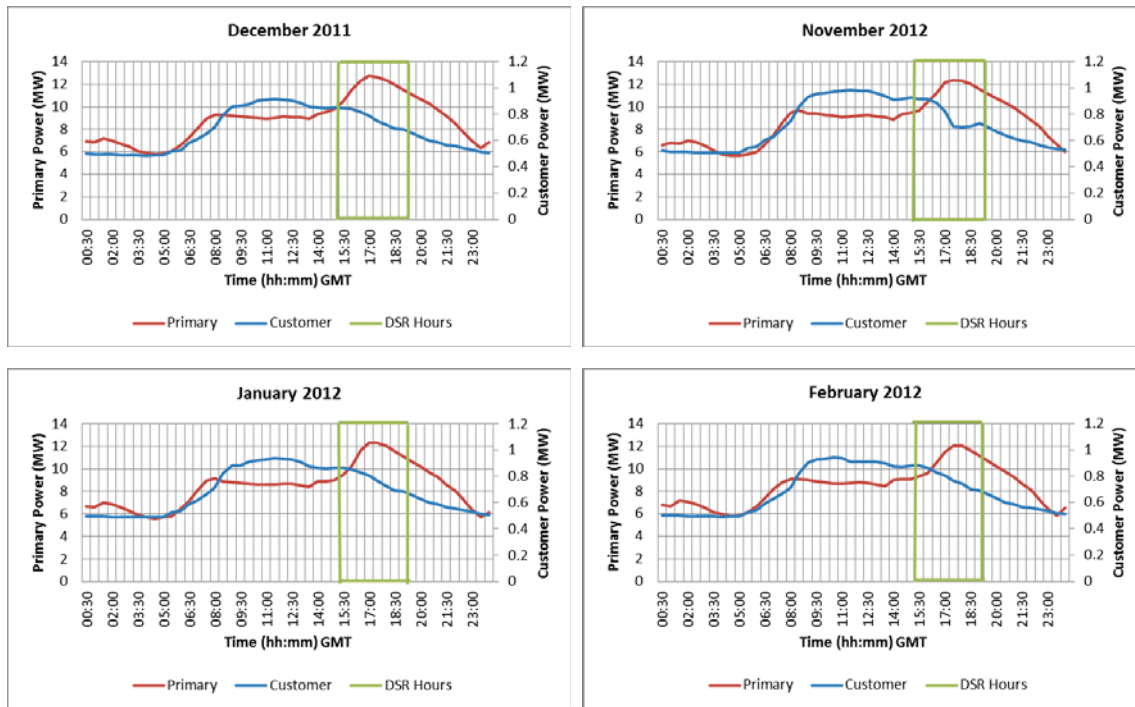


Figure 2 – Comparison of primary substation and customer's average monthly power consumption per half hour

It can be seen from these profiles that this particular customer is able to provide DSR during the months and time periods required. Once again, there are situations where the portfolio of I&C customers in that location will not match the network load profile requirements. In this scenario I&C DSR will not be a viable alternative to convention network solutions.

Product term sheet

A term sheet is a bullet-point document outlining the material terms and conditions of a business agreement. After a term sheet has been produced it guides counterparty negotiations and legal counsel in the preparation of a proposed final agreement. It then guides, but is not necessarily binding, as the signatories negotiate, usually with legal counsel, the final terms of their agreement. A DNO DSR term sheet was produced by the CLNR project to describe the network requirements and to outline the product requirements to potential providers of DSR. Attached below is an extract from the CLNR term sheet which outlines the key DSR product parameters.

Product Term Sheet

Season	Nov – Feb 2011/12
Availability Window	Mon – Fri 1500 - 1900
Max Call Duration	<i>Note 1</i>
Indicative No of Calls <i>Note 2</i>	10 consecutive WDs called once every three years
Response Time	15mins
Response Duration	4 hrs/day
Availability Price £/MWh	STOR used as a benchmark
Utilisation Price £/MWh	STOR used as a benchmark

Note 1:-

Max Call Duration: The product is required on a post fault / outage basis. A statistical framework has been developed to calculate an indicative number of calls per annum. The same methodology can be used to calculate a maximum number of calls, however further discussion is required to understand how the contract may accommodate additional calls above the maximum in the possible event of multiple failures.

Note 2:-

Indicative number of calls: There is a 10% risk of any given primary being on reduced supply. Approximately, half of these incidents are resolved in a day; most are resolved within a fortnight; but we need the flexibility, in extreme circumstances, to be able to keep calling a response through the peak load season.

The product term sheet was found to be an invaluable tool to describe our requirements to third parties.

2.2. Market channel assessment

A number of options were available to engage with the DSR market. The options included working with:

- I&C customers directly;
- Aggregators;
- Suppliers; and
- National Grid (the Transmission System Operator).

For the winter 2012 trials the CLNR project focused on developing working relationships with three aggregators as the customer facing entity. The aggregators bring a number of capabilities of value to the project, these included the ability to:

- identify customers with flexibility potential in our regions;
- work with customers to develop the capability to provide flexibility;
- provide technical assistance for customers with metering, equipment upgrades and communications;
- execute commercial agreements to monetise the arrangements; and
- implement operating procedures.

For the autumn 2013 I&C trials the project will work with the aggregators again but in addition we have engaged directly with I&C customers. This has expanded our customer engagement experience and provides a valuable comparison of the aggregator model compared to a DNO dealing directly with customers. Further information will be presented following the autumn 2013 trials with regard to this aspect of the project.

Short Term Operating Reserve (STOR) is a service for the provision of additional active power from generation and/or demand reduction managed by National Grid. National Grid have created the main I&C DSR market in GB via STOR. Partnering with National Grid is a natural development for the network owners. This proposal was presented in the 2012 LCN Fund proposal the 'GB Flexibility Market' and it is now being assessed by the 'DSR Networks Forum'.

2.3. Contract structures

For the winter 2012 trials one contract structure was developed and agreed with three aggregators. The contract template is outlined in Appendix A.

The contract template outlines the key parameters. However, the CLNR project identified the following learning outcomes which require special attention when constructing I&C DSR contracts:

- The process that measures the DSR response at a site, often referred to as the benchmark methodology. The 2012 contract utilised 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. The 2013 trials have developed two further options. 1) Is a floor methodology, which required the site to drop consumption below a threshold level and 2) a further baseline methodology 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. The difference is the DSR delivered. More information will be presented about these two methodologies after the autumn 2013 trials.

- The pricing structure used in the 2012 trials was based on the STOR methodology, which uses an availability and utilisation component. The 2013 contracts have also utilised a daily price concept which removes the availability and utilisation structure.
- The price is a key consideration. However, the market is dominated by STOR and this sets a benchmark for DSR providers. Literature reviews point to prices based upon the value of deferred/accelerated reinforcement. As headroom declines and the baseline date for reinforcement approaches, the value of deferral (and hence node-specific prices) rises. The unscaled marginal costs from the long-run incremental costs (LRIC) model proposed for the EHV Distribution Charging Methodology (EDCM) was used as an illustrative valuation guide for the I&C flexibility contracts. The STOR price is economic for some but not all of the DNO DSR scenarios.
- The approach to non-performance with respect to the level of DSR provided or the time taken to respond requires consideration. The DNO needs a penalty mechanism for non-performance. The contract structure attached stopped future payments following a failure event. However, an operational contract may require a stronger penalty condition.

2.4. Winter 2012 trial description and results

Three DSR contracts were signed with two aggregators for the winter 2012 trials based on the contract structure described above and replicated in Appendix A. The sites were located in our regions but not in areas of our network which required DSR. The autumn 2013 trials will assess the feasibility of targeting specific geographic locations for the provision of DSR.

The key objectives of the first trial were to:

- Assess the network requirement
- Develop the I&C DSR product
- Assess the market entry channels
- Develop relationships with DSR providers
- Design and execute DSR contracts
- Assess the operational trials
- Apply learning for the 2013 autumn trials

The three sites and the operational DSR parameters were as follows;

Customer 1: Mining

Contracted DSR: 2 MW

DSR Type: CHP Generation

Availability: 3pm – 6pm, Weekdays

Response Time: 15 minutes

Season: January – February 2012



Customer 2: Refrigeration

Contracted DSR: 0.75 MW

DSR Type: Load Reduction

Availability: 3pm – 7pm, Weekdays

Response Time: 20 minutes

Season: January – February 2012



Customer 3: Web-Hosting

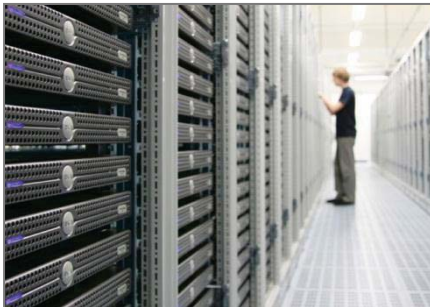
Contracted DSR: 0.8 MW

DSR Type: Diesel Generation

Availability: 3pm – 7pm, Weekdays

Response Time: 20 minutes

Season: February 2012



Operation protocols and performance

The contracts were tested during January and February 2012. A DSR event was simulated from the network perspective based on an event simulation plan. The DSR instruction was made via a telephone call from Northern Powergrid control rooms and the project team to the aggregator control rooms. Two instructions were issued from our Yorkshire Control Room and Northeast Control Room respectively, as a mechanism to introduce the concepts of DSR to our operational colleagues.

In total, 13 DSR instructions were issued across the portfolio. 10 instructions resulted in a successful DSR response. The reasons for the failed events included a fire at one of the sites and DSR not being delivered in accordance with the contractual requirements at the other two sites.

The contracts delivered the operational performance in line with planned expectations. The evaluation of what degree of confidence can be applied to DSR will require a larger test than the three sites in this trial.

The monitoring of what DSR was delivered was verified by post event metering data. In addition, this process supported the settlement process which validated what payments should be made to the aggregators. The settlement process was a manual activity and did require an iterative process to agree final positions with the aggregators. More development is required to produce a process that would be efficient on a greater scale.

2.5. I&C Customer engagement research

To gain a more detailed understanding of how much potential industrial and commercial (I&C) demand side response (DSR) resource exists when targeting specific primary substations a research exercise has been carried out on our behalf by two commercial aggregators, Flexitricity and ESP. Ten primary substations were selected representing 1.5% of the Northern Powergrid major substation population.

Through a series of telephone conversations, questionnaires and meetings, the I&C customers in the selected primary areas were approached to assess their knowledge of DSR, establish their willingness and capability to participate in DSR and identify barriers to DSR programmes.

It was found that when targeting a tight geographic area the initial customer drop-out rates are high due to issues associated with contacting the sites, contacting the right person at the site and the suitability of the load to participate in DSR. When contact is made with the right person in the business there is initially a low level of awareness of DSR. But when the concept is explained, a large proportion of them want to understand more about the practical opportunities and the revenues it could generate.

The lead times from making initial contact with a customer to finalising a DSR contract can range from 12 to 24 months. DNOs will have to ensure these lead times are accounted for in the network design process if DSR is to be implemented as a practical alternative to network reinforcement.

The full report is located in Appendix B.

2.6. 2013 Autumn trials

The autumn 2013 trials will build on the winter 2012 trials. The key development items for the autumn 2013 trials are to;

- Assess the process of acquiring DSR at specific geographic locations;
- Engage directly with I&C DSR providers;
- Enhance the communication despatch protocols between the DNO and the aggregators. The network control system (GUS) will issue DSR instructions direct to the aggregators and potentially directly to I&C customers via SMS or modbus over TCP/IP over a VPN; and
- Build a larger DSR portfolio to test response from a broader cross section of the I&C customer base.

2.7. Learning outcomes

The 2012 trials, the preparatory work for the 2013 trials and the I&C Customer engagement research have delivered a number of learning outcomes as discussed below.

1. The DNOs can build effective relationships with both the aggregators and direct with I&C customers for the purpose of providing DSR products for DNO networks. However, DNOs require the infrastructure to manage these relationships, either in-house or via a third party such as an aggregator.
2. The DNOs are effectively in a competitive market for DSR primarily with the National Grid STOR products. The two network requirements are potentially complementary and a joint DNO/ Transmission System Operator (TSO) and even Transmission Operator (TO) product may create value for all stakeholders. There are additional costs associated with information sharing between the parties. The viability of this coordinated approach is being assessed by the Networks DSR forum.
3. The I&C contract template attached in Appendix A is only one example of a DSR contract. Each network scenario or network requirement may alter certain parameters. The potential parameter changes are likely to impact the pricing structures and how to measure the DSR delivered. A comparison of the three frameworks developed by the CLNR project will be undertaken after the 2013 autumn trials.
4. The time required to finalise the legal framework for DSR products is material. The key activities can be split into three areas:
 - contractual design,
 - negotiations with third parties; and
 - legal counsel.

This process can take up to 4 months. This time requirement should reduce as counterparties and DNOs become familiar with the contract structures. Although, there is a high degree of probability that the process will always have new customers unfamiliar with DSR to accommodate.

5. The DSR contracts delivered a 77% success rate when participants were instructed to deliver DSR. The scale of the trial at this stage is insufficient for a degree of confidence to be determined to inform industry standards for wider deployment.
6. Locating customers that are willing to offer DSR for four hours in a day over a maximum 14-day period (potentially more than 14 days in some circumstances) will reduce the number of customers that can participate in these schemes. A solution to this issue is to use a portfolio of customers to deliver the DNO's requirements. In this scenario an individual customer commits to provide DSR on less onerous terms than the DNO's requirements. For example, the customer may only commit to deliver two hours of DSR in a day over a maximum of 4 days. The DNO obtains their requirements by contracting with a portfolio of customers that can collectively but not individually deliver the network requirements. This approach opens the potential to reduce the obligations for the DSR provider which in turn will create a larger pool of customers for the DNOs to engage with.
7. The knowledge transfer process from the project to the DNO's operational teams will involve a significant resource commitment. The following areas will be involved:
 - a. Asset management network planning. Actively managed DSR is not currently a tool at the disposal of network engineers; a process is required to transform DSR from a concept to a real option for network planners.
 - b. Network control. The network control engineers monitor the network and react in real time. The introduction of DSR in the control room will require robust systems, processes and training for the network engineers.
 - c. Sales teams. The requirement for customer facing or front office resources will depend on the market entry model selected. However, as noted above in the I&C customer engagement section there is merit in the DNO taking responsibility for the first contact with customers and this could be taken further to include aggregator activities. Our views on the model will evolve as the CLNR project progresses.
 - d. Support or back office teams. DSR contracts will require a resource impact on staff in the functions of procurement, settlement, legal and commercial.

I&C Customer engagement research

8. When targeting a tight geographic area the initial customer drop-out rates are high due to issues associated with contacting the sites, contacting the right person at the site and the size of site load (e.g. sites less than 200kVA may not be considered practical for bespoke I&C contract structures).
9. When contact is made with the right person in the business there is a low level of awareness of what DSR is amongst customers. Of the 20 customers (> 200 kVA) asked if they had heard of the term 'demand response' or 'demand side response', only three had the correct understanding of the term.

10. When the concept of DSR is explained to customers a large proportion of customers want to understand more about the practical opportunities. For example 12 of the 20 respondents (>200kVA) were interested in understanding more about the opportunity once it was explained that some businesses can generate revenue from providing DSR.
11. The prospect of customers investing time and resources to develop their DSR capability did not represent a barrier with 17 of the 20 (>200kVA) customers still interested in DSR.
12. Remote control access and control of customers' assets was not a barrier to the next stage of the DSR implementation process.
13. Even if customers show a positive interest in the DSR concept there may still be issues with some sites as further investigations identified limited flexibility to alter their load profiles.
14. The implementation of DSR from generation substitution is the most successful entry point for new I&C customers wishing to participate in DSR schemes. Following this first step, customers can then engage in further developments that may be more intrusive to their core processes such as load management. Energy efficiency is also a good entry point for customers new to DSR.
15. The lead times from making initial contact with a customer to finalising a DSR contract can range from 12 to 24 months. DNOs will have to ensure these lead times are accounted for in the network design process if DSR is to be implemented as a practical alternative to network reinforcement.
16. The project has utilised two customer engagement models 1) via the aggregator and 2) direct with I&C customers. A third hybrid option where the DNO owns the initial customer contact and only passes 'warm' leads to the aggregators may be a more efficient model. The advantage is the DNO owns first contact point with the customer and can fully assess the viability of I&C DSR in specific areas as opposed to reliance on third parties.

3. Test cell 19 - Ancillary Services Voltage Support Service

This report describes the process undertaken to prepare for the physical trials for test cell 19 and the learning captured. In summary the stages undertaken and described below were as follows:

- Assessment of network requirements
- Market channel assessment
- Autumn 2013 trials
- Learning

3.1. Assessment of network requirements

Definition

The ancillary services (voltage support) provision service is a proposition for I&C customers with sufficiently controllable generation, or merchant generators, to contribute to wide-area voltage control; in response to signals from EAVC schemes, the generator may be required to alter its mode of operation to support or reduce volts by modulating real and (particularly) reactive power.

Problem

Any new power flow will affect existing voltage and thermal constraints. Where new generation offsets existing load (and vice versa) it will tend to ease constraints. However, we expect much new generation to more than offset existing load at some time, creating a reverse power flow.

The main way in which distribution networks can be considered to be unidirectional is in voltage control. The permissible voltage limits have been allocated on the assumption that power flows only towards customers. Therefore, reverse power flows will often create voltages above legal limits.

That is, networks are designed to run at maximum permissible voltage at minimum expected demand and minimum permissible voltage at maximum expected demand. As soon as generation reverses the power flow or even reduces net demand below the design level, legal voltage limits will be exceeded.

Present network design is to limit the generator capacity to the level at which the upper limit is not exceeded with maximum generation and minimum load.

Voltage control

With the expansion of generation, voltage rise will become a significant constraint for both DNOs and generators in terms of securing the network reliability and maximising the power

output. Implementing a voltage control scheme could be an option to satisfy both parties if there are adequate economic incentives in place.

DNOs normally request generators to either be capable of operating within a specific range of power factor or to operate at a fixed power factor. This requirement is based on the characteristics of the network and aims to keep voltage profiles within limits. Generators are however, capable of providing voltage support by injecting or absorbing reactive power. This will mean that there will be times when the generator will not operate close to or at the nominal power factor in the connection agreement; however this is a trade-off between potentially reducing active power export over a relatively short period and enabling higher generation capacity and energy production in the long term.

The effectiveness of this voltage control is restricted to the actual reactive power capabilities of the units and it is for this reason that generation curtailment will also need to be considered as a voltage control solution. This scheme will reduce a given percentage of the power output when the voltage at the connection bus exceeds the statutory limit.

Product Specification

Two types of product are being assessed:

1. Generator Operation Mode – Voltage Control
2. Generation Curtailment – Demand Response

Carried out two ways:

1. *Active Control* – Northern Powergrid monitors voltage and manages the control output required.
2. *Passive Control* - fit monitoring equipment, set upper voltage limit and allow generator to control output.

The CLNR project is focused on testing a proposition which demonstrates ‘Generator Operation Mode – Voltage Control via ‘Active Control – Northern Powergrid monitors voltage and manages the control output required via instructions issued to the generation control room’.

3.2. Market channel assessment

The CLNR project has targeted two generating customers, 1) merchant generators and 2) I&C customers with large CHP plants. Both groups proved receptive to initial conceptual discussions. The project has now focused on the merchant generators primarily as this relationship has developed faster than the I&C customer discussions.

3.3. Autumn 2013 trials

A trial with a windfarm is currently being discussed with a renewables developer. Copied below is the product term sheet for the trial currently being discussed.

Category	Parameter	Notes
Counterparty	Renewables developer	
Site	Wind farm site	
Season	Autumn 2013	
Availability Window days	Monday – Sunday	
Availability Window Time	All day	
Response Time	20 mins	
Lead (Mvar)	17.75 (PF 0.95)	
Lag (Mvar)	-24.27 (PF 0.91)	
£/Mvarh Availability Utilisation	Based on the National Grid Default Payment Mechanism (DPM)	The National Grid Default Payment Mechanism (DPM) was £2.92/MVArh for summer 2013. There are no reactive power charges by Northern Powergrid for sites connected at EHV level.
Trial plan	Open ended – Test leading and lagging controls	The detailed trial plan to be designed
Communications	Instructions may be issued by our central control grand unified scheme (GUS) or a verbal instruction may be more practical	Telephone instruction
Connection agreements	Restrictions	To be investigated

The renewable developer is interested in participating in the trials. The spring and summer 2013 is being utilised to firm up the operating plans and the contractual framework.

3.4. Learning outcomes

The test cell 19 trials discussions and interaction with merchant generators and I&C customers have delivered a number of learning outcomes as discussed below.

Test cell 19

1. Both the merchant generators and I&C customers with generating assets are receptive to discuss voltage support services.
2. The merchant generators are also open to discussions about non-firm connection agreements although as would be expected the developers would want to understand the details and risks in detail before making any commitments. However, the concept was acceptable as a mechanism to support the connections process. This proposition has already been deployed as a business as usual solution in a few situations across our network.
3. The basic term sheet outlined above will be used to construct legal agreements. Further learning developed from this trial will be communicated after the 2013 autumn trials.
4. This product is unlikely to provide a material new revenue stream for the merchant generators. However, the value of this product for the merchant generators will be as a mechanism to enhance the connection options for new DG sites.

Appendix A - I&C DSR contract utilised for the 2012 I&C DSR trials

DATED _____ 2012

NORTHERN POWERGRID (NORTHEAST) LIMITED

and

NORTHERN POWERGRID (YORKSHIRE) PLC

and

.....

COMMERCIAL AGGREGATOR PILOT SCHEME AGREEMENT
HALF HOURLY INDUSTRIAL AND COMMERCIAL CUSTOMERS

relating to the Customer-Led Network Revolution Project

THIS AGREEMENT dated the _____ day of _____ 2012 is made

BETWEEN:-

- (1) NORTHERN POWERGRID (NORTHEAST) LIMITED (CRN 2906593) whose registered office is at Lloyds Court, 78 Grey Street, Newcastle upon Tyne, NE1 6AF (“**Northeast**”);
- (2) NORTHERN POWERGRID (YORKSHIRE) PLC (CRN 4112320) whose registered office is at Lloyds Court, 78 Grey Street, Newcastle upon Tyne, NE1 6AF (“**Yorkshire**”); and collectively “**Northern Powergrid**”; and
- (3) (“the “**Aggregator**”).

BACKGROUND

- (A) Northeast and Yorkshire are licensed electricity distribution network operators who are participating in the Customer-Led Network Revolution Project (the “**Project**”) which was established to consider the best means to minimise operating costs whilst simultaneously meeting Customer requirements to install greater levels of renewable generation and evaluate the possibilities of switching to lower carbon forms of heating and transport.
- (B) As part of the Project, Northern Powergrid wishes to consider how Customer load reduction and flexible distributed generation can be utilised as an alternative to electricity distribution network reinforcement. In order to consider this proposition, Northern Powergrid is seeking to establish a pilot scheme with the assistance of aggregators who would act as an intermediary between the Customer and the Northern Powergrid (the “**Pilot**”).
- (C) The Aggregator is an experienced aggregator who currently participates in the Short Term Operating Reserve scheme operated by National Grid Electricity Transmission plc, upon which the Pilot is based, and wishes to participate in the Pilot with Northern Powergrid.

IT IS AGREED as follows:-

1. DEFINITIONS AND INTERPRETATION

1.1. THE WORDS AND PHRASES BELOW SHALL HAVE THE FOLLOWING MEANINGS:

“Affiliate”	means any subsidiary or parent undertaking of a party or any company which is a subsidiary company of the ultimate parent undertaking of a party where the expressions “parent undertaking” and “subsidiary” having the meanings ascribed thereto by section 1159 and 1162 of the Companies Act 2006 save that in relation to Northern Powergrid the term shall be restricted to its subsidiaries or parent undertakings that are registered in the UK;
“Agreed Capacity”	means the amount of Demand Response to be provided by a Site for which Northern Powergrid has contracted, with the Aggregator to provide as set out in Schedule C to this Agreement, in MW;
“Apparatus”	means all equipment in which electrical conductors are used, supported or of which they may form a part;
“Arising IPR”	means any Intellectual Property Rights created pursuant to this Agreement and the Pilot;
“Authorised Person”	means the persons listed in Part 1 of Schedule A;
“Availability Price”	means those sums described as such and set out in Part 2 of Schedule B;
“Availability Payment”	means the payment made by Northern Powergrid to the Aggregator in consideration for the Aggregator making available of the Demand Response and the Demand Response Services during the Season pursuant to Clause 6.1;

“Availability Window”	means the time period(s) detailed set out in paragraph 4, Part 1 of Schedule B;
“Background IPR”	means any Intellectual Property Rights, excluding Arising IPR, which are controlled or owned by a party;
“Balancing and Settlement Code”	means the document of that name established by National Grid Electricity Transmission plc pursuant to its transmission licence and to which Northern and Yorkshire are signatories;
“Bank Holiday”	means any day Monday to Friday inclusive upon which banks in the UK are closed by law;
“Confidential Information”	means all information designated as such in writing, together with all other information which relates to the business, affairs, developments or personnel of a party or information which may be reasonably regarded as the Confidential Information of the party disclosing it (the “Disclosing Party”);
“Connection and Use of System Code”	means the document designated as such by the Secretary of State as amended from time to time;
“Customer”	means a person connected to an electricity distribution network owned or operated by Northern Powergrid;
“Demand”	means in relation to a Site, the maximum amount of electrical energy being consumed at such Site at a specific point in time;
“Demand Response”	means either a reduction in Demand or a level of Generation provided by Customers to the Aggregator in accordance with the agreement between them provided during a Response Event;

“Demand Response Services”	means the services more particularly described in Schedule B;
“Distribution Code(s)”	means the Distribution Code established by an electricity distribution network operator pursuant to its license;
“End Time”	means in respect of an Instruction the time upon which the Response Period will end;
“Energy Delivered”	means in relation to each Site and for each Settlement Period (or part thereof) that is included in the Response Period that amount of the Agreed Capacity provided at such Site and calculated in accordance with Clause 6.5, in MWh;
“Generating Unit”	means any Apparatus which produces electricity;
“Generation”	means the electrical output (in MW) of a Generating Unit;
“Instruction”	means an instruction issued by an Authorised Person on behalf of Northern Powergrid to the Aggregator pursuant to Clause 4.2;
“Intellectual Property Rights” or “IPR”	means any and all of the following:- <ul style="list-style-type: none">(a) rights in inventions, patents, registered designs, design rights, know-how, trademarks and service marks (whether registered or not) and all rights in relation to any Internet domain name;(b) any trade, brand or business name and any distinctive sound used to differentiate the goods and services of a business; (c) utility models;

(d) copyright (including all such rights in computer software and databases); and

(e) any rights or forms of protection of a similar nature to those detailed above;

“Material” means an increase in fuel prices of more than 10% since the date of this Agreement;

“Personal Data” has the meaning attributed to that expression in the Data Protection Act 1998;

“Response Period” means the period of time, commencing on the Start Time and ending at the End Time for stipulated in the relevant Instruction;

“Response Time” means, the period detailed in paragraph 4.1, Part B, Schedule 1;

“Season” means the period of time in which Demand Response Services will be provided as more particularly detailed at paragraph 4.1, Part 1, Schedule B;

“Settlement Period” has the meaning ascribed to it in the Balancing and Settlement Code;

“Site” means each of the Customer’s sites listed in Schedule C, (as amended from time to time), in respect of which the relevant Customer and the Aggregator have entered into an agreement or other arrangement whereby on receipt of notification by the Aggregator such Customer will provide the agreed Demand Response;

“Start Time”	means in respect of an Instruction the time the Response Period commences;
“Term”	means the duration of this Agreement as more particularly set out in Clause 2;
“Utilisation Price”	means those sums described as such and set out in Part 2 of Schedule B; and
“Utilisation Payment”	means the sums payable by Northern Powergrid to the Aggregator for the Energy Delivered during the Response Period and calculated in accordance with Clause 6.2.

1.2 In this Agreement, unless otherwise expressly provided or unless the context otherwise requires, references to:-

1.2.1 the singular include the plural and vice versa.

1.2.2 words denoting any gender shall include all genders.

1.2.3 a person includes any individual, firm, body corporate, association or partnership government body or any joint venture association or partnership (whether or not having legal personality).

1.2.4 Clauses and Schedules are to Clauses of, and Schedules to, this Agreement.

1.2.5 laws, statutory provisions and regulatory obligations shall include reference to any subordinate legislation made pursuant thereto and shall be construed as referring to those laws, provisions and subordinate legislation as respectively amended or re-enacted from time to time.

1.2.6 the parties include their respective successors in title, permitted assigns and legal personal representatives.

1.3 The headings of this Agreement are for ease of reference only and are not part of this Agreement for the purposes of construction.

1.4 The Schedules form part of this Agreement and shall have effect as if set out in full in the body of this Agreement and accordingly any reference to this Agreement includes the Schedules.

2. TERM AND TERMINATION

2.1. This Agreement shall commence on 23 January 2012 and continue until 31 March 2012.

2.2. This Agreement may be terminated by either party upon 1 (one) month prior written notice to the other party.

3. PILOT SCHEME

3.1. The Aggregator and Northern Powergrid have entered into this Agreement to evaluate whether the provision of Demand Response Services can avoid the need to reinforce congested areas of Northern Powergrid's electricity distribution networks.

3.2. The parties acknowledge and agree that the Demand Responses Services are provided as part of the Pilot and they anticipate they will agree changes to the same from time to time in accordance with Clause 3.3.

3.3. The parties shall cooperate with each other in order to determine the appropriate level of Demand Responses Services required by Northern Powergrid and provided by the Aggregator. No change to this Agreement shall be effective unless agreed by the parties in writing. Areas in which the parties foresee such changes occurring are:-

3.3.1. amendments to the Season set out in Part 1 of Schedule B;

3.3.2. amendments to the operating parameters currently set out in Part 2 of Schedule B; and/or

3.3.3. amendments to the Agreed Capacity for any Site.

3.4. The parties anticipate that an Instruction could result in a Site(s) providing Demand Response for 10 consecutive working days once in a three year period and the Aggregator has used this example when discussing the Pilot with Customers.

3.5. If there is a Material change in fuel prices after the commencement date of this Agreement, the parties shall review such change in order to determine whether changes will be made to the Utilisation Charges.

4. DEMAND RESPONSE SERVICES

4.1. In consideration for the Availability Payments calculated in accordance with Clause 6, the Aggregator has or shall enter into agreements with Customers to provide the Demand

Response Services during the Availability Windows in accordance with this Agreement. The Customers participating in the Pilot are set out in Schedule C.

- 4.2. Northern Powergrid may from time to time issue Instructions to the Aggregator detailing the Site(s) that are to respond and the Response Period for which its response is required. The Response Period must fall within the Availability Window. Where a Response Period extends beyond a single Availability Window, it shall be taken to include only those Availability Windows which fall within the Response Period. Where the Response Period is continuing for more than 1 (one) Availability Window, Northern Powergrid shall by 11.00am each calendar day provide updates to the Aggregator on the anticipated Response Period.
- 4.3. After the receipt of an Instruction, the Aggregator will, within the Response Time designated in paragraph 4.1, Part 1, Schedule B, acknowledge its receipt and that it has instructed the relevant Customer('s) Site(s) accordingly.
- 4.4. If any Customer(s) indicates in respect of any Site(s) that due to technical breakdown or other similar event, it is unable to provide the Agreed Capacity, the Aggregator shall notify Northern Powergrid as soon as reasonably practicable that the Agreed Capacity is unavailable, pursuant to Clause 1.1, Part 1, Schedule B.
- 4.5. The parties agree that, for the purpose of notifications and confirmations issued pursuant to this Clause 4, the forms of communication detailed below are acceptable:-
 - 4.5.1. telephone; and
 - 4.5.2. e-mail.
- 4.6. The Response Period of an Instruction must not be less than 15 (fifteen) minutes. Any Instructions not fulfilling this condition may be ignored.
- 4.7. Sites shall not participate in the Short Term Operating Reserve scheme operated by National Grid Electricity Transmission plc for the same Availability Window as is used for this Agreement. Sites shall be allowed to participate in Triad Demand management, with no penalties or other adverse effects for doing so imposed by this agreement.

5. REPORTING

- 5.1. By 12:00 (midday) on the day immediately following the provision of Demand Response the Aggregator shall provide metering data in respect of each Site that provided such Demand Response to Northern Powergrid as evidence of the Demand Response provided during such event.
- 5.2. Any reports provided by the Aggregator, pursuant to Clause 5.1, shall be issued by e-mail to xxxxx.xxxxx@northernpowergrid.com in CSV (Comma Separated Values) format.

6. PAYMENTS

- 6.1. An Availability Payment (AF_{sm}) shall be paid monthly by Northern Powergrid to the Aggregator which will be an amount calculated in accordance with the following formula (using the notation as defined in Clause 6.3):-

$$AF_{sm} = \sum_{j \in M_m} (AP_{sj} \times 0.5 \text{hours} \times CM_{sj} \times FF_{sj} \times FM_{sj})$$

6.2. A Utilisation Payment (UF_{sm}) shall be paid monthly by Northern Powergrid to the Aggregator which will be an amount calculated in accordance with the following formula (using the notation as defined in Clause 6.3):-

$$UF_{sm} = \sum_{j \in M_m} (R_{sj} \times EP_{sj})$$

6.3. In Clause 6.1 and 6.2:-

$\sum_{j \in M_m}$ is the summation over all Settlement Periods j , in the set M_m of Settlement Periods in the Availability Windows;

AP_{sj} is the Availability Price, in £/MW/h, applicable in Settlement Period j for Site s , taken to be the value specified in Part 2, Schedule B;

CM_{sj} is the Agreed Capacity, in MW, in respect of Site s , applicable in each Settlement Period j ;

FF_{sj} is 0 in respect of each Settlement Period j , contained in an Availability Window where Agreed Capacity is declared unavailable for Site s by The Aggregator or where Clause 6.4 provides that, in respect of Settlement Period j and Site s , the Aggregator will not be entitled to receive an Availability Payment, otherwise 1;

FM_{sj} is 0 in respect of each Settlement Period j , contained in an Availability Window where Clause 13 (Force Majeure) applies in respect of Site s , otherwise 1;

R_{sj} is the Energy Delivered, in MWh (being a volume not greater than the Agreed Capacity multiplied by the duration of a Settlement Period, or when a Response Period commences during a Settlement Period, the relevant part thereof, in hours), by either the increase in Generation or the reduction in Demand by Site s in Settlement period j , in accordance with an Instruction, as determined by Clause 6.5; and

EP_{sj} is the Utilisation Price, in £/MWh, applicable in Settlement Period j for Site s , taken to be the value specified in Part 2, Schedule B.

6.4. If, for a Settlement Period in an Availability Window for which an Instruction was given, the Energy Delivered (as determined by Clause 6.5) falls below 90% of the Agreed Capacity multiplied by the duration of a Settlement Period (or when a Response Period commences during a Settlement Period, the relevant part thereof) in hours, the Aggregator will no longer be entitled to receive Availability Payments for that Settlement Period and subsequent Settlement Periods until the Aggregator reports to Northern Powergrid that the Site is available again.

6.5. With respect to an Instruction, the Energy Delivered, in MWh, for a Site and Settlement Period shall be calculated by subtracting the Site's metered consumption for the aforementioned Settlement Period from the Site's metered consumption for the Settlement Period immediately preceding the Settlement Period in which the Instruction was received. For the avoidance of doubt, metered consumption includes the aggregate of any Demand minus the aggregate of any generation. It is acceptable for the metered consumption to be negative if the amount of generation is greater than the amount of Demand at a point in time.

7. INVOICING

7.1. For each month during the Season, the Aggregator shall issue a request for payment to Northern Powergrid in respect of the Availability Payments and Utilisation Payments incurred in that month on or before the 7th (seventh) day of the following month.

7.2. Northern Powergrid shall, within 2 (two) business days of receipt of the same, issue an order number which the Aggregator must quote on its invoice and either confirm to the Aggregator that the request for payment is correct or advise that the request for payment is incorrect and work with The Aggregator to resolve any outstanding issues.

7.3. In circumstances where a request for payment cannot be agreed, Northern Powergrid shall pay the undisputed part of the invoice and the balance shall be referred to dispute in accordance with Clause 18.

7.4. Properly rendered invoices, or undisputed parts thereof, shall be paid by Northern Powergrid within 30 days of receipt of the invoice.

8. IPR OWNERSHIP

8.1. All Background IPR belonging to a party is and shall remain the exclusive property of that party owning it (or, where applicable, the third party from whom its right to use the Background IPR has derived).

8.2. Subject to any existing third party obligations, each party grants the other party a royalty-free, non-transferable, non-exclusive, licence to use its Background IPR for the sole purpose of the performance of its obligations under this Agreement, but not for the purposes of commercial exploitation or otherwise.

8.3. Arising IPR shall vest and be owned by Northern Powergrid.

8.4. Northern Powergrid Limited hereby grants and agrees that it will grant to the Aggregator a non-exclusive, perpetual, royalty free, fully paid-up license to use such Arising IPR for its own internal purposes, but not for the purposes of commercial exploitation or otherwise.

9. IPR INDEMNITY

9.1. If any claim is made against or notice is received by a party (the "**Defending Party**"), either by or from a third party alleging infringement of its Intellectual Property Rights by virtue of the Defending Party's use of the Background IPR supplied to it by the other party (the "**Indemnifying Party**"), the Defending Party shall inform the Indemnifying Party of the

infringement (alleged or otherwise) by its Background IPR as soon as reasonably practicable upon such infringement coming to its notice.

- 9.2. Subject to Clauses 9.2.3 and 9.3, the Indemnifying Party will indemnify and hold harmless the Defending Party against all liability, losses, damages, costs, legal costs, professional and other expenses of any nature whatsoever incurred or suffered by the Defending Party in respect of any claim or action that the use of Indemnifying Party's Background IPR in respect of its performance of the Project infringes the Intellectual Property Rights of any third party (an '**Intellectual Property Infringement**') provided that the Defending party:
- 9.2.1. gives notice to the Indemnifying Party of any Intellectual Property Infringement forthwith upon becoming aware of the same;
 - 9.2.2. gives the Indemnifying Party the sole conduct of the defence to any claim or action in respect of an Intellectual Property Infringement and does not at any time admit liability or otherwise settle or compromise or attempt to settle or compromise the said claim or action except upon the express instructions of the Indemnifying Party; and
 - 9.2.3. acts in accordance with the reasonable instructions of the Indemnifying Party and gives the Indemnifying Party such assistance as it shall reasonably require in respect of the conduct of that defence.
- 9.3. In respect of any claim for which an indemnity is sought under this Agreement the Defending Party seeking such indemnity will:
- 9.3.1. as soon as reasonably practicable after becoming aware of the claim provide the Indemnifying Party with reasonable details of it and thereafter provide in a timely manner such information relating to the claim as may reasonably be requested from time to time;
 - 9.3.2. not make, and use its reasonable endeavours to procure that there is not made, any admission of liability, except with the prior written consent of the Indemnifying Party, (such consent not to be unreasonably withheld or delayed);
 - 9.3.3. keep the Indemnifying Party reasonably informed of all material developments relating to the claim;
 - 9.3.4. use its reasonable endeavours to procure that the handling of the claim, including without limitation any resistance of or defence to it, is carried out and conducted in all material respects in accordance with such reasonable written directions as may be given by the Indemnifying Party; and
 - 9.3.5. at the option of the Indemnifying Party, relinquish the handling and control of the claim to the Indemnifying Party and thereafter use its reasonable endeavours to cooperate in the handling of the claim, including without limitation any resistance of or defence to it or not settle or compromise the claim, and procure that the claim is not settled or compromised, except with the prior written consent of the Indemnifying Party which consent shall not be unreasonably withheld or delayed.

10. CONFIDENTIALITY

- 10.1. A party (the “**Receiving Party**”) shall keep confidential and shall not disclose to any third party other than its, or its Affiliates’, directors, officers or employees who need to know the Confidential Information, any Confidential Information disclosed to it or otherwise belonging to another party or its Affiliates, save to the extent authorised by such other party, or required by this Agreement.
- 10.2. The Receiving Party shall not, during the period of 2 (two) years after the termination of this Agreement, use any such Confidential Information for any purpose other than the carrying out of its obligations under this Agreement or other than in accordance with the terms of this Agreement.
- 10.3. The undertaking in Clause 10.2 above shall not apply to Confidential Information:
 - 10.3.1. which, at the time of disclosure, has already been published or is otherwise in the public domain other than through breach of the terms of this Agreement or breach of any other obligation owed to a party;
 - 10.3.2. which, after disclosure, is subsequently published or comes into the public domain by means other than an action or omission on the part of any of the parties;
 - 10.3.3. lawfully acquired from third parties who had a right to disclose it with no obligations of confidentiality to any of the parties; or
 - 10.3.4. is required to be disclosed by applicable law or court order or requested by Northern Powergrid’s regulatory body, which is empowered by Statute or Statutory Instrument, but only to the extent of such disclosure and the Receiving Party shall notify the Disclosing Party promptly of any such request.
- 10.4. When a party is permitted to disclose Confidential Information to another person by the other party then such party shall secure that the recipients of any such Confidential Information shall enter into a confidentiality agreement on terms substantially similar to the terms of this Clause 10.

11. TERMINATION

- 11.1. If the following occurs in respect of either party (the “**Defaulting Party**”):
 - 11.1.1. the Defaulting Party commits a material breach of this Agreement, and the other party serves written notice of such breach or default on the Defaulting Party and the Defaulting Party fails to remedy such default or breach within thirty days after receipt of such written notice; or
 - 11.1.2. the Defaulting Party passes or has passed in respect of it a resolution for its winding-up; or
 - 11.1.3. a court of competent jurisdiction makes an order for the Defaulting Party’s winding-up or dissolution or makes an administration order in relation to that party; or
 - 11.1.4. the Defaulting Party has appointed a receiver over, or an encumbrance takes possession of or sells an asset or any part of the business of, that party; or

11.1.5. the Defaulting Party makes an arrangement or composition with its creditors generally or makes an application to a court of competent jurisdiction for protection from its creditors generally; or

11.1.6. the Defaulting Party is unable to pay its debts;

then the other party may, in addition to any other remedies which it may have at law or equity, give notice to the Defaulting Party terminating this Agreement in which case the provisions of Clause 15 (Continuing Provisions) shall apply.

11.2. Any such notices shall be effective as of the date of the receipt of such notice.

12. LIMITATION OF LIABILITY

- 12.1. Nothing in the Agreement limits a party's liability for death or personal injury for fraud or fraudulent misrepresentation or for any other liability to the extent it may not be excluded or limited by law.
- 12.2. Subject to Clause 12.1, neither party shall be liable under or in relation to the Agreement to the other for any special, indirect, consequential or pure economic loss, loss of turnover, profits or goodwill, whether or not the loss in question would arise in the ordinary course of events or was in the contemplation of the parties as at the date of the Agreement, is reasonably foreseeable or otherwise.
- 12.3. Subject to Clauses 12.1 and 12.2 each party's liability to the other (in aggregate) is limited to 1 (one) months Availability Charges.
- 12.4. Nothing in this Clause shall prevent or restrict any party from enforcing any obligation (including suing for a debt) owed to it under or pursuant to this Agreement.

13. FORCE MAJEURE

- 13.1. A party shall not be liable for failure to perform its obligations under this Agreement, nor be liable to any claim for compensation or damage, nor be deemed to be in breach of this Agreement, if such failure arises from an occurrence or circumstances beyond the control of that party.

14. NON-ASSIGNMENT

- 14.1. This Agreement or any of the rights or obligations hereunder may not be assigned or otherwise transferred or sub-contracted by any party other than to their respective Affiliates, in whole or in part, without the express prior written consent of the other party.

15. CONTINUING OBLIGATIONS

- 15.1. The provisions of Clause 6 (Payments), 7 (Invoicing), 8 (IPR Ownership), 9 (IPR Indemnity), 10 (Confidentiality), 11 (Limitation of Liability), 12 (Continuing Obligations), 13 (Governing Law), 14 (Dispute Resolution), 15 (Bribery Act) and 16 (Miscellaneous), shall survive termination of this Agreement.

16. GOVERNING LAW

- 16.1. This Agreement shall be governed by and construed in accordance with English Law and each party agrees to submit to the exclusive jurisdiction of the English Courts as regards any claim or matter arising under this Agreement.

17. NO PARTNERSHIP

- 17.1. Nothing in this Agreement shall create or be deemed to create a partnership (within the meaning of the Partnership Act 1890) or to have created the relationship of principal and agent, a membership or any other legal entity between the parties other than as specifically set out herein.

18. DISPUTE RESOLUTION

- 18.1. The parties shall use good faith efforts to resolve any dispute, claim or proceeding arising out of or relating to this Agreement. In the event that any disputes cannot be resolved at this level then a director of the parties who have authority to settle the same shall use good faith efforts to resolve the dispute. If the matter is not resolved through negotiation, it shall be settled as agreed by the parties by mediation in accordance with the Centre for Dispute Resolution ("CEDR") Model Mediation Procedure (the "Model Procedure").
- 18.2. To initiate mediation a party must give notice in writing to the other parties to the dispute requesting mediation pursuant to the Model Procedure. A copy of the request shall also be sent to CEDR. The mediation shall be before a single, jointly agreed upon, mediator.
- 18.2.1. If the parties in dispute are unable to select a mutually agreeable mediator within 60 days of a dispute being notified to the relevant directors, then either party may refer the matter to the Courts in accordance with 18.2.2.
- 18.2.2. Failing resolution under 18.1, the matter shall be referred to the exclusive jurisdiction of the English Courts.
- 18.3. Nothing in this Clause 18 shall prevent any party from taking immediate action in the Courts or seeking interlocutory relief (including, but not limited to, by way of an injunction) to protect its Confidential Information and Intellectual Property Rights.

19. ENTIRE AGREEMENT

- 19.1. This Agreement including its Schedules supersedes all other agreements and understandings, whether written or oral, between the parties about the Pilot. This Agreement and its Schedules, which are incorporated into and form part of this Agreement, constitute the entire agreement between the parties with regard to the Pilot.

20. NOTICES

- 20.1. Any notice to be given under this Agreement shall be sent by facsimile or first class recorded delivery or delivered personally to the following addresses:

Northern Powergrid (Northeast) Limited
For the attention the Company Secretary
Lloyds Court. 78 Grey Street, Newcastle upon Tyne, NE1 6AF Lloyds Court

Northern Powergrid (Yorkshire) plc
For the attention the Company Secretary
Lloyds Court. 78 Grey Street, Newcastle upon Tyne, NE1 6AF Lloyds Court

.....
For the Attention of
.....

20.2. Any notices or agreed variations shall be served by recorded delivery.

20.3. For the avoidance of doubt, notices sent by e-mail shall not be deemed to be validly served for the purposes of this Clause 20.

21. PRECEDENCE CLAUSE

21.1. In the event of any conflict between the Agreement and the Schedules they will take precedence in the order set out below:

1. Terms and Conditions
2. Schedule A
3. Schedule B
4. Schedule C

22. BRIBERY ACT

- 22.1. The parties shall:
- 22.1.1. comply with all applicable laws, statutes, regulations, and codes] relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010 (“Relevant Requirements”);
 - 22.1.2. not engage in any activity, practice or conduct which would constitute an offence under sections 1, 2 or 6 of the Bribery Act 2010 if such activity, practice or conduct had been carried out in the UK;
 - 22.1.3. have and shall maintain in place throughout the term of this Agreement its own policies and procedures, including (but not limited to) adequate procedures under the Bribery Act 2010, to ensure compliance with the Relevant Requirements and will enforce them where appropriate;
 - 22.1.4. promptly report to the other any request or demand for any undue financial or other advantage of any kind received by the such party in connection with the performance of this Agreement; and
 - 22.1.5. immediately notify the other party (in writing) if a foreign public official becomes an officer or employee of the such party or acquires a direct or indirect interest in such party (and warrants that it has no foreign public officials as officers, employees or direct or indirect owners at the date of this Agreement).
- 22.2. The parties shall ensure that any persons associated with then and who are performing services in connection with this Agreement do so only on the basis of a written contract which imposes on and secures from such person terms equivalent to those imposed on the parties in this Clause 22. The parties shall be responsible for the observance and performance by such persons of the Relevant Requirements, and shall be directly liable to the other party for any breach by such persons of any of the Relevant Requirements.
- 22.3. Breach of this Clause 22 shall be deemed a material breach of this Agreement...
- 22.4. For the purpose of this Clause 22, the meaning of foreign public official and whether a person is associated with another person shall be determined in accordance with section 7(2) of the Bribery Act 2010 (and any guidance issued under section 9 of that Act), sections 6(5) and 6(6) of that Act and section 8 of that Act respectively. For the purposes of this Clause 22, a person shall be associated with a party if it is a subcontractor of that party.

23. Miscellaneous

- 23.1. If any part or any provision of this Agreement shall to any extent prove invalid or unenforceable in law, including the laws of the England, the remainder of such provision and all other provisions of this Agreement shall remain valid and enforceable to the fullest extent permissible by law, and such provision shall be deemed to be omitted from this Agreement to the extent of such invalidity or unenforceability. The remainder of this Agreement shall continue in full force and effect and the parties shall negotiate in good faith to replace the invalid or unenforceable provision with a valid, legal and enforceable provision which has an effect as close as possible to the provision or terms being replaced.

- 23.2. No failure to exercise or delay in the exercise of any right or remedy which any party may have under this Agreement or in connection with this Agreement shall operate as a waiver thereof, and nor shall any single or partial exercise of any such right or remedy prevent any further or other exercise thereof or of any other such right or remedy.
- 23.3. Except as otherwise expressly provided for herein, the parties confirm that nothing in this Agreement shall confer or purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of Contracts (Rights of Third Parties) Act 1999.
- 23.4. This Agreement is not intended to establish, and shall not be construed by either party in the future as having established, any form of business partnership or joint venture between themselves. Moreover, neither party shall use the other party's name, crest, logo or registered image for any purpose without the express permission of the other party.
- 23.5. Counterparts. This Agreement may be executed in any number of counterparts and by the parties on separate counterparts. Each counterpart shall constitute an original of the Agreement but all the counterparts together shall constitute one and the same Agreement.
- 23.6. As witness, the duly authorised representatives of the parties have executed this Agreement after the Schedules on the date stated.**

SCHEDULE A
Aggregation Procedures

Part 1 – Persons Authorised to issue Demand Response Notices pursuant to Clause 4.2:-

Name of Authorised Person	Designation
.....	Commercial Manager
.....	Asset Management Lead Engineer

Part 2 – Contact Details for Authorised Persons

Name of Authorised Person	Mobile No.	E-mail Address
.....	07885 711424
.....	07764 204978

Part 3 – The Aggregator’s Contact Details for receiving Instructions

Telephone Number	E-mail Address
.....

SCHEDULE B

Demand Response Services

The Demand Response Services are set out below in Part 1 of this Schedule B and the Charges payable to the Aggregator in respect of the same in Part 2.

Part 1

The Demand Response Services provided by the Aggregator will comprise the following:-

1. Availability Declarations

- 1.1 By 10:00 am each Friday of the Season the Aggregator shall issue to Northern Powergrid by e-mail the Site(s) that are unavailable to provide Demand Response in the week immediately following the issue of such notice (commencing on the Monday of such week).
- 1.2 If, after the issuing notification pursuant to paragraph 1.1 above, the Aggregator becomes aware of any changes to the availability of the Site(s) so notified, it will advise Northern Powergrid of such changes as soon as reasonably practicable.

2 Demand Response

- 2.1 The Aggregator shall ensure that the telephone numbers and e-mail addresses provided in Part 3 of Schedule 1 are monitored 1 (one) hour prior to and during the Availability Window, each day of the Term.
- 2.2 The Aggregator shall provide the Demand Response Services as more particularly set out in Clauses 3 and 4 of this Agreement.

3 Performance Monitoring

The Aggregator shall provide metering data from the Customer(s) Site(s) providing Demand Response as evidence of the response provided by Customer(s).

4 Periods of Availability

4.1 The table below details the Term, Availability Window and Response Time for the Demand Response Services.

Season	23 January 2012 – 29 February 2012
Availability Window	Mon – Fri, excluding statutory Bank Holidays, 15:00 – 19:00
Response Time	20 minutes

Part 2

Availability and Utilisation Prices

The Table below details the Availability Price and the Utilisation Price.

Availability Price	£/MWh
Utilisation Price	£/MWh

Schedule C

Customer's Participating in the Pilot

Site address	MPAN	Agreed Capacity (MW)

SIGNED BY

For and on behalf of Northern Powergrid (Northeast) Limited

Print Name:

Position:

Date:

SIGNED BY

For and on behalf of Northern Powergrid (Yorkshire) Plc

Print Name:

Position:

Date:

SIGNED BY:

For and on behalf of

Print Name:

Position:

Date:

Appendix B - Assessment of Industrial and Commercial Demand-Side Response Potential

Executive summary

To gain a more detailed understanding of how much potential industrial and commercial (I&C) demand side response (DSR) resource exists when targeting specific primary substations a research exercise has been carried out on our behalf by two commercial aggregators, Flexitricity and ESP. Ten primary substations were selected representing 1.5% of the Northern Powergrid major substation population. These ten substations supply a total of 251 I&C sites, 92 of which have a maximum demand greater than 200kW which is what we have determined to be the minimum level of demand required to participate in I&C DSR schemes.

Through a series of telephone conversations, questionnaires and meetings, the I&C customers in the selected primary areas were approached to assess their knowledge of DSR, establish their willingness and capability to participate in DSR and identify any barriers to DSR programmes.

It was found that when targeting a tight geographic area the initial customer drop-out rates are high due to issues associated with contacting the sites, contacting the right person at the site and the suitability of the load to participate in DSR. When contact is made with the right person in the business there is a low level of awareness of what DSR is but when the concept is explained a large proportion of them want to understand more about the practical opportunities and the revenues it could generate.

The lead times from making initial contact with a customer to finalising a DSR contract can range from 12 to 24 months. DNOs will have to ensure these lead times are accounted for in the network design process if DSR is to be implemented as a practical alternative to network reinforcement.

Introduction

The purpose of this paper is to present the findings from the I&C DSR assessment. The assessment exercise set out to gain a more detailed understanding of how much potential I&C DSR resource exists on specific parts of our network.

Project

The assessment of I&C DSR potential is part of the Customer-Led Network Revolution (CLNR) project.

Headline Requirements

Ten primary substation areas were selected to assess the I&C DSR market potential in each primary substation area. This represents 1.5% of the Northern Powergrid major substation population.

The I&C customers in the selected primary areas were approached to:

- Assess their knowledge of DSR;
- Establish their willingness and capability to participate in DSR programmes; and
- Identify barriers to DSR programmes.

Approach / Scope

The research methodology was both quantitative and qualitative in order to garner market knowledge. Each interface with the customer was accurately documented for both engagement and attrition. Two aggregators, Flexitricity and ESP were engaged to complete the customer research process.

Flexitricity were given six primary substations with the task of approaching all half hourly metered customers supplied from these primaries. Customer demand ranged from 8kW to 7MW. The objective was to:

- Complete a survey (Appendix 1 gives details of the questions posed in the attitudinal survey) and fact find (Appendix 2 gives details of the questions asked during the fact find) intended to assess customers knowledge of DSR as well as practical questions regarding the energy consuming and energy generating assets on the site;
- Assess customers willingness and capability to participate in DSR schemes; and
- Maintain a log of communications with each customer.

ESP was tasked with approaching all customers with a maximum demand of over 200kW (8 – 16 customers per primary substation to provide 2 – 4 MW of peak lopping per primary) at four primary substations in the Northern Powergrid area to assess their potential to participate in DSR schemes.¹

The six primary substations allocated to Flexitricity were:

- Denwick- a low density rural 20kV network in Northumberland
- Rise Carr – a high density urban 6kV network in Darlington
- Goole – a high density urban 11kV network in East Yorkshire
- Annfield 20 – a medium density suburban 20kV network in County Durham
- Aycliffe Industrial – a medium density suburban 11kV network in County Durham and
- Pallion Trading – a high density urban 11kV network in Sunderland

Denwick and Rise Carr primary substations were selected as these are the test regions for the CLNR project and any customers interested in DSR would be asked to participate in the trials; the other four primary substations were selected as they are all nearing their firm capacity and therefore DSR could be a real alternative to network reinforcement. Each customer was engaged to establish their willingness and capability to participate in DSR programmes and to assess their knowledge with regard to energy usage.

The four primary substations allocated to ESP were:

- Bottesford – a medium density suburban 11kV network in Scunthorpe

¹ ESP were not tasked to undertake a customer questionnaire

- Claywheels Lane – a medium density suburban 11kV network on the outskirts of Sheffield
- Jarratt Street – a high density urban 11kV network in Doncaster
- Martongate- a medium density suburban 11kV network in Bridlington

These four primary substations were also chosen because they are nearing firm capacity and therefore DSR could be a real alternative to network reinforcement.

The customers offered a good representative mix of market sectors covering commercial offices, warehouses, health, retail, education, hotel and catering, sport and leisure, public sector, manufacturing, logistics, engineering, chemical, and pharmaceutical. Customers ranged from high street shops, supermarkets, hotels, schools and hospitals to water pumping and sewerage stations, ports, food processing, plastics and manufacturing plants.

The aggregator’s usual commercial engagement methodology was employed and each stage of communication with the customer was recorded. The propositions presented to customers included existing DSR programmes (e.g. STOR) and CLNR requirements.

A summary of statistics and feedback from participating and non-participating customers is highlighted below.

Statistics from Flexitricity’s customer survey

A total of 509 calls were made over the period of the survey.

182 MPANS were targeted across 6 primary substations. Some MPAN’s were for the same site therefore 152 sites were targeted across the 6 primary substations. The sites included water companies, retailers, hospitals, schools, councils and manufacturers. Of these 152 sites:

- 78 sites were cancelled for the reasons given in Table 1 below;
- Contact could not be achieved with the decision maker contact (DMC) at 44 sites; and
- Contact was made with the DMC at 30 sites.

Of the 30 sites where contact was made with the DMC, 14 customers remained interested and of these, 9 sites have a demand of over 200kW.

Table 1 provides further analysis about why the engagement process with 78 sites was cancelled:

Table 1	
Reason for Cancelled Questionnaires	Number of Records
Number unobtainable	26
Existing relationship with Flexitricity	16
Referred to central contact	13
No names policy	6
Proposition not relevant	6
Business closed	4
Wrong number	4

The correct person was not identified	2
Wrong site	1
Total	78

Table 2 highlights why where the DMC was identified, contact with the DMC was not achieved:

Table 2	
Reason for Outstanding Questionnaires	Number of Records
No answer	10
Not available	27
Voicemail	7
Total	44

Table 3 outlines the success rate of completing a survey when contact with the DMC was achieved:

Table 3	
Outcome of contact with DMC	Number of Records
Survey & fact find complete	13
Survey complete	3
Customer not interested	7
Referred to central contact	3
Referred to another person	2
Not relevant	2
Total	30

Outputs from Flexitricity

Table 4 gives the number of I&C customers per primary substation:

Table 4						
Primary Substation	All Sites			Sites with Max Demand over 200kW		
	No. of MPANs	No. of Sites	No. of Customers	No. of MPANs	No. of Sites	No. of Customers
Denwick	29	27	23	8	8	8
Rise Carr	12	11	11	5	5	5
Goole	52	42	40	18	17	16
Annfield 20	44	31	27	21	15	14
Aycliffe Industrial	22	19	20	7	6	6
Pallion Trading	23	22	21	8	8	8
Total	182	152	142	67	59	57

Table 5 provides further analysis on the outcome of the research per primary substation:

Table 5						
Primary Substation	All Sites			Sites with Max Demand over 200kW		
	Complete	Outstanding	Cancelled	Complete	Outstanding	Cancelled
Denwick	5	7	15	3	2	3
Rise Carr	3	3	5	1	1	3
Goole	7	12	23	7	4	6
Annfield 20	8	8	15	5	3	7
Aycliffe	2	7	10	1	2	3

Industrial						
Pallion Trading	5	7	10	3	2	3
Total	30	44	78	20	14	25

Table 6 shows the positive interest attracted when contact with the DMC was achieved:

Table 6				
Primary Substation	All Sites		Sites with Max Demand over 200kW	
	Interested	Not interested	Interested	Not interested
Denwick	4	1	2	1
Rise Carr	1	2	0	1
Goole	4	3	4	3
Annfield 20	2	6	0	5
Aycliffe Industrial	0	2	0	1
Pallion Trading	3	2	3	0
Total	14	16	9	11

Outputs from ESP

Table 7 gives the number of I&C customers per primary substation:

Table 7						
Primary Substation	All Sites			Sites with Max Demand over 200kW		
	No. of MPANs	No. of Sites	No. of Customers	No. of MPANs	No. of Sites	No. of Customers
Bottesford	26	21	21	8	6	6
Claywheels Lane	21	21	20	10	10	10
Jarratt Street	49	45	42	13	11	11
Martongate	17	12	12	6	6	6
Total	113	99	95	37	33	33

Table 8 provides further analysis on the outcome of the research per primary substation:

Table 8							
Primary Substation	Meeting Held	Call Back	Referred to Central Contact	Interested but no Capability	Not Applicable	No Interest	Site <200kW therefore not applicable
Bottesford	1	2	1		2		15
Claywheels Lane	4	4	1		1		11

Jarratt Street	2	2	2	1	2	2	34
Martongate				2	1	3	6
Total	7	8	4	3	6	5	66

Of the 7 meetings held, 6 sites could only offer a limited demand response capability with only 1 site presenting the potential to provide demand response.

Table 9 gives a summary of the customer engagement by both aggregators, Flexitricity and ESP. It also shows the proportion of our I&C customer base we sought to engage.

Table 9				
Summary of Customer Engagement	Number of Records			% of NPg I&C customer base
	Flexitricity Survey	ESP Survey	Total	
Sought to engage	152	99	251	1.5%
Managed to speak	74	33	107	0.6%
Initially interested	30	22	52	0.3%
Still interested	14	7	21	0.1%

Table 10 gives a summary of the potential DSR available at each primary substation following the research exercise.

Table 10							
Primary Substation	Firm Capacity (MVA)	Max Demand (MVA)	DSR Required (MVA)	No. Sites >200kW	Cumulative Available DSR at Sites >200kW	No. Interested Sites >200kW	Cumulative potential DSR (MW)
Bottesford	23	21.5	2	6	3.2	1	0.6
Claywheels Lane	24	23.9	2	10	11.5	3	2.3
Jarratt Street	23	21.89	2	11	10.5	2	5.7
Martongate	15.3	13.36	1	6	3.4	1	0.3
Denwick	30	22.16	2	8	2.5	1	0.3
Rise Carr	23	10.99	1	5	3.0	0	0
Goole	23	20.00	2	17	7.4	3	1.3
Annfield 20	28	25	1	15	12.3	1	2.3
Aycliffe Industrial	17	16.65	1	6	16.2	0	0
Pallion Trading	24	20.55	2	8	4.0	3	1.2

Following completion of the research exercise there is a potential to secure a cumulative total of 10MW of DSR resource from a total of 74MW available across the 10 primary substations. From a total of 92 sites, 10 sites over 200kW remain interested. If we were successful in signing all of the sites to a contract we would be able to provide the required DSR at 3 of the 10 primary substations.

Next Steps

Discussions are ongoing between the aggregators and the customers who have expressed an interest in providing DSR however, these are not expected to be concluded within the timescales required for the CLNR trials.

Conclusions

The conclusions from the I&C customer survey are:

- When targeting a tight geographic area the initial customer drop-out rates are high due to issues associated with contacting the sites, contacting the right person at the site and the size and shape of the site load e.g. sites less than 200kW may not be considered practical for bespoke I&C contract structures.
- When contact is made with the right person in the business there is a low level of awareness of what DSR is amongst customers. Of the 20 customers with a demand greater than 200kW asked if they had heard of the term 'demand response' or 'demand side response' only 3 had the correct understanding of the term.
- When the concept of DSR is explained to customers a large proportion of customers want to understand more about the practical opportunities e.g. 12 of the 20 respondents with a demand greater than 200 kW were interested in understanding more about the opportunity once it was explained that some businesses can generate revenue from providing DSR.
- The prospect of customers investing time and resources to develop their DSR capability did not represent a barrier with 17 of the 20 respondents with a demand greater than 200kW still interested in DSR.
- Remote control access and control of respondents' assets was not a barrier to the next stage of the DSR implementation process.
- Even if customers show a positive interest in the DSR concept there may still be issues with some sites as further investigations identified no scope to provide DSR, not a high enough demand at the site or load profiles that did not correlate with the load profile of the primary substation.
- The implementation of DSR from generation substitution is the most successful entry point for new I&C customers wishing to participate in DSR schemes. Following this first step, customers can then engage in further developments that may be more intrusive to their core processes such as load management or energy efficiency.
- The lead times from making initial contact with a customer to finalising a DSR contract can range from 12 to 24 months. DNOs will have to ensure these lead times are accounted for in the network design process if DSR is to be implemented as a practical alternative to network reinforcement.
- The initial customer engagement activity is a critical part of the overall process. During the I&C DSR trials Northern Powergrid has utilised two customer engagement channels:
 - 1) Working with the aggregators as third party intermediaries
 - 2) Direct with I&C customers that have energy managersThe benefits of utilising the expertise provided by the aggregators, is:

- access to sales teams with industry experience;
- existing portfolios and customer prospects;
- proven capability to deliver front-to-end processes e.g. site evaluations, installation of smart meters, IT/Communications with site and control room, maintenance programmes (on-site generation), personnel training and on-going support; and
- valuable industry knowledge.

However, there may be merit in DNOs creating their own in-house DSR process capabilities which would ensure the objectives of these teams are fully aligned to the objectives of the distribution network.

Appendix 1: Flexitricity Attitudinal Survey

(duration 2 minutes)

1. Have you ever heard of the term 'demand response' or 'demand side response'?

[Closed-ended question; one answer only]

- a. Yes
- b. No
- c. Possibly (ready to respond to "I think it's ...")
 - i. Correct understanding of demand/side response
 - ii. In-correct understanding of demand/side response

2. If we were to explain that some businesses can generate revenue from [?medium-to-large?] electricity or consuming equipment; what would be your initial response?

[Closed-ended question; one answer only, assessed by interviewer]

- a. Interested ... i.e. I'd like to know more
- b. Mild ... i.e. I might be interested, but this sort of thing isn't a priority
- c. Cynical ... i.e. people make these claims all the time
- d. Not interested ... i.e. whatever you tell me I'm too busy for this sort of thing
- e. Other ... prompt for response
 - i. Free text

3. Understanding that to access demand response revenue will require an audit of your metering data and technical information; followed by a site audit and possibly an investment into on-site equipment; how interested would you be to progress?

[Matrix question; 5 point scale]

- a. 1 - Very interested
- b. 2 - Interested
- c. 3 - Open-minded

- d. 4 - Mildly interested
- e. 5 - Not interested at all

4. Revenues average at around £40,000 per year; however demand response requires automated remote control of your energy assets. With the assurance your assets would never be called-upon if they were being used for your core business/operations, how willing would you be to proceed to the next stage of implementation?

[Matrix question; 5 point scale]

- a. 1 - Very willing
- b. 2 - Willing
- c. 3 - Open-minded
- d. 4 - Not very willing
- e. 5 - Not willing at all ... prompt for response
- i. Free text

5. Having discussed these various points; would you be interested in providing me with information on your energy assets so that we can assess whether your site is suitable for demand response?

[Closed-ended question; one answer only]

- a. Yes ... proceed to fact find
- b. No ... mark as Exit 1
- c. Yes, but not now:
 - i. Book a time for fact find
 - ii. Be transferred to someone that can assist with fact find

Appendix 2: Flexitricity Fact Find Questionnaire

1. **Hi Good morning. Can you confirm you are at the 'input address'**
2. **Great. Are you able to tell me who your facilities manager is please?**

I need the person responsible for all large scale electricity equipment on your site.....” (If unsure, ask who is the MD, Ops manager, Facilities Manager, Engineering Manager)

3. **Can you put me through to them please?**
 4. **Good morning, I'm calling on behalf of Northern Power Grid and I've been told that you're the person responsible for all large scale electricity equipment on your site. Is this correct?**
 5. **Have you ever heard of the term 'demand response' or 'demand side response'?**
 6. **If we were to explain that some businesses can generate revenue from [?medium-to-large?] electricity or consuming equipment; what would be your initial response?**
 7. **Understanding that to access demand response revenue will require an audit of your metering data and technical information; followed by a site audit and possibly an investment into on-site equipment; how interested would you be to progress?**
 8. **Revenues average at around £40,000 per year; however demand response requires automated remote control of your energy assets. With the assurance your assets would never be called-upon if they were being used for your core business/operations, how willing would you be to proceed to the next stage of implementation?**
 9. **Having discussed these various points; would you be interested in providing me with information on your energy assets so that we can assess whether your site is suitable for demand response?**
- 10. Tell us about your site's connection permissions (if you know them)**
- Short term parallel (bumpless or soft load transfer)
 - Full parallel with permission to export
 - Full parallel without permission to export
 - Power Purchase Agreement in place
 - Don't know
 - Other (please specify)

11. **What type of an opportunity does your site represent?**

Generate electricity

- Turn down consumption
- Both
- Not sure

12. Tell us about your site / equipment

- Standby generators
 - **13. What type of load is it protecting; what are the primary processes on site?**
 - **14. What size is the standby generator(s)**
 - 500kW – 1MW
 - 1MW – 2.5MW
 - 2.5MW+
- CHP and hydro generators
 - **15. What is the primary purpose of the generator(s)?**
 - **16. What size is it?**
 - <500kW
 - 500kW – 3MW
 - 3MW+
- Diesel rotary UPS
 - **17. What is the process that the DRUPS unit is protecting?**
 - **18. What size is it?**
 - 500kW - 1MW
 - 1MW – 2.5MW
 - 2.5MW+
 - **19. Does the asset generate at fixed output power at different levels?**
 - Yes
 - No

- Demand reduction
 - **20. Describe the site and its core purpose.**
 - **21. What processes can be interrupted without impacting core business?**
 - **22. What is the size of the load? (overall site and flexible portion)**
 - 500kW - 1MW
 - 1MW – 2.5MW
 - 2.5MW+
 - **23. How predictable / manageable is the consumption profile?**
 - Predictable
 - Variable