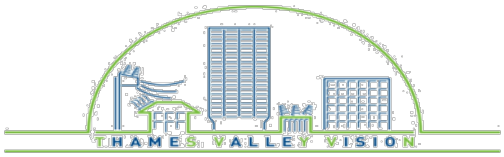
Scottish and Southern Energy Power Distribution



New Thames Valley Vision

PROJECT PROGRESS REPORT

Project Number	SSET2003
DNO	Southern Electric Power Distribution Ltd
Reporting Period	December 2012 to June 2013

Bracknell Forest Council

ea technology

KEMA DNV

Honeywell

University of Reading

1 Executive summary

Ofgem guidance: Executive Summary (This section should be no more than 4 pages) This section should be able to stand alone and provide a clear overview of the project's progress and any significant issues over the last period. All stakeholders, including those not directly involved in the project, should be able to have a clear picture of the progress. The DNO should describe the general progress of the project and include any notable milestones or deliverables achieved in the period. The Executive Summary should also contain two subsections: one for the key risks and one for the learning outcomes.

The New Thames Valley Vision (NTVV) is a Low Carbon Network Fund Tier 2 project selected by Ofgem, the UK's energy regulator, during the 2011 competitive selection process. This five year project is focussed on the Low Voltage (LV) network and aims to demonstrate how electricity distribution networks can better serve their customers by understanding, anticipating and supporting their energy use as they move towards low carbon technologies. The project explores a mixture of analytic, technological and commercial solutions.

The project has met all Successful Delivery Reward criteria milestones since inception and for this report period with a focus on designing and deploying hardware in support of the core learning outcomes. A short summary of delivery achievements against each of the core learning outcomes is given below:

Learning Outcome: Understanding

To help understand how energy flows around the LV network, the project has completed customer recruitment and installation activities for 253 end point monitors in local homes and businesses and 108 monitors in substations. These devices gather energy usage information and securely transmit the details to a secure central data store. In addition, data flows for commercial and half-hourly properties have been made available for the connections in Bracknell. Access to this information has enabled early work to characterise and categorise usage patterns. This work will be further extended in the next reporting period to give the first version of a set of standard energy usage profiles to assist future network planning and operations. Underpinning the information and data flows has required the installation and commissioning of a full set of networks, firewalls, servers and storage.

Learning Outcomes: Anticipating and Optimising

The base version of the project's Distribution Management System for the LV network of Bracknell has been successfully installed and reviewed under User Acceptance Testing. This base version will be further enhanced by subsequent product releases to enable the role and application of LV network management to be explored. The use case analysis and high level designs for the Network Modelling Environment have now been completed with work underway to establish the interfaces between the modelling environment and wider project roles, such as energy profile forecasting, smart control and network design. Subsequent analysis to enable forecasting and aggregation of energy profiles will draw on the data gathered to facilitate better network planning through interactions with the Distribution Management System and Network Modelling Environment.

Learning Outcome: Supporting Change

The project is on track to bring many of the 30 Automatic Demand Response (ADR) schemes online for an initial testing plan this summer. Engagement for these ADR trials has drawn on a considered plan of engagement and has been designed to allow project participants to take part without a reliance on incentive payments – the application of these will be explored once the initial performance of the scheme in Bracknell has been established. A 'request-for-information' process has been completed and a 'request-for-quotation' process is underway to select Energy Storage and Management units to be deployed in Bracknell. Work to establish control algorithms for the energy storage devices has explored the relevance of day-ahead (offline) methods and is now moving to the application of real-time (online) information and control. An initial hot-thermal storage unit, in conjunction with a domestic PV installation has been commissioned to prove the operation of the device when used to give predictable domestic and network benefits. A further four units will be installed in the summer with a subsequent 25 installed by autumn 2013.

Stakeholders

The low carbon community advisory centre (Your Energy Matters) has held a number of specific events in conjunction with Bracknell Forest Council; with weekend attendances at one event exceeding 100 people. This site will continue to explore the role that a DNO and Local Authority have in working with local customers to help improve energy use. Building on this, the project has just begun the design of trials to assess how a selection of low carbon technologies for domestic properties and business premises can impact the LV network. Work to establish a mechanism for tracking potential changes to industry practice, governance arrangements and to prepare appropriate training material is drawing to a close ready to be added to the project's learning capture approach in the next reporting periods

1.1 Risks

Ofgem guidance: The risks section reports on any major risks and/or issues that the DNO encountered, including any risks which had not been previously identified in the Project Direction. The DNO should include a short summary of the risk and how it affects (or might affect) delivering the project as described in the full submission. When relevant, the DNO should group these key risks under the following headings:

a. recruitment risks – describe any risks to recruiting the numbers of customers to take part in the project as described in the full submission and how these will impact on the project and be mitigated;

b. procurement risks – describe any risks to procuring the equipment and/or services needed for the project, as described in the full submission, and how these will impact on the project and be mitigated;

c. installation risks – describe any risks to the installation of the equipment (including in customers' homes, and/or large scale installations on the network) and how these will impact on the project and be mitigated; and

d. other risks.

Project risk management is considered in detail in section 10 of this report; a high level summary is shown on the following page:

Risk Description (Category & specific activity)	Further details and impact	Controls
Recruitment		
'High-density' end-point monitoring	Existing end point monitoring deployment has given a good coverage of the Thames Valley area. To enable detailed study a number of feeders with around 80% of customer coverage would be ideal	A revised Customer Engagement Plan has recently been approved to allow a more targeted approach and appropriate methods of reward for participation to help secure 80% penetration levels
Other project trials with customers	A number of engagement activities are planned to start this summer: exploring the impact of hot thermal storage and other low carbon technologies on the LV network. It is necessary to engage customers with such technologies for the project to conduct trials to explore their impacts	As above
Procurement		
Energy storage and Management units	The request-for-quotation procurement process for these units has not concluded. However, drawing on the earlier request-for-information stage it is likely that these devices may require additional time for the system integrator to combine technologies into a field deployable device. This is unlikely to have an impact on price, project scope or learning outcomes but may delay installation	The tendering process will be completed and, depending on outcome, the delivery schedule may require modification to reflect the availability of technology
Installation		
System integration	A number of components in the Distributed Solutions Integrator system rely on scheduled product releases separate from the activities of NTVV	The project is tracking the progress of these releases. It currently does not believe there to be any reason for delay at this stage

1.2 Learning Outcomes

Ofgem guidance: The learning section reports on the learning outcomes outlined in the Full Submission. This section should include, but is not limited to:

a. a summary of the key learning outcomes delivered in the period;
b. a short overview of the DNO's overall approach to capturing the learning;
c. the main activities towards third parties which have been undertaken in order to disseminate the learning mentioned in a.; and
d. the DNO's internal dissemination activities.

Please note that these two subsections should only give an overview of the key risks and the main learning. They should not replace the more detailed information contained in the "Learning outcomes" and "Risk management" sections of the progress report.

Learning outcomes are considered in detail in section 8 of this report; a high level summary of outcomes delivered in this period is shown on the following page:

Key learning outcomes

The following pieces of work have been completed in this period and represent knowledge outputs

- Customer engagement requirements and physical installation constraints with respect to end-point monitoring
- Initial model for secure acquisition of LV energy, power and other electrical characteristics (such as voltage, total harmonic content etc)
- Initial model for characterisation and categorisation of customer energy use
- Customer engagement requirements and installation-relevant building management system (BMS) capabilities for demand response trials in the study area
- Application of open-loop day-ahead optimal control of energy storage and management units for control of LV network

Approach to learning capture

The NTVV project consists of a number of Packages of Work (PoW) which directly map to core learning outcomes and learning dissemination methods. Each PoW consists of number of components, where a component is defined as a:

Deliverable – defined activity with clear stages of implementation and completion;

Trial – aspects which require investigation and/or experimentation; or

Report – produced to formalise project outcomes, to enable the sharing of learning and outputs related to a deliverable or trial, or to address a specific evidence requirement of an SDRC (Successful Delivery Reward Criteria).

The principal mechanism for formalised learning capture draws on the methodical testing strategy and sequent analysis within each project trial.

Summary of Third Party targeted dissemination

(For further details please see section 7.2)

- Academic workshop - LV Clustering
- Engagement event for local business community, GE Smart Grid Centre
- Presentation to Ofgem on learning to date from NTVV
- Powering up for the 21st Century: How will smart grid affect your asset management strategy?
- Smart Grids Workshop for Electricity Supply Board (ESB), Ireland
- Presentation on ‘New Thames Valley Vision’ at Sustainability Live, Birmingham
- Series of events to promote Low Carbon Technologies at Your Energy Matters Centre
- Academic workshop series - Advanced analytics methods for load forecasting, customer segmentation and battery control
- Poster presentation on ‘Evaluating individual load forecasts’
- Presentation on ‘How and why a DNO would implement LV network monitoring and Active Network Management’
- Presentation on ‘Lessons Learned from UK Low Carbon Networks’
- SE Carbon Action Network visit to Your Energy Matters Centre
- Climate Berkshire visit to Your Energy Matters Centre

DNO Internal targeted dissemination

SEPD has taken an integrated approach to the delivery of NTVV. Other than a small group of staff dedicated to the project, the project makes use of a pool of in house experts. This approach seeks to draw on a wide body of knowledge whilst also disseminating findings through a natural process of persistent contact. It also enables a broad group of people to benefit from the close interaction with project partners. This approach is additionally supported through a series of rolling workshops designed to keep the general business engaged in the project.

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3 Project manager's report

Ofgem guidance: The project manager's report should be a more detailed version of the Executive Summary. This section should describe the progress made in the reporting period against the project plan. Any key issues should be drawn out and described in detail, including how these issues were managed. The DNO should also include details of deliverables and/or events, referring where necessary to other sections of the PPR. This section should also provide an outlook into the next reporting period, including key planned activities. It should describe any key issues or concerns which the project manager considers will be a major challenge in the next reporting period.

The New Thames Valley Vision (NTVV) consists of a series of related Packages of Work (PoW) which directly map to core learning outcomes and learning dissemination methods. For many of these packages the project activities are now moving from a customer enrolment and hardware deployment phase into the initial stages of a series of project trials. For other packages, in accordance with the project plan, work to engage customers and deploy hardware is yet to begin.

Whilst much of the work to date has focussed on designing and deploying the right hardware and infrastructure to support core learning outcomes, the project has been careful to capture early findings and share these through its dissemination activities. The project is keen to share and build on earlier engagement and during this reporting period it has held or actively participated in a number of dissemination events (as per section 8.3).

The NTVV has implemented all activities in accordance with the Project Direction and is progressing to plan. All Successful Delivery Reward Criteria (SDRCs) for this reporting period have been met, details of which are included in section 7. The following summary outlines the progress to date for each Package of Work and key activities in the next reporting period.

End point monitoring

(Core learning outcome: Understanding)

End point monitoring equipment records half-hourly energy usage at individual properties and securely transmits this data for analysis on a daily basis. Consistent with the project plan, by the end of January 2013, the New Thames Valley Vision project had installed 253 end point monitors with consenting customers in the Bracknell and wider Thames Valley Area. Given that smart metering is not expected to have significant deployment for some years, successfully gaining access to this information within the study area on time is an important milestone. Accordingly SDRC 9.2 (a) had been aligned to this stage and required 250 monitors to be installed by the end of January 2013. The achievement of this SDRC was recorded through the submission of an evidence report to Ofgem on 31st January 2013.

These first end point monitors use EDMI Mk7c Atlas smart meters installed in series with the customer's tariff meter and connected between the SEPD 'cut out' fuse and the meter. During installation it was found that around 22% of properties did not have sufficient space to install an end point monitor in this manner. Typically this was due to additional equipment such as time switches associated with the tariff meter, and occasionally due to very small existing meter boards, meter

boards located in very tight or inaccessible spaces, or due obstructions from customer equipment. The solution adopted by the project to this constraint is twofold: 1) to ensure the early requirement for appropriate end-point monitoring data was met, additional customers within the study area were invited to take part in the project and; 2) the project is working to deploy cut-out based monitoring which will be able to be deployed in many more locations (this product is being progressed through the separate IFI 2010_13 project). Cut-out monitors have not yet been fitted and final testing is being carried out to ensure compliance with BS7657 prior to fitting.

The EDMI Mk7c Atlas devices communicate over GPRS (General Packet Radio Service) using the 'DLMS HLS' security protocol to ensure privacy. DLMS HLS was implemented following an extensive review of the security model for end point monitoring and was specifically required by the project to give the best possible security above that of a standard unit. Like all radio communications, GPRS does have limitations and at this time five monitors are not in regular contact but are collecting data ready to be transmitted when connections are restored. Work is in progress to improve communications and will require alternative aerials, appropriately authorised staff and an appointment with the customer at a mutually convenient time.

Data from the end point monitoring has been made available for analysis within the project. Similarly, half hourly data for more than 50 large commercial customers and for more than 100 small commercial customers within the study area has been identified from MRA 'D' data flows and made available for analysis.

The project plans to deploy further end point monitoring to support data analysis requirements which indicate a need to monitor around 80% of customers on a single LV feeder. Further to the data gathered through direct monitoring, the NTVV is working with energy suppliers to interact with the data generated from their smart metering programmes in the area. At present the level of smart metering deployment in the area appears quite low; with one supplier indicating that their deployment plans may be adjusted to reflect recent DECC announcements. Similarly half hourly data has been requested from Western Power Distribution's Smart Hooky LCNF project – for which verbal agreement has been reached in principle although the process of data sharing remains to be confirmed.

Substation monitoring

(Core learning outcome: Understanding)

Substation monitoring equipment records electrical characteristics for each feeder and each phase within that feeder on a half-hourly and also five-second basis. Consistent with the project plan, by the end of April 2013 the NTVV had installed 108 substation monitors at sites chosen to complement analysis by taking into account the nature of the local network and customers served by that substation. SDRC 9.2 (b) had been aligned to this stage and required 100 devices to be installed by the end of April 2013. The achievement of this SDRC was recorded through the submission of an evidence report to Ofgem on 10th April 2013.

Substation monitoring uses GE Digital Energy DGCM monitors with units being ordered and installed on a batch basis to ensure the minimum level of hardware is deployed to meet project requirements. Up to 215 further units will be specified and installed throughout the project as subsequent analysis indicates this is appropriate. Of this first batch, two devices remain to be installed with one requiring an electrical joint to be made to provide voltage connections and one unit to be repaired under warranty.

Information from the substation monitors is received and stored in the data historian Pi Process Book on a near real-time basis and is immediately available for analysis at that point. 60 of these devices are currently being operated on a five-second polled basis to test the higher level of performance that will be required to enable real-time control of Energy Storage and Management Units (ESMUs) and to investigate the nature of energy consumption within a half-hour interval. Operation at this higher level of performance has identified some limitations with the current configuration of the substation monitor which will require further work to refine the use of the DNP3 protocol to make the transmission of data more efficient.

A number of substation monitors have suffered communications problems linked to the GPRS network. These issues remain under investigation to distinguish the cause between poor signal strength and/or functional problems linked to continuous transmission of data. Likewise a number of monitors have failed in service to date; these have been returned under warranty however it is not yet known whether the cause of the problems are due to design, quality or other unrelated issues.

Characterisation

(Core learning outcome: Understanding)

The systems required to support the characterisation of energy usage have been commissioned along with the necessary tools for the project to begin analysing the data being recorded from both end point and substation monitors as well as internal data from the existing distribution flows.

Initial work to categorise and characterise energy usage patterns relevant to the operation of an electrical network have drawn on both the early NTVV end point monitor data and the publicly available Irish smart meter data[1]. The project is considering the findings from some early, simplified clustering of data which will act as a foundation for more complex and sophisticated techniques in the future. An important finding from this work has been the need to choose the correct attributes that represent each customer: if highly variable attributes are chosen then a measure of this volatility is also necessary in the clustering. Another important finding is the effect of magnitude on the clustering: if this effect is over-emphasised in the data then clustering methods tend to be based upon magnitude alone. Without an awareness of these issues, this could have hindered an understanding of the deeper properties of the data. To manage these effects some form of normalisation will be required in future segmentations.

[1] http://www.ucd.ie/issda/data/commissionforenergyregulation/

Future work will address the following questions: Should exceptional behaviours such as overnight storage heaters be identified before clustering begins or should they be identified after clustering as aberrant? What is a suitable measure to assess the success of a clustering? What resolution clustering is most suitable for the aims of DNOs? SDRC 9.5a, due at the end of November 2013 will establish a unique, reliable method for customer segmentation based on individual behavioural energy consumption; and produce a first version of the universal customer categorisation vocabulary for DNOs.

ICT requirements

(Core learning outcome: Understanding)

The ICT infrastructure in terms of network, firewall, server and storage to support the Distributed Solutions Integrator System (DSI) and analysis of data have been built and commissioned. The applications have been installed and additional configuration to ensure that substation monitoring data is accurately recorded and the quantity of data being transferred is optimised for best cost effectiveness.

Additional work is on-going to support the interfaces for ADR as well as ensuring that the design for cut out based monitoring is fit for purpose. Improvements have been delivered to both the end point monitor and head end encryption protocols and half hourly energy import and export data is now being securely transferred to the GE hosted system. The penetration test was conducted of both the end point monitor and the GE hosted head end system and the internal review of the findings approved the security profile of both the device and the head end for use on the NTVV project.

Network Modelling Environment

(Core learning outcome: Anticipating)

The Network Modelling Environment (NME) combines a geospatial records tool (Electric Office) with a power analysis tool (Cymdist) to enable the LV network to be studied and the effects on energy usage profiles to be calculated and presented.

All project requirements for the NME have been identified and recorded as have the principles for the transfer and handling of energy profiles. These requirements have been used to create and agree a high level design for the NME and detailed design is currently being prepared. The business process models for how the system will be utilised by the project team and project partners to run the network scenarios as well as identify the optimal locations for ESMU installation have been developed.

Access to Electric Office and Cymdist has been given to relevant project partners across a unified Support Portal. This has allowed the modelling tool Cymdist to be further reviewed and initial work on the provision of library data (network electrical characteristics) is now underway. Similarly, work is underway to update existing GIS data based on information from substation and network surveys. Clearly, the more accurate the data is prior to transfer to the NME, the higher the probability that power flow analysis will be accurate and representative from the outset. Data from other existing systems which identify the relationship between address, points of connection and other universal

references (such as MPAN) are being reviewed to assess how a fully geo-tagged referencing scheme can be created. Street light data has been obtained from Bracknell Forest Council for import into the existing GIS prior to the transfer to the NME. Street lighting represents the majority of un-metered load on the network, and awareness of lamp location and type will enhance any network modelling subsequently carried out in the NME.

The development of the NME is on target for completion by December 2013 in line with the project plan and SDRC 9.6.

Distribution Management System

(Core learning outcome: Anticipating)

The Distribution Management System (DMS) takes the principles of SCADA management and control and applies it to the LV network. A base version of the DMS (using PowerOn Fusion from GE Digital Energy) has been built and commissioned and is now being used to poll substation monitors – this 'Shadow System' operates in parallel with the operational DMS used for HV operations on the SEPD networks. The NTVV DMS routinely collects over 17,500 analogue attributes either in real time or over half hourly periods. The user acceptance testing of the base DMS system has concluded with only minor product defects being raised and a suite of appropriate symbols to match SEPD's operational practice are being developed by in house cartographers for the key network components.

The SMOS (Smart Meter Operating System) has been established and hosted by GE Digital Energy to capture and package the end point monitor data. The data is currently made available by file transfer and will be integrated with the Distribution Management System (DMS) on subsequent releases of Power On Fusion.

The NTVV will build on future functionality to be released in later versions of PowerOn Fusion and is reviewing the functionality for the LV network and the systems interfaces as these releases are readied. The next phase of DMS enhancements will focus on the readiness for the introduction of the Automatic Demand Response (ADR) and Common Information Model (CIM) interfaces needed to support the full DSI system. The development of the DMS is on target for completion by January 2014 in line with the project plan and SDRC9.2(c)

Aggregation and Forecasting of energy profiles

(Core learning outcome: Anticipating)

Aggregation analysis attempts to allow the use of relatively sparse data from only a handful of end points to be 'buddied' such that the power flows across a network can be assessed. Forecasting analysis runs a number of scenarios (varying in both timescale and application) to support future power flow analysis.

The University of Reading will produce feeder power flow profiles by aggregating the modelled demand and usage profiles of customers. This work will follow the categorisation of customers and

requires the creation of a buddying engine to pair non-metered households with metered ones or surrogates based on the metered users to create virtual customer monitoring.

The project is assessing the appropriateness and availability of additional data from existing sources for the Bracknell area such as Elexon Profile Class information, Land Registry and household Energy Performance Certificates which could all have potential application in the creation and association of energy profiles with customers. The University of Reading will create an agent-based forecasting engine to produce short, medium and long-term network demand forecasts with envelopes of uncertainty.

To be able to complete the aggregation and forecasting tasks requires that sufficient data is available from end points, and that sufficient end points are located on specific feeders that also have substation monitoring so that comparisons can be made between real and modelled values. Work is on target for completion by April 2014 (in line with SDRC 9.5(c).

Automatic Demand Response (ADR)

(Core learning outcome: Supporting)

The project has committed to engage 30 buildings on to trials of the Honeywell ADR system by summer 2015 and has set an internal target to achieve this milestone two years early. As at the beginning of June 2013, thirteen customers have agreed their load shed strategies, six of which have ADR equipment installed and commissioned; a further 17 organisations are performing legal reviews with the intention of also joining; and some organisations are looking to enrol more than one building. A summer testing plan is planned for this year to introduce the system and to gauge initial customer reaction to load reduction events. This test plan will be preceded by a welcome session in July.

23% (seven sites) through this project have been found to have minimal or no building management system. A building management system is the normal base requirement for ADR participation. However, to reflect the local situation, the project is considering how minimal control functions could be added to these buildings to enable their participation and what the business case would be in terms of project based learning and also in the context of future business-as-usual application.

Design for the integration of the functionality and the ‘look and feel’ of the ADR elements in to the DMS has been issued and the interface specification work is underway with both GE and Honeywell. The necessary communications links have been put in place between SEPD and GE and the link to Honeywell is due imminently.

Energy Storage and Management Units

(Core learning outcome: Supporting)

The NTVV project is exploring the concept of an Energy Storage and Management Unit (ESMU) which combines power electronics and energy storage to help manage voltage performance, thermal limitations, efficiency and emergency response on the LV network. The project intends to deploy a number of these devices on the LV network and has taken learning from SEPD’s associated LCNF

Tier 1 project on LV connected battery storage. Further to the problem statement developed as per SDRC 9.4a last year, the NTVV has developed a specification for field deployable units to be sited in the urban environment which can balance load between phases, use storage to balance peaks and troughs, provide reactive voltage support, improve power quality and harmonics, provide local emergency demand reduction and also provide frequency response actions. For a device to be field deployable, it is important that the size, form and operating environment are suitable for installation along the footpath of a typical urban street.

As these devices are not presently found on the LV network, a 'request for information' (RFI) stage was included in the tendering process. 77 participants were invited to respond to the RFI, to which eight responses were received. Although the RFI indicated that there were a number of suppliers who had the products and capability to implement storage or electronics, none had (as yet) configured these into a single deployable package. The RFI confirmed the initial assumption that the most appropriate energy storage technology would be lithium ion and that, through a number of collaborations, there would be the potential for existing technologies to be configured in to the required solution. The RFI responses also indicated that there were no specification changes that would allow other products to be used in substitution. The NTVV is currently progressing a 'request for quotation' (RFQ) process which will be drawing to a close shortly.

In relation to the RFQ for the ESMU hardware, the NTVV has also defined the communications requirements for these devices and put them to the market through a RFQ tendering process. This process has now closed and the responses are being considered to choose the most appropriate communication between the DMS and ESMUs.

Smart Control

(Core learning outcome: Supporting)

Building on the related energy use categorisation, aggregation and forecasting analysis, smart control seeks to dispatch Energy Storage and Management Units in the most optimal manner. The initial work to evaluate the impact of ESMU control using an offline plan only based on day-ahead information (effectively open loop) has been developed to give a thorough analysis of the potential impact of energy storage controlled in this way. The results highlight the maximum potential and pitfalls of such systems. The University of Reading team are now beginning to assess the benefits of real time control in addition to day-ahead planning.

The control algorithms under development will ultimately be used to implement real time control of the deployed ESMUs. As discussed above, the Support Portal with direct access to SCADA data and analysis tools has been made available and a training day held to familiarise users to this environment. The University of Reading are in the process of building OpenDSS models to interact with Matlab through the Support Portal using network data as produced from the Network Modelling Environment. Initial work using these models has demonstrated the impact of the location of the ESMU within the feeder on the voltages and currents in that feeder. Early results suggest that the location of the ESMU is critical and can make the difference between no benefit and maximum benefit.

Work continues to ensure these algorithms interact with the network Modelling Environment and the Distribution Management System

Having defined the overall functional requirements for ESMU control, work has been ongoing to specify the individual control functions and define the use of agents in the system. The business process for the creation of operational control algorithms has been described and the architecture to support the development of these algorithms has been designed. The next phase will be to ensure that the design is completed to incorporate the ESMU communications mechanism and to formalise the support arrangements for the operational implementation of control algorithms.

Hot Thermal Storage

(Core learning outcome: Supporting)

The thermal storage capacity of existing hot water tanks in domestic customer properties is being explored as an efficient way to enable the connection of large volumes of photovoltaic (PV) panels onto the existing network. An initial five Coolpower EMMA units have been purchased to assess their control algorithms with respect to the network advantage they could bring. The first of these units has been installed and has led to a series of conversations to modify the control algorithm such that the customer and the network receive predictable benefits throughout the course of the year. A further 25 units are now on order with the aim to have 30 installed this summer/autumn following customer engagement activities.

Cold Thermal Storage

(Core learning outcome: Supporting)

In combination with other project trials which aim to explore the amount of controllable thermal demand on the LV network, the NTVV is looking to encourage up to 50 commercial customers to install ice cooling storage units. Drawing on US and Australian experience, where this technology is widely deployed, the 2011 full submission pro-forma envisaged that these units would be funded by the customer as a naturally growing market for these devices formed in the UK. This would allow the project to monitor these devices alongside the ADR trials at no additional cost. However our work to date has not identified any such units deployed in the UK. To better understand this situation, the project has begun a market analysis of cold thermal storage in I&C buildings in the UK with the aim of appreciating how and if the installation of these units will provide relevant learning.

Low Carbon Promotions

(Core learning outcome: Supporting)

The NTVV is looking to assess how a selection of customer based low carbon technologies can impact the local LV network and what, if any support a DNO can give to the promotion of these technologies, which is appropriate to the role and obligations of a DNO. This activity is in the early stages of development and is going through a process to review technologies that will be promoted, methods of promotion, methods for monitoring the impact of any promotion and of the resulting effect on the LV network.

Local Authority

(Core learning outcome: Supporting)

In additional to the advisory work at the Your Energy Matters centre, the NTVV is looking at how Bracknell Forest Council, the Local Authority, and a DNO can best work together to maximise low carbon opportunities. Note: this work is not due to start at this stage in the project

Industry Governance

(Knowledge dissemination)

The project completed a review of GB DNO commercial and governance frameworks during the last reporting period and has been identifying the relevant trigger points and associated questions to be embedded in other Packages of Work to assess how project progress may inform future changes to commercial and governance frameworks.

Stakeholder Engagement

(Knowledge dissemination)

Over the past year and into this reporting period, the NTVV has engaged in a broad fronted programme of local stakeholder engagement encompassing commercial customers (see the ADR progress report section), partnering with Bracknell Forest Council to provide low carbon advice (see the 'Your Energy Matters' low carbon advisory centre progress report section) and also engagement with customers to invite their participation in specific project trials. At this stage, over 550 local customers have signed up to participate in the NTVV project. The conclusions from these activities have been reported in the February 2013 'Customer Engagement Lessons Learnt' report, to successfully meet SDRC 9.3c. This report made the following core observations:

Low Carbon Community Advisory Centre and www.thamesvalleyvision.co.uk website

(Knowledge dissemination)

The centre, known as 'Your Energy Matters' has been open for just over six months and has attracted a wide range of visitors. The centre is open daily from Tuesday to Saturday and has held an additional six events covering a broad range of low carbon advisory topics. For example, in April a successful one day event on external wall insulation attracted over 30 customers with staff from Bracknell Forest Council able to make follow up home energy efficiency visits. In May a two day event combined low carbon advice with the local launch of My Electric Avenue (1^2EV) – SEPD's 2012 LCNF Tier 2 project; this attracted over 100 visitors. The report for SDRC 9.7 in March 2013, details the progress and impact that this site and the associated project website are making in disseminating project outcomes and in exploring how a DNO can support low carbon choices.

Transition into 'business and usual' – development of policies and training materials

(Knowledge dissemination)

The first year's activity to identify the relevant national standards that may be informed by the outputs of the NTVV and how these changes can be best captured by the project is drawing to a close; as is the related piece of work to identify how relevant stakeholders can best be trained in use of these new approaches and what information would be needed to create and deliver training material. During the

next reporting period recommendations will be made as to how best to capture the industry-specific knowledge and make it ready for UK business as usual implementation.

Learning & Dissemination

The outputs of activities in association with this Package of Work are covered in detail in section 8.

Project Governance

The Project Partner Review Board and Project Steering Group met on:

- 24th January 2013 Project Partner Review Board
- 4th January 2013 Project Steering Group
- 24th February 2013 Project Partner Review Board
- 1st February 2013 Project Steering Group
- 28th March 2013 Project Partner Review Board
- 25th April 2013 Project Partner Review Board (full day review workshop)
- 20th May 2013 Project Partner Review Board

4 Consistency with full submission

Ofgem guidance: The DNO should confirm that the project is being undertaken in accordance with the full submission. Any areas where the project is diverging or where the DNO anticipates that the project might not be in line with the full submission should be clearly identified. The DNO should also include, where appropriate, references to key risks identified under "Risk Management".

The New Thames Valley Vision is being conducted in accordance with the full submission. To ensure all commitments from this submission are completed in a timely and efficient manner, the project has developed a comprehensive Package of Work structure with clear linkages to the text of the full submission.

The project is aware of two potential variances, which are currently being monitored. Mitigation measures have been provisionally identified:

No.	Package of Work	Variation & Mitigation	Risk Register
1	Supporting: Energy Storage & Management Units	Tendering processes are not complete - however information from the initial RFI indicates that some work may be required by systems integrators to bring technologies together in a deployable solution. There are no anticipated impacts to learning outcomes or project objectives but there is potential for a significant delay to the fulfilment of an early SDRC relating to installation of these systems. The RFQ tender process will be completed to schedule and an order placed with the supplier to ensure deliverables as per the full submission are fulfilled. If necessary, a delivery schedule will be designed such that two units will be delivered early to enable on site testing and integration with smart control systems (ideally, before original SDRC date) and then for all remaining units to be installed by the already defined later SDRC date.	S3-e
2	Supporting: Cold Thermal Storage	The full submission envisaged that these units would be funded by customers in Bracknell as a naturally growing market for these devices formed in the UK. This would have allowed the project to monitor these devices alongside the ADR trials at no additional cost. However work to date has not identified any such units deployed in Bracknell. To better understand this situation, the project has begun a market analysis of cold thermal storage in I&C buildings in the UK with the aim of appreciating how and if the installation of these units will provide relevant learning. Should the analysis indicate that there is no readily available market for these devices in the UK (which in itself is viable project learning outcome) then the project would consider modifying future plans to exclude cold thermal storage. This would be unlikely to have any bearing on cost as this was not a funded item in the first place.	S5-a

5 Risk management

Ofgem guidance: The DNO should report on the risks highlighted in box 26 of the full submission pro forma, plus any other risks that have arisen in the reporting period. DNOs should describe how it is managing the risks it has highlighted and how it is learning from the management of these risks.

The project risk register is a live-document designed to identify actual and potential barriers to the satisfactory progress of the NTVV. The register is used to target resources and to develop control measures and mitigations. The NTVV risk register is a single log of risks as identified by SEPD, GE, University of Reading, Honeywell, DNV KEMA, EA Technology and Bracknell Forest Council. The register is reviewed at the monthly Project Partner Review Boards and is reported to the SEPD Project Steering Group.

Risks are assessed against their likelihood and impact, where the impact considers the effect on cost, schedule, reputation, learning, the environment and people. Risks are scored before (inherent) and after (residual) the application of controls. Risks which are closed are removed from the live register, with any learning captured through the Learning Moments and Project Trials described in section 7.

Increased focus is placed on risks with amber or red residual scores and also on all risks with a red inherent score (to ensure there is no over-reliance on the controls and mitigation measures). At present, there are six risks that fall into this category, a seventh risk is also listed below which is referenced by section 4 of this report:

		Inherent									Residual							
		Impact									Impact							
#	Risk Description	Cost	Schedule	Reputation	Learning	Environment	People	Likelihood	Score	Risk Control/Mitigation Actions	Cost	Schedule	Reputation	Learning	Environment	People	Likelihood	Score
S3-e	Energy Storage and Management Unit RFI procurement process and interim RFQ results indicate that work maybe required by systems integrators to bring technologies together in a deployable solution. No impact to learning outcomes or project objectives but significant delay to early SDRC	3	5					4	3	1. Completion of tender process to schedule to place contract with supplier 2. Once facts established by tender raise variation with Ofgem 3. Design delivery schedule such that two units will be delivered before original SDRC date and all units to be installed by later existing SDRC date.	3	4					4	16
U2-d	Firmware upgrade of LV Monitoring Devices may be required after commissioning of the devices	3	3		3			5	3	1. Detailed tests before commissioning will help to reduce the likelihood of this to happen 2. Remote upgrade possibility to be analysed. There is a risk that all commissioned devices need to be personally visited. 3. Firmware revision being considered by product supplier	2	3		2			4	12

		Inherent									Residual							
		Impact									Impact							
#	Risk Description	Cost	Schedule	Reputation	Learning	Environment	People	Likelihood	Score	Risk Control/Mitigation Actions	Cost	Schedule	Reputation	Learning	Environment	People	Likelihood	Score
A1-d	The data transfer mechanism around the export of the LV network model from NME to DMS is dependent on a product enhancement. There is a risk that this enhancement will not be delivered in line with the project schedule. The development is done by terms internal to the supplier	2	3					5	2	1. Regular communication with the product team developing the CIM interface to cover LV network. 2. Proactive communication with the product team will identify any issues which may impact the delivery schedule as early as possible in order for the project team to work towards finding a suitable solution for all parties.	2	3					4	12
U1-e	Smart meter installation programme (by others) delayed.	2	3		3			5	2	1. Regular engagement with supply companies 2. Increase count of deployed end-point monitors targeted to support analysis	2	1		1			5	10
A1-e	The feasibility of driving the LV power analysis in the CYMDIST package from Smallworld Electric Office and of returning the results of the analysis for visualisation in EO has not yet been tested in an associated Tier 1 project. The risk is that when we address this aspect through the NTVV delivery through COM integration, it may become apparent that this is far more complex than anticipated and is outside the skill set of the delivery team.	2	4	1				3	2	1. Should it be identified that the execution team do not have the necessary skills to execute we will have the potential to use CYME consultants for this part of project. 2. We have confirmed that the CYME team do possess the skills required. 3. Identification of the timeframes around these requirements being defined and an understanding of the delivery timeframes required to meet the requirement must be sought as early as possible.	2	3	1				3	9
T4-d	The envisioned deployment of PVs with a local RSA will not materialise - due to a change of the RSA's development plans and ideas (as well as a change to the commercial proposal due to change in FiT). This was intended to create a high density PV network challenge and also be a basis for recruitment/ deployment of storage solutions.	3	3		3			4	3	1. Support and explore new PV ventures with local housing organisations 2. Establish new participants as part of wider low carbon promotions work	2	3		3			2	9
S5-a	No current awareness of cold thermal storage units in Bracknell. Whilst the project anticipated customers would want to have and to pay for these units, a suitably mature market for commercial action does not appear to have evolve	2	3		3			2	2	1. Understand proposition and discuss with commercial customers (where relationship already exists) 2. Complete a specific analysis to identify if there is an appropriate market for these units 3. Consider if manufacturer could supply units to help support customer costs 4. If no practical proposition for customers is found (a viable project learning outcome) then modify future plans to exclude cold thermal storage	1	2		3			1	3

6 Successful delivery reward criteria (SDRC)

Ofgem guidance: The DNO should provide a brief narrative against each of the SDRCs set out in its Project Direction. The narrative should describe progress towards the SDRCs and any challenges the DNO may face in the next reporting period.

The NTVV has identified eight Successful Delivery Reward Criteria (SDRC) which span both the objectives and the lifecycle of the project. Each SDRC is split into a number of sub components and each component has defined criteria, evidence and a target date for completion. The following tables lists the individual SDRC components in chronological order and details the project's progress towards their achievement for those due to be completed in this reporting period (up to December 2012) and into the next reporting period (up to June 2013).

	Completed (SDRC met)		Emerging issue, remains on target		SDRC completed late
	On target		Unresolved issue, off target		Not completed and late

SDRC	Due	Description	Status
SDRC 9.3a	29/2/2012	Start Consumer Consortia element of customer engagement programme	Complete – as noted in previous Project Progress Report
SDRC 9.3b	29/2/2012	Arrange and hold the first "Energy Efficiency" focus group	Complete – as noted in previous Project Progress Report
SDRC 9.1a	31/5/2012[2]	First ADR Agreement negotiated and signed with Commercial Customer	Complete – as noted in previous Project Progress Report
SDRC 9.1b	31/7/2012[3]	Install the Honeywell/ SSEPD interface equipment, programme the Building Management System (BMS) and implement a manual Peak Load Shedding event, via the Demand Response Aggregation Server (DRAS), and track the actual kW shift in Peak Load	Complete – as noted in previous Project Progress Report
SDRC 9.4a	31/7/2012	Develop problem statement, hypothesis and test deployment programme for coordinated energy storage and power electronics on the Low Voltage distribution network - building on previous and current battery installation tests	Complete – as noted in previous Project Progress Report
SDRC 9.2a	31/1/2013	250 In house end point monitors installed & learnings presented	**Complete** – 253 end-point monitors installed and evidence report delivered by 31st January 2013
SDRC 9.3c	28/2/2013	Produce customer engagement lessons learnt Report	**Complete** – Customer engagement lessons learnt report delivered on 28th February 2013
SDRC 9.7	28/2/2013	Successful establishment of all aspects of the Low Carbon Community Advisory Centre –including display material at various locations, the associated interactive website, and the method and means of capture of stakeholders views on the learning outputs…	**Complete** – Report discussing public engagement through the Low Carbon Community Advisory Centre and Website report delivered on 28th February 2013

[2] The Project Direction placed additional requirements on SSEPD - these requirements have now been met. In placing these requirements, Ofgem agreed that SDRCs that the target date for this SDRC should be set at two months later than the date originally published in Section 9 of the full submission pro-forma.

[3] The Project Direction placed additional requirements on SSEPD - these requirements have now been met. In placing these requirements, Ofgem agreed that SDRCs that the target date for this SDRC should be set at two months later than the date originally published in Section 9 of the full submission pro-forma.

SDRC 9.2b	30/4/2013	100 Substation monitoring installations installed	**Complete** – 108 substation monitors installed and evidence report produced by 31st January 2013
SDRC 9.5a	30/11/2013	Establish a unique, reliable method for customer segmentation based on individual behavioural energy consumption. Produce first version of the universal customer categorisation vocabulary for DNOs	On track - Initial characterisation work finished and being combined with live project data
SDRC 9.6	31/12/2013	Build, Install and Commission the Low Voltage Modelling Environment component of the Distributed Solutions Integrator System (DSI).vocabulary for DNOs	On track – high level design compete with ICT infrastructure in place between project partners

Beyond the next reporting period, the following table lists the remaining SDRCs in chronological order:

SDRC	Due	Description
SDRC 9.2c	31/1/2014	Install and commission the Network Management component of the Distributed Solutions Integrator System (DSI)
SDRC 9.4b	31/3/2014	Install 30 thermal energy storage devices as defined in (9.4a)
SDRC 9.4c	31/3/2014	Install 25 LV connected batteries as defined in (9.4a)
SDRC 9.2d	30/4/2014	Develop and trial method of optimising network monitoring based on installation of first 100 substation monitors
SDRC 9.5b	30/4/2014	Produce first report on the testing of the various mathematically rigorous methods used, develop and produce accurate half hour resolution short, medium and long term rolling forecasts of domestic energy loads
SDRC 9.5c	30/4/2014	Aggregate and integrate the short, medium and long term forecasts and produce first report on the modelling LV load profiles
SDRC 9.8a	30/11/2014	Prepare final reports on the trials carried out on the subjects listed in "Evidence 9.8" as well as an end of project report
SDRC 9.4d	31/3/2015	Produce learnings from energy storage and power electronic deployment to assess the hypothesis as defined in (9.4a)
SDRC 9.1c	30/4/2015	30 Customers signed up to Automatic Demand Response (ADR) programme and host customer event-renew new arrangements
SDRC 9.8b	30/11/2015	Prepare final reports on the trials carried out on the subjects listed in "Evidence 9.8" as well as an end of project report
SDRC 9.8c	30/11/2016	Prepare final reports on the trials carried out on the subjects listed in "Evidence 9.8" as well as an end of project report
SDRC 9.8d	30/4/2017	Hold a project review seminar to discuss the learning from the project. Attendees will be invited including Customers, Ofgem, DNO's, product suppliers and other stakeholders to discuss the way forward

7 Learning outcomes

Ofgem guidance: The DNO should briefly describe the main learning outcomes from the reporting period. It should update Ofgem on how it has disseminated the learning it generated as part of the project over the last six months

The principle aim of the NTVV is to demonstrate that understanding, anticipating and supporting changes in consumer behaviour can help DNOs to develop an efficient network for the low carbon economy. The NTVV is structured around five Learning Outcomes (LOs) which act as the defining research questions to be answered by this project.

LO-1: **Understanding** - What do we need to know about customer behaviour in order to optimise network investment?

- LO-1.1 What is the optimum level and location of network monitoring?
- LO-1.2 To what extent can customers be categorised in order to better understand their behaviour?

LO-2: **Anticipating** - How can improved modelling enhance network operational, planning and investment management systems?

- LO-2.1 How could network headroom change as customers react to low carbon stimuli?
- LO-2.2 How can modelling outputs be fed into operational systems and processes in a meaningful manner?
- LO-2.3 How can modelling outputs be fed into planning systems and processes in a meaningful manner?
- LO-2.4 How can modelling outputs be fed into investment systems and processes in a meaningful manner?
- LO-2.5 How can network modelling outputs be fed into town planning systems and processes and vice-versa?
- LO-2.6 What changes are required to industry governance and documentation to facilitate a modelling based approach to network monitoring?

LO-3: **Optimising** - To what extent can modelling reduce the need for monitoring and enhance the information provided by monitoring?

- LO-3.1 To what extent can modelling be used in place of full network monitoring?
- LO-3.2 How might modelling assumptions change over time?

LO-4: **Supporting Change (technologically)** - How might a DNO implement technologies to support the transition to a Low Carbon Economy?

- LO-4.1 How could distributed solutions be configured into the DNO environment
- LO-4.2 How could a network management solution integrate with building management systems
- LO-4.3 How can the DNO best engage with customers to encourage demand reduction, and where on the network is each most effective
- LO-4.4 How would network storage be used in conjunction with demand Response

LO-5: **Supporting Change (commercially)** - Which commercial models attract which customers and how will they be delivered?

- LO-5.1 Large commercial
- LO-5.2 Light commercial (SMEs)
- LO-5.3 Domestic

7.1 Approach to learning capture

Packages of Work aligned to Learning Outcomes

The NTVV consists of a number of Packages of Work (PoW) which directly map to core learning outcomes and learning dissemination methods. Each PoW consists of number of components, where a component is defined as a:

Deliverable – defined activity with clear stages of implementation and completion;

Trial – aspects which require investigation and/or experimentation; or

Report – produced to formalise project outcomes, to enable the sharing of learning and outputs related to a deliverable or trial, or to address a specific evidence requirement of an SDRC (Successful Delivery Reward Criteria).

The principal mechanism for formalised learning capture draws on the methodical testing strategy and subsequent analysis within each project trial. The 'Packages of Work' (PoW) summary documents have now been reviewed by the leads on each PoW. The April Project Partner Review Board included a session to introduce the Project Trial Report template and process for completion and review at each stage. Project trials are now in development.

Learning Moments

Ad-hoc or 'process' learning from project staff continues to be captured using a learning log which partners are requested to contribute to on a monthly basis. New entries on the log for each month are discussed as 'Learning Moments' at the Project Partner Review Board. This provides an opportunity to share lessons across the different project activities, raising awareness of pitfalls to avoid/learning points to take into account and allows partners to provide advice/insights in relation to the learning.

7.2 Learning Moments

The following 'Learning Moments' have been recorded during this reporting period.

LV Modelling – academic understanding of the network and network issues

Investing time in face to face communication between academics and DNOs, has been worthwhile and opened up communication channels, for example SEPD staff have learned that their ideas for additional data analysis can often be accommodated by University of Reading. For University of Reading, creating effective bespoke customer categorisations by energy data requires DNO understanding. Well-planned meetings have enabled better understanding by academics of uncertainty on the network, and correct areas of focus for current and future work. This has informed the modelling work, including decisions on use of appropriate resolution of data from monitoring equipment and assessment of potential limitations and practicality issues with 30min resolution of smart meter data.

Training – development and evolution of approach to identifying training priorities

Development of 'Training Matrix'

A three-axis matrix was developed to plan delivery of training: on the x,y and z axes respectively are stakeholders (those who need to know ..), delivery vehicles (how we tell them …) and learning outcomes (what they need to know..). A spreadsheet with macros was designed to plot 'sweetspots' on this matrix, which can be used to inform decisions on which combinations of these variables the training Package of Work resource should be focussed on.

Training is solutions biased rather than learning outcome biased

Following development of the initial training matrix, with an axis for learning outcomes, it was recognised that it should be the solutions that are being trialled which are the starting point for determining training need not the learning outcome. Solutions, if they are implemented, will require people to do things differently and therefore will require training. This learning point led to further insights on training development, relating to how the project is delivered and learning captured:

- Solutions cut across several project activities increasing the complexity of building up a picture of their impact. As well as learning outcome project managers, there may well be a requirement for solution champions or workgroups, working across the learning outcome structure.
- In order to develop training materials, project managers need to be aware of the requirement to capture information on how a solution will be deployed. This consideration needs to be input into trial designs.

Training is not just a classroom sport – consider other methods of delivery for cost effective learning

Passing on new knowledge and skills could be an expensive task. The matrix approach has shown that virtually everyone in the DNO, their supply chain and customers need to know or do something different if the NTVV propositions become business as usual. The power of toolbox talks, tip-sheets and 'behavioural influence' was one of the insights from the Training work in this period. It is particularly interesting to note that time of use tariffs can be considered a form of training, on the basis that they may provide information to customers on the optimum time to use electricity to avoid network constraints.

Customer engagement via Your Energy Matters (Low Carbon Community Advisory Centre) and uptake of Low Carbon Promotions – the value of events

Visits from 'walk in' customers were found to be relatively low. Various methods of promoting the centre have been used including web site promotion, press releases and communication at Bracknell Forest Council public meetings. To date specific events have been found to be the most effective way of increasing traffic – significant numbers (highest 1 day total c.100) attended events promoting electric vehicles, solid wall insulation and the Green Deal, providing opportunities to raise awareness of the project with a local audience.

Events have successfully encouraged uptake of low carbon promotions in the local area e.g. five Green Deal assessments, seven 'champions' for recruitment of EV 'cluster' trial participants for the LCNF Tier 2 I2EV project (branded for the public as 'My Electric Avenue).

Weekends are the optimum time for low carbon promotions events since it is more likely that both members of two person (couple) households, with joint responsibility for significant household decisions, can attend.

Low carbon promotions work to encourage early uptake of new schemes informs scheme development and roll out

By recruiting 'early adopters' of solid wall insulation and Green Deal assessments, NTVV has enabled early learning by this sector. It is only by working through real cases that issues with initial practical delivery processes are identified, enabling refinement of schemes and processes. Real cases also provide an opportunity to set precedents relating to new policies, e.g. re-classification of solid wall insulation as permitted development provided it does not materially change building appearance requires initial cases to establish consistent interpretation of policy.

Project Management – planning and managing multiple activities with partners

Some bottlenecks in response time from one partner were seen during this period, the lesson learned from this was that initial programme planning had underestimated the impact of milestones from multiple activities on a single team in the partner organisation. Identification of this learning point is informing project planning, both on NTVV and on SEPD's side in set up of future projects.

Project Management – planning sequence of events and milestones

There were several lessons learned relating to project planning for IT systems development, based on practical experience of project delivery. Firstly, the time required to capture, document and review requirements was underestimated. More generous estimates should be used for this activity in future projects. Secondly, User Acceptance Testing for the LV network modelling environment was planned to occur shortly after requirements capture. While sound in principle (approach for functionality was well understood), in practice, this activity should have been scheduled later, as it was difficult to achieve for software which had not yet been designed.

Similarly, customer training was scheduled ahead of software development. In practice, it was not possible to produce training materials or conduct training until development had been completed.

Hosting issues – communication of data security requirements

Explicit communication and checks on mutual understanding of requirements are essential. While both parties felt data security requirements were generally known and well understood, it was learned that the Penetration test requirement for the hosted modelling environment could have been more effectively communicated – its location on a shared infrastructure meant that testing had to be synchronised with other customers, causing some delay. Earlier awareness of the requirement could have avoided this.

End point monitoring – understanding implication of upgrades

The project offered a possibility to upgrade meters rolled out (with a firmware change). While this proved to be very valuable, the implications for data collection were not fully considered. It was found that depending on the content of the firmware change, the values measured and stored on the meters could get overwritten. While communication to the Head End system is not activated, data overwritten in this way is lost.

ADR trial participant recruitment – engagement process

Various lessons have been learned through the process of recruiting participants to the ADR trials in relation to effectiveness of methods used and steps which need to be built into the process

<u>Effectiveness of one to one meetings</u>

One to one enrolment meetings have been found to be the most effective means of engagement as these provide the means to answer customers' specific questions (and an appropriate environment for customers to ask these questions) and to explain the programme in detail. While methods such as letters, website promotion, press releases and proactive calls have been trialled, no recruitment has been achieved without a face-to-face meeting. However, the team report anecdotal evidence that they have found these early multi-method outreach activities and ongoing communications have helped customers understand the ADR programme, the NTVV project and their role in participating. Early outreach activities have also helped 'warm up' the potential audience.

<u>Tailoring the 'sales pitch' to the different customer groups</u>

To date large corporate clients and public sector/educational institutions have been most receptive to engagement.

Corporate clients value the corporate social responsibility (CSR) benefits to their brand and are willing to spend time and resources on getting their buildings 'ADR ready', as they see potential for overall eventual savings through roll out to a number of buildings if they have a large estate.

Public sector/educational customers are also receptive to potential CSR benefits and the potential for learning/awareness raising on energy issues for their building users.

Smaller local businesses are less receptive to the same messages. They may not have a large enough estate or brand to see the same long term benefits and therefore cannot justify the time required to gather information required for pre-audit and to review legal conditions without a financial

incentive for participation. Also their buildings are less likely to meet minimum requirements, or don't have the control required in existing BMS.

Asking the right questions at the right stage

Requesting a list of documents at the first meeting with a potential customer can bring down the subsequent pre-audit and qualification stage to within a week. Documents to request include asset lists and schematics of mechanical and electrical equipment.

Similarly presenting the Installation and DR Programme agreement for review by the customer's legal deptartment should be as early as possible since approval takes the longest of all activities in the enrolment process.

Site audits – data security issues need to be introduced early

Potential ADR customers need to be made aware of the stability and security aspects of load shed strategies and transferring data out of the building. It has been found that discussions at the site audit stage need to cover internet protocols involved and internet access from the building, to ensure that appropriate systems are in place. Including advice at this stage on how customers can better secure their buildings (from a cybersecurity point of view) can add value to the process for customers.

Build time for identification and fixing of backlog maintenance issues into enrolment process, after pre-audit and prior to installation

Many issues arise in older buildings due to backlog maintenance which can hold up the smooth installation of the ADR controller. It is very difficult to identify the issues during a pre-audit and only after proper inspection can the problems be identified.

To date every building except one (Bracknell and Wokingham College) has required some update/maintenance work to make it 'ADR ready' - lack of single BMS to control all systems is common problem reducing potential load shed. Honeywell have introduced 'cost per kW shed' business cases based on this learning.

Substation monitoring – GPRS communications

GPRS SIM cards in devices installed in areas of low signal strength may latch onto GSM base stations. This will result in slower data transfer, which may not be a problem, but the protocol with which the GSM system operates allows the communications to close unless the device triggers it. This could mean no data will be received unless someone visits the site and triggers an alarm in the substation monitor. The Real Time Systems team have been made aware of this issue and are looking for a solution within the project. Smart meter rollout may experience the same issues.

7.3 Dissemination Activities

A dissemination log is maintained to capture details of activities project staff have undertaken to share learning from the project. Staff are encouraged to record details of outcomes and recommendations from the activities they participate in. The dissemination log is reviewed at monthly Project Partner Review Boards in the same way as the learning log. The table below shows the main dissemination activities which have been completed in this period and highlights are noted for some activities to give an overview of dissemination impacts:

Academic workshop - LV Clustering (February 2013), University of Reading

Engagement event for local business community, GE Smart Grid Centre (February 2013), SEPD, Honeywell

Ongoing engagement event for local business community to learn more about smart grid and low carbon technologies and benefits to businesses through tour and case study presentation, also

recognition of NTVV ADR trial participants' contribution to project with awards.

Presentation to Ofgem on learning to date from NTVV (March 2013), SEPD

Focused on end-point monitors, substation monitors, the low carbon community advisory centre, use case analysis for the distribution management system, automatic demand response, electronics and batteries and smart control. The open-format presentation was present by project leads in customer engagement, engineering hardware, ICT systems and smart control.

'Powering up for the 21st Century: How Will Smart Grid Affect your Asset Management Strategy? – Electricity distribution case study' at Asset Management in an Uncertain World, Institute of Asset Management Conference (March 2013), GE

Smart Grids Workshop for Electricity Supply Board (ESB), Ireland (March 2013), GE

NTVV architecture featured as case study of what is achievable through demonstration. Follow up requested by ESB to learn more about what is possible on their networks

Presentation on 'New Thames Valley Vision' at Sustainability Live, Birmingham (April 2013), SEPD

Series of events to promote Low Carbon Technologies at Your Energy Matters Centre, Bracknell Forest Council

- Green Deal Day (March 2013)
- Zest Solid Wall Insulation (2 events, April & May 2013)
- My Electric Avenue (I2EV) Day (May 2013)

Academic workshop series - Advanced analytics methods for load forecasting, customer segmentation and battery control (May 2013), University of Reading

Findings from other LCNF work (WPD FALCON) and European researchers provided comparative insights from different approaches which serve to put the NTVV findings to date into context e.g. Swiss work on classification of households by socio-economic category using energy consumption. Knowledge sharing with academic specialists ensures NTVV methods and findings are taken into account in ongoing smart grid research.

Poster presentation on 'Evaluating individual load forecasts' at Optimisation and Big Data workshop, University of Edinburgh (May 2013), University of Reading

This presentation discussed issues when predicting individual vs. aggregated energy profiles, development of new measures for evaluation and creation of fast algorithms for real-time error and forecast computation. The aim was to seek peer review/validation of the novel methods developed for NTVV. A lot of positive feedback was received and new national and internal contacts were made who gained awareness of project for first time. New contacts will be invited to future events in University of Reading's workshop series.

Presentation on 'How and why a DNO would implement LV network monitoring and Active Network Management' at GE Digital Energy – International Software Summit (May 2013), SEPD

This presentation was very well received. The focus on practical experience and lessons learned from a DNO was valued by the audience and provided useful insights on practicalities to product developers e.g. time for installation and commissioning of monitoring equipment found to be longer than expected by manufacturer, allowing potential for adaptations to reduce time taken.

Presentation on 'Lessons Learned from UK Low Carbon Networks' at GE Digital Energy – International Software Summit (May 2013) , SEPD and Honeywell

SE Carbon Action Network visit to Your Energy Matters Centre (May 2013), Bracknell Forest Council
Climate Berkshire visit to Your Energy Matters Centre (May 2013), Bracknell Forest Council This event and previous event provided an opportunity for Local Authority sustainability/sustainable energy staff from the wider south east regional area to learn about project and the type of opportunities there are to work with DNOs on shared objective of meeting Carbon Plan aims.

8 Business case update

Ofgem guidance: The DNO should note any developments or events which might affect the benefits to be gained from the Second Tier project. Where possible the DNO should quantify the changes these developments or events have made to the project benefits compared to those outlined in the full submission proposal.

Scottish and Southern Energy Power Distribution's (SSEPD) core purpose is to provide the energy people need in a reliable and sustainable way. To achieve this, our delivery priority is to deliver upgraded electricity transmission networks, operational efficiency and innovation in electricity and gas distribution networks as they respond to the decarbonisation and decentralisation of energy. Through its learning outcome approach NTVV has been designed to feed into and update this business plan by:

- In the short term providing a benchmark network in which the implications of disruptive technologies can be assessed and scaled.
- Allow us to cost and plan the monitoring of our network with the optimal level of low cost equipment and communications infrastructure taking full account of the longer term input from Smart metering data.
- Allow us to produce short, medium and long term models of investment requirements for a range of disruptive technology penetration levels
- Provide us with an evaluation, technical, economic and commercially, of a range of innovative network management tools releasing capacity on the network.
- Provide a template into which solutions from other SSEPD and other DNO projects can be fed to allow comparative evaluation and inform solution selection for inclusion in our business plan.
- Quantify and define resource requirements including staff and contractor skill sets to support the roll out of the business plan.
- Generate new processes, standards and procedures that are required to implement the NTVV approach as business as usual.

Our experience shows us that whilst individual technical and commercial solutions may be challenging, the real challenges emerge when these solutions are scaled up. This is the driver behind the creation of a network operations and planning environment, which in essence performs three critical functions:

- Creates the environment in which planners, operational staff and business systems will interact with the data derived from and solutions implemented in the project.
- Allows the flow of information from DNO legacy systems to the new solutions to reap the benefit of existing system information e.g. connectivity, circuit ratings, system operational state.
- Seamless integration of new solutions into core business and real time system allowing control along side traditional systems using the same staff infrastructure e.g. control rooms, planning tools.

SSEPD has not noted any developments or events which might affect the wider business case outlined above and as detailed in the full submission proposal but as an individual project, focussed on delivering learning outcomes, SSEPD has not at this stage identified any direct financial benefit likely to be gained through delivery of this specific project.

As indicated in the Bid Submission business case, SEPD has now joined with other European DSOs and academic institutions to draw on the outputs of the NTVV and similar projects through the DISCERN FP7 project. The main objective of DISCERN is the enhancement of European distribution grids with technical and organisational solutions for the optimal level of smart grid intelligence. DISCERN will provide DSOs with a better understanding of best-practise system solutions for monitoring and control. Based on the recommendation from DISCERN, DSOs will be enabled to implement solutions that have been tested and validated in various countries and circumstances. DISCERN will provide insights into the optimal level (amount) of observability on the LV/MV network. More details of this project can be found at the project's website http://www.discern.eu/

9 Progress against budget

Ofgem guidance: The DNO should report on expenditure against each line in the Project Budget, detailing where it is against where it expected to be at this stage in the project. The DNO should explain any projected variance against each line total in excess of 5 per cent.

Project expenditure is within the budget defined in the Project Direction. The table below details expenditure against each line in the Project Budget and compares this with planned expenditure to date[4]. Projected variances are are also listed for changes >5% .

	Budget	Expenditure ITD (£K)	Comparison with expected expenditure	Projected Variance (at project conclusion)		
				(£K)	%	#
LABOUR	**5,932.76**	**1,459.86**	**-12.4%**	**160.00**	**2.7**	
Project and ICT management	1,236.45	463.42	-12.0%	0.00		
Project engineering (monitoring, energy management & network design)	1,387.60	430.15	-9.5%	0.00		
Network Field Resources	610.00	34.76	-4.5%	0.00		
Customer, commercial and knowledge management	826.10	198.24	-17.0%	160.00	19.4	3
ICT architecture	358.13	193.40	-10.9%	0.00		
ICT field resource	1,514.48	139.88	-19.1%	0.00		
CONTRACTORS	**8,710.71**	**2,965.85**	**-19.4%**	**153.15**	**1.8**	
LV network monitoring installation	718.00	99.68	-57.1%	0.00		
HV network monitoring equipment	65.00	0.00	-	0.00		
Battery storage installation	458.00	0.00	-	0.00		
Communications	100.00	0.00	-	0.00		
Smart analytics	1,926.80	274.41	-23.3%	0.00		
Integration of monitoring, modelling and management	3,844.07	2,044.72	-12.8%	171.35	4.5	2
Automatic demand response	333.88	227.06	-10.0%	-18.20	-5.5	1
Learning dissemination, website and low carbon community centre	203.00	85.40	-25.9%	0.00		
Integration activities to support DNO business as usual	785.70	61.31	-59.3%	0.00		
Real-time systems and information technology equipment	122.76	63.12	-30.7%	0.00		
Customer, commercial and knowledge management	80.00	56.29	0.1%	0.00		
ICT field resource	73.50	53.86	32.8%	0.00		

[4] Expenditure is compared with a dynamic assessment of project phasing which reflects the nature of specific contract payments and physical delivery milestones. A comparison of expenditure with phased budget will often indicate a payment lag due to the nature of invoicing processes.

EQUIPMENT	**4,526.44**	**1,736.45**	**1.1%**	**-219.92**	**-4.9**	
LV network monitoring equipment	1,318.92	627.18	4.4%	34.05	2.6	2
HV network monitoring equipment	111.20	0.00	-	0.00		
Communications	417.00	87.01	0.0%	0.00		
Battery storage equipment	1,100.00	0.00	-	0.00		
Integration of monitoring, modelling and management	435.75	234.99	0.0%	-200.76	-46.1	2
Automatic demand response	755.87	505.39	0.0%	-53.21	-7.0	1
Thermal storage	80.00	5.22	-12.3%	0.00		
Real-time systems and information technology equipment	307.70	276.67	-2.3%	0.00		
IT	**4,043.53**	**298.71**	**-43.4%**	**288.99**	**7.1**	
Integration of monitoring, modelling and management	2,650.37	226.31	0.0%	217.59	8.2	2
Automatic demand response	909.44	0.00	-	71.41	7.9	1
Learning dissemination, website and low carbon community centre	1,352.97	40.00	0.0%	0.00		
ICT Field Resource	328.92	32.41	0.0%	0.00		
TRAVEL & EXPENSES	**335.22**	**32.30**	**8.7%**	**-222.22**	**-66.3**	
Integration of monitoring, modelling and management	222.22	0.00	-	-222.22	-100	2
General	113.00	32.30	8.7%	0.00		
PAYMENTS TO USERS	**591.00**	**0.00**	**-**	**0.00**		
Payments to Users	591.00	0.00	-	0.00		
DECOMMISSIONING	**392.00**	**0.00**	**-**	**0.00**		
Network field resources	50.00	0.00	-	0.00		
LV network monitoring decommissioning	332.00	0.00	-	0.00		
Customer, commercial and knowledge management	10.00	0.00	-	0.00		
OTHER	**988.38**	**200.96**	**-8.7%**	**-160.00**	**-16.2**	
Land	160.00	0.00	-	0.00		
Learning dissemination, website and low carbon community centre	272.60	86,383.31	-8.0%	0.00		
Real-time systems and information technology equipment	423.03	113,058.41	-9.5%	-160.00	-37.8	3
ICT field resource	132.75	1,520.72	12.4%	0.00		

Notes:

1 Movement of cost allocations within the activity “Automatic Demand Response” to better reflect the nature of project costs/milestone payments. No substantive change in overall in cost of activity.
2 Movement of cost allocations within the activity “Integration of monitoring, modelling and management” to better reflect the nature of project costs/milestone payments. Travel & Expenses not treated as exceptional items within the performance of this activity. No substantive change in overall in cost of activity.
3 Detailed design has identified savings in some licensing costs. Budget reallocated to enhance customer experience through full-time staffing at high street outlet. No substantive change in combined cost of activities.

10 Bank account

Ofgem guidance: The DNO should provide a bank statement or statements detailing the transactions of the Project Bank Account for the reporting period.
Where the DNO has received an exemption from Ofgem regarding the requirement to establish a Project Bank Account it must provide an audited schedule of all the memorandum account transactions including interest as stipulated in the Project Direction.

Transaction details for the NTVV Project Bank account during this reporting period are listed in the Appendix. This extract has been redacted to protect the financial details of transacting parties; the full, un-altered copy has been submitted in a confidential appendix to Ofgem.

A summary of the transactions to date are shown in the table below:

Description	**Totals** (project inception to end of May 2012)
Northern Electric Distribution Limited	£1,190,000.00
Yorkshire Electricity Distribution Plc	£1,710,000.00
Scottish Hydro Electric Power Distribution Plc	£560,000.03
Southern Electric Power Distribution	£5,700,000.00
Southern Electric Power Distribution (10% contrib)	£2,701,002.00
SP Distribution Limited	£1,150,000.00
SP Manweb Plc	£1,130,000.00
Eastern Power Networks Plc	£1,980,000.00
London Power Networks Plc	£1,710,000.00
South Eastern Power Networks Plc	£1,690,000.00
Western Power Distribution (Midlands East) Plc	£0.00
Western Power Distribution (Midlands West) Plc	£0.00
Western Power Distribution (South Wales) Plc	£0.00
Western Power Distribution (South West) Plc	£4,370,000.00
Interest Received	£24,869.98
Payments out of account	-£6,366,390.42
Balance	**£18,419,481.59**

11 Intellectual Property Rights (IPR)

Ofgem guidance: The DNO should report any IPR that has been generated or registered during the reporting period along with details of who owns the IPR and any royalties which have resulted. The DNO must also report any IPR that is forecast to be registered in the next reporting period.

In commissioning project partners to commence project activities, the NTVV has applied the default IPR treatment to all work orders (as defined in the Low Carbon Networks Fund Governance Document v.5, Section 2). This will ensure IPR which is material to the dissemination of learning in respect of this project is controlled appropriately.

No Relevant Foreground IPR has been generated or registered during the December 2012 – June 2013 reporting period. No Relevant Foreground IPR is forecast to be registered in the next reporting period.

The NTVV intends to gather details of IPR through the structure of individual project trials. Specifically, in concluding a project trial the following details will be gathered: 1) what components required for trial replication and, 2) what knowledge products required for trial replication. Likewise in configuring the overall system architecture and underlying business process to enable the NTVV, a methodology to use conventional Business Process Mapping approaches to reveal IPR artefacts is being explored.

12 Other

Ofgem guidance: Any other information the DNO wishes to include in the report which it considers will be of use to Ofgem and others in understanding the progress of the project and performance against the SDRC.

No further details.

13 Accuracy assurance statement

Ofgem guidance: DNO should outline the steps it has taken to ensure that information contained in the report is accurate. In addition to these steps, we would like a Director who sits on the board of the DNO to sign off the PPR. This sign off must state that he/she confirms that processes in place and steps taken to prepare the PPR are sufficiently robust and that the information provided is accurate and complete.

This Project Progress Report has been prepared by the Project Delivery Manager and reviewed by the Project Director before sign-off by the Director of Distribution, who sits on the Board of SEPD.

This report has been corroborated with the monthly minutes of the Project Steering Group and the Project Partners Review Board to ensure the accuracy of details concerning project progress and learning achieved to date and into the future. Financial details are drawn from the SSE group-wide financial management systems and the project bank account.

Prepared by:	Nigel Bessant	Project Delivery Manager	10th June 2013
Recommended by:	Nigel Bessant	Project Delivery Manager	10th June 2013
Reviewed by:	Stewart Reid	Project Director	11th June 2013
Final sign-off:	Stuart Hogarth 	Director of Distribution	17/6/13

Appendix - Redacted copy of bank account transactions

Bankline

RBS The Royal Bank of Scotland

Statement for account **-**-** ******** from 01/12/2012 to 11/06/2013

Short name:	**********	Currency:	GBP
Alias:	**********	Account type:	SPECIAL INT BEARING
BIC:	********	Bank name:	NATIONAL WESTMINSTER BANK
IBAN:	**********	Bank branch:	**********

Date	Narrative	Type	Debit	Credit	Ledger balance
	CLOSING BALANCE				**18,419,481.59Cr**
30/05/2013	SOUTHERN ELECTRI NTVV COSTS	EBP	669,577.88		18,419,481.59Cr
28/03/2013	SOUTHERN ELECTRI NTVV COSTS	EBP	1,504,938.27		19,089,059.47Cr
28/03/2013	R B S-SP DISTRIBUT LOW CARBON NETWORK	BAC		95,833.33	20,593,997.74Cr
28/03/2013	R B S-SP MANWEB LOW CARBON NETWORK	BAC		94,166.67	20,498,164.41Cr
28/03/2013	SOUTH EASTERN POWE LOW CARB NETWORKS	BAC		140,833.33	20,403,997.74Cr
28/03/2013	EASTERN POWER NETW LOW CARB NETWORKS	BAC		165,000.00	20,263,164.41Cr
28/03/2013	LONDON POWER NETWO LOW CARB NETWORKS	BAC		142,500.00	20,098,164.41Cr
28/03/2013	NORTHERN ELECTRIC LCNF	BAC		142,500.00	19,955,664.41Cr
28/03/2013	NORTHERN ELECTRIC LCNF	BAC		99,166.67	19,813,164.41Cr
28/03/2013	ELECTRICITY NORTH ELECTRICITY NW ********** **********	BAC		72,500.00	19,713,997.74Cr
28/03/2013	**********	INT		10,294.67	19,641,497.74Cr
25/03/2013	/RFB/WPD LCNF PA ********** WESTPOWSWEST	CHP		364,166.67	19,631,203.07Cr
22/03/2013	SCOTTISH HYDRO-E TVV COSTS	EBP		46,666.67	19,267,036.40Cr
11/03/2013	SEPD PLC-INCOME A/ MARCH TVV TRANSFER	EBP		475,000.00	19,220,369.73Cr
08/03/2013	SEPD PLC-INCOME A/ MAR TVV TRANSFER	EBP		225,083.50	18,745,369.73Cr
28/02/2013	R B S-SP DISTRIBUT LOW CARBON NETWORK	BAC		95,833.33	18,520,286.23Cr
28/02/2013	R B S-SP MANWEB LOW CARBON NETWORK	BAC		94,166.67	18,424,452.90Cr
28/02/2013	SOUTH EASTERN POWE LOW CARB NETWORKS	BAC		140,833.33	18,330,286.23Cr
28/02/2013	EASTERN POWER NETW LOW CARB NETWORKS	BAC		165,000.00	18,189,452.90Cr
28/02/2013	LONDON POWER NETWO LOW CARB NETWORKS	BAC		142,500.00	18,024,452.90Cr
28/02/2013	NORTHERN ELECTRIC LCNF	BAC		142,500.00	17,881,952.90Cr
28/02/2013	NORTHERN ELECTRIC LCNF	BAC		99,166.67	17,739,452.90Cr
	BALANCE BROUGHT FORWARD				**17,640,286.23Cr**

NB: Transactions with today's date may still be subject to confirmation and may subsequently be reversed from your account.

Date	Narrative	Type	Debit	Credit	Ledger balance
	BALANCE CARRIED FORWARD				**17,640,286.23Cr**
28/02/2013	ELECTRICITY NORTH ELECTRICITY NW ********** **********	BAC		72,500.00	17,640,286.23Cr
25/02/2013	/RFB/WPD LCNF PA ********** WESTPOWSWEST	CHP		364,166.67	17,567,786.23Cr
22/02/2013	SCOTTISH HYDRO-E TVV COSTS	EBP		46,666.67	17,203,619.56Cr
11/02/2013	SEPD PLC-INCOME A/ FEB TVV TRANSFER	EBP		475,000.00	17,156,952.89Cr
08/02/2013	SOUTHERN ELECTRI NTVV COSTS	EBP	810,780.12		16,681,952.89Cr
08/02/2013	SEPD PLC-INCOME A/ FEB TVV TRANSFER	EBP		225,083.50	17,492,733.01Cr
28/01/2013	SOUTH EASTERN POWE LOW CARB NETWORKS	BAC		140,833.33	17,267,649.51Cr
28/01/2013	EASTERN POWER NETW LOW CARB NETWORKS	BAC		165,000.00	17,126,816.18Cr
28/01/2013	LONDON POWER NETWO LOW CARB NETWORKS	BAC		142,500.00	16,961,816.18Cr
28/01/2013	NORTHERN ELECTRIC LCNF	BAC		142,500.00	16,819,316.18Cr
28/01/2013	NORTHERN ELECTRIC LCNF	BAC		99,166.67	16,676,816.18Cr
28/01/2013	SCOTTISH POWER ********** SP MANWEB PLC	CHP		94,166.67	16,577,649.51Cr
28/01/2013	SCOTTISH POWER ********** SP DISTRIBUTION LTD CHAPS TFR	CHP		95,833.33	16,483,482.84Cr
28/01/2013	ELECTRICITY NORTH ELECTRICITY NW ********** **********	BAC		72,500.00	16,387,649.51Cr
25/01/2013	/RFB/WPD LCNF PA ********** WESTPOWSWEST	CHP		364,166.67	16,315,149.51Cr
24/01/2013	SCOTTISH HYDRO-E TVV COSTS	EBP		46,666.67	15,950,982.84Cr
14/01/2013	SEPD PLC-INCOME A/ JAN TVV TRANSFER	EBP		475,000.00	15,904,316.17Cr
11/01/2013	SEPD PLC-INCOME A/ JAN TVV TRANSFER	EBP		225,083.50	15,429,316.17Cr
31/12/2012	**********	INT		7,955.59	15,204,232.67Cr
28/12/2012	SOUTH EASTERN POWE LOW CARB NETWORKS	BAC		140,833.33	15,196,277.08Cr
28/12/2012	EASTERN POWER NETW LOW CARB NETWORKS	BAC		165,000.00	15,055,443.75Cr
28/12/2012	LONDON POWER NETWO LOW CARB NETWORKS	BAC		142,500.00	14,890,443.75Cr
28/12/2012	NORTHERN ELECTRIC LCNF	BAC		142,500.00	14,747,943.75Cr
28/12/2012	NORTHERN ELECTRIC LCNF	BAC		99,166.67	14,605,443.75Cr
	BALANCE BROUGHT FORWARD				**14,506,277.08Cr**

Date	Narrative	Type	Debit	Credit	Ledger balance
	BALANCE CARRIED FORWARD				**14,506,277.08Cr**
28/12/2012	SCOTTISH POWER ********** SP DISTRIBUTION LTD CHAPS TFR	CHP		95,833.33	14,506,277.08Cr
28/12/2012	SCOTTISH POWER ********** SP MANWEB PLC	CHP		94,166.67	14,410,443.75Cr
28/12/2012	ELECTRICITY NORTH ELECTRICITY NW ********** **********	BAC		72,500.00	14,316,277.08Cr
27/12/2012	/RFB/WPD LCNF PA ********** WESTPOWSWEST	CHP		364,166.67	14,243,777.08Cr
24/12/2012	SOUTHERN ELECTRI NTVV COSTS	EBP	394,579.09		13,879,610.41Cr
21/12/2012	SCOTTISH HYDRO-E TVV COSTS	EBP		46,666.67	14,274,189.50Cr
14/12/2012	SEPD PLC-INCOME A/ DEC TVV TRANSFER	EBP		225,083.50	14,227,522.83Cr
10/12/2012	SEPD PLC-INCOME A/ DEC TVV TRANSFER	EBP		475,000.00	14,002,439.33Cr
	OPENING BALANCE				**13,527,439.33Cr**
Totals			**3,379,875.36**	**8,271,917.62**	

NB: Transactions with today's date may still be subject to confirmation and may subsequently be reversed from your account.