Scottish and Southern Energy Power Distribution

New Thames Valley Vision

PROJECT PROGRESS REPORT

Project Number	SSET2003
DNO	Southern Electric Power Distribution Ltd
Reporting Period	June 2014 to December 2014

Bracknell Forest Council

ea technology

DNV·GL

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. During the past six months the trials using the commissioned systems have continued and the first outcomes from the results of the trials have been reported. A short summary of delivery achievements against each of the core learning outcomes is given below:

Learning Outcome: Understanding

The project continues to collect energy use data from customers and substations and has now gathered over two years of energy usage data giving an improved view of how energy is used and produced on the LV network. For domestic customers the data gathered from end point monitoring has been utilised to begin to create buddied and forecasted load profiles for customers without monitoring equipment installed. Data collected from 31 customers with hot thermal storage devices installed has been analysed to identify the nature of photovoltaic (PV) generation peaks on the LV network. At this stage, there is a good body of evidence to suggest that this method of peak PV export management can be effective on an individual and concentrated basis. The smart cut out fuse monitor has undergone some firmware modifications to ensure it aligns to the functional requirements of the already deployed end point monitors and has equivalent data security measures in place. The third and final tranche of substation monitoring equipment is now being installed into targeted sites to support the remaining project trials.

Learning Outcomes: Anticipating and Optimising

During this period the project has been utilising the commissioned Network Modelling Environment (NME) to deliver the trials and studies to begin to identify how low carbon technologies may affect local networks based on varying levels of uptake. The main area of initial focus for the trials has been on the effect of electric vehicles and PV installations on local networks. To achieve this modelling the team have allocated load profiles to all domestic customers across the study area, which has enabled

the model to be augmented with scenarios of high penetration, clustered electric vehicle charging and hence the effect on the network identified. Initial results from the modelling work reveal that even under the clustered high Electric Vehicle (EV) uptake scenario by 2022 the impacts on the low voltage distribution network are relatively small. There were no voltage issues identified and only a small number of thermal capacity issues. During this period a desktop exercise into the scalability and replicability of the Distribution Management System has been concluded based on the project findings. The result of this analysis is that a similar DMS to accommodate LV SCADA could be created for a full licence region in around 12 months based on the NTVV delivery model.

Learning Outcome: Supporting Change

The demand side response for commercial load reduction has now signed up the 30 customers required to fulfil the trials in full. The installed customers have continued to participate actively in regular load shed events during the reporting period and analysis of the data from the extensive load shedding strategy initiated in January 2014 has been undertaken. This has shown a correlation between temperature and the quantity of load a customer can shed using ADR. There has been only one example of a customer logging any difficulties experienced during a longer load shed and further trials will validate the point at which participants notice an environmental impact in their building. Based on the evidence available to date, the time when a load shed notification is sent has no recordable impact on the participants' ability to respond to the request. The project will be verifying this outcome as the trials are extended over the next two years. The installation of 30 hot thermal storage units has proved a success and the project is moving to identify additional project participants to adopt this technology. The data from the additional units will be valuable in ensuring the results to date are valid across a larger sample. The Energy Storage and Management Units (ESMUs) have undergone further design modifications to ensure they meet the high standards required by SSEPD of any equipment to be installed as street furniture. The new methodology for assessing the merit of a cold thermal storage solution to defer peak loads has been assessed by project partners and all other Distribution Network Operators (DNOs). This external scrutiny has given the project additional assurance that the learning gathered from trialling this form of technology will deliver value to other DNOs.

Stakeholders

The Low Carbon Community Advisory Centre has closed as scheduled and analysis of the performance and success of the centre has been completed. The centre proved to be a valuable method of engaging with project participants and the wider public - giving energy efficiency advice in addition to news and updates about the project. Customers with hot thermal storage devices have received personalised data postcards which highlight their individual change that result from diverting their generated solar power into their hot water tanks. In addition to domestic customers, the project engaged with organisations related to new planning consents and new housing developments to identify whether the use of modelling techniques could reduce the time to obtain firm connection agreements.

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 given here:

Risk Description (Category & specific activity)	**Further details and impact**	**Controls**
Recruitment		
'High-density' end-point monitoring	A revised recruitment approach to engage a high proportion of customers on an LV feeder has been trialled. This has increased the number of participating customers but has not, to date, reached the 80% target level. There is a risk that coverage cannot meet 80% which would reduce the statistical confidence in the analysis of load aggregation methods.	A locally responsive recruitment approach is ongoing - consistent with the Customer Engagement Plan If only areas with less than 80% density can be formed, the project will seek to create more areas at lower densities as an alternative approach to this analysis.
Subsequent phases of hot-thermal storage trials	Subsequent deployments of hot thermal storage equipment are underway to test strategies for areas with concentrations of solar panels. There remains a risk that customers within the identified areas do not wish to, or cannot have a management unit installed. Whilst this would be disappointing from a technical demonstration perspective it would still represent valuable learning since customer acceptance is an essential part of the overall solution. Discussions with property developers have concluded that the use case where this technology would be deployed alongside concentrated PV as part of new build housing has little relevance since developers have indicated that PV is not a selling point	Further areas with appropriate levels of solar panel concentration being identified with recruitment targeted at individual homes. Equipment manufacturer engaged to ensure data capture and analysis is being used to best extent and has the potential to be extrapolated to circumstances beyond those monitored in the NTVV project.

Risk Description (Category & specific activity)	Further details and impact	Controls
	and even if it were, the developer would prefer to use larger service cables rather than increase the onsite electrician costs associated with additional management equipment.	
Procurement	None	None
Installation Energy Storage and Management Units	The manufacture reports additional delays to production and delivery as the result of further final design reviews. The potential for non-delivery against the revised schedule remains. However, at this stage, installation as per the revised timeline can still be met.	Twice weekly calls with manufacturer, close scrutiny on design modifications and heightened delivery milestones and evidence of completion of criteria
Other	None	None

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 below:

Key learning outcomes

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

- End Use and Network Monitoring Evaluation
- Demand Side Response Evaluation
- Network controlled Automated Demand Response Evaluation & Energy Efficiency
- LV Network Storage (Hot Thermal Storage)
- EV Chargers Usage Evaluation and Issues
- Smart Meter Performance
- Integration Solution Control Evaluation
- Overall Proven Benefits of modelling both financial and customer service

In addition, the following 'Learning Moments' (ad hoc and process related learning) are captured:

- Knowledge gained from substation monitoring installations and environmental considerations
- The business case for Demand Side Response must consider upstream benefits for voltages
- Definition of functional requirements for delivery of new software
- The uncertainty over the level of anticipated EV uptake
- Clear and concise wording and expectation in customer contracts
- The accuracy of creating 'buddied' profiles using a smaller data set
- Assumptions of ADMD minimum of zero could change based on customer numbers

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 a Successful Delivery Reward Criteria (SDRC).

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

Summary of Third Party targeted dissemination

A summary of both internal and external dissemination events can be found below. (For further details please see section 7.2):

- Presenting to local schools on the project at year group assemblies on the project
- Workshop on the effects of electric vehicles on the LV network
- A street barbecue event was held to meet local residents and engage customers
- LCNF project progress presentation to DECC
- Focus group held with the 'Eco-Group' at a local school
- Poster on LV Energy Storage at the HubNet Smart Grid Symposium
- LV Network Workshop presenting papers based around academic proposals on LV network modelling and management
- A presentation given to IMechE on energy storage being
- An interview given to ITN on the projects Automated Demand Response (ADR) programme
- A tour of a flagship green Waitrose store for project participants
- A presentation to the IET on energy storage, the route of least resistance?
- A demonstration of the integrated NME and DMS to a Turkish network operator
- Three presentations given at the LCNI conference on ADR, data and analytics and energy storage and smart control of LV connected ESMUs.
- A poster on hot thermal storage at the SSEPD stand at the LCNI conference
- A presentation given to the IET on the energy storage

DNO Internal targeted dissemination

SSEPD 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. The project continues to work closely with the business to ensure any learning is passed to business transformation projects and programmes to deliver value and enhance the service offered to customers.

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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. Having established the majority of the proposed hardware and systems, the project has successfully identified and reported on the associated key findings. The project has now begun a detailed phase of trials which will test and evaluate the relative advantages and/or disadvantages of these technologies and systems. As the project progresses a number of key customer participation and engagement activities remain – these are being carefully managed to ensure successful outcomes and to also ensure learning is captured for future application.

The project is keen to share this information 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. The project now has data from some customers for over two years and this data is being used to identify how customers can be categorised based on their energy consumption and their projected use, and then to create load profiles from this source data. The installed units have suffered a small percentage of communication issues which the team have been actively resolving over the reporting period. The devices selected hold up to two years data locally and as such no data was lost. Priority was given to devices approaching the two year anniversary of installation and all data was extracted manually.

An additional form of end point monitoring device known as the Smart Cut Out Fuse is being readied for deployment on the project to support the aggregation trials by delivering a flexible device which can be installed in a high density scenario. The Senical Supply Point Monitor (SPM) has been selected to deliver the high density monitoring; this device has now passed all of the electrical safety tests required and the final phase of internal authorisations of the device and the head end system are

being readied for the customer installations in 2015. The first unit was received by SSEPD for testing of communication to the head end system in September and this unit has been used to validate the reading accuracy in conjunction with a spare end point monitor.

Substation monitoring

(Core learning outcome: Understanding)

In conjunction with the end point monitors, the first tranche of 100 substation monitors has been installed for over two years. This has given the project detailed view into the use of energy at LV substations. During this reporting period upgrades have been performed on devices with communications issues to install dual UMTS/GSM GPRS routers and revised firmware has been rolled out to restore communications automatically when connectivity to the GPRS tunnel is lost. The firmware and internal router hardware upgrades have significantly improved the reliability of the devices connection to the DMS and ensured that the granular high frequency polled data is retained in the data historian. Additionally a third tranche of substation monitors has been delivered, configured, pre-commissioned and the installation of these monitors on-site is progressing through December. At the time of writing, 20 sites from the third tranche had been successfully commissioned on-site taking the total installed device count to 260.

In addition to the high frequency data needed by the academic project partners to deliver the smart analytics work of aggregation and forecasting, the substation monitoring deployments have shown potential to provide support to everyday operations and maintenance.

Characterisation

(Core learning outcome: Understanding)

The majority of the detailed work on the characterisation of domestic and small to medium sized enterprises (SMEs) is now complete. The work delivered under this characterisation has been utilised directly to inform the buddying of customers to create load profiles for the low carbon technology modelling activities.

Over this reporting period the characterisation of SME customers was based on their operational hours, their mean daily use (calculated from their quarterly meter readings), and smart meter data from other SMEs. Five distinct clusters have been defined by mean daily usage. The operational hours of the business can be obtained from the internet and used to inform the analysis. Whilst this methodology is practicable for use on a small scale project need, for a wider deployment of these techniques a new mechanism for identifying hours of business would be required.

Network Modelling Environment

(Core learning outcome: Anticipating)

The NME combines a Geographical Information System (GIS) Electric Office with a power flow analysis tool (Cymdist) to enable the LV network to be studied from a single interface. The effects of applying particular energy usage profiles are calculated and presented back to the user in the GIS view. The NME presents a geographical view of the LV network which can display the load flow results visually for different situations and energy usage profiles.

The impact in terms of both circuit loading (thermal constraints) and voltage can be assessed and quickly reviewed using a green, amber or red colouring on the branches (cables) or point of connection. Significant trials of the NME have been performed over this reporting period to understand how the NME can be used to support investments by customers, industry, DNOs and local government.

In early July the project team received extensive training on the use of the Cymdist power flow analysis engine and the reporting functions. This has enabled the team to begin the formal trials using the NME. The initial trials compared the performance of the NME with the traditional power flow analysis engine used by SSEPD, how the tool could handle the modelling of new customer connections and highlighting where stress points or voltage excursions may be experienced based on simulated end point load increases.

The trials then began to utilise the NME to simulate the modelling of disruptive technology penetration on the LV network. The focus of the trials was on the effect of EV vehicles to meet the defined deliverable for SDRC 9.8a (8). The full analysis and results of this work can be found in section 7.2 of this report where formal learning based on submitted reports is covered.

Building on the experience gained and reported by the NTVV project, the wider business has prepared plans to look at a data improvement strategy for both the SEPD and SHEPD licence regions. This has been based on the approach taken to collate data for the NTVV NME and draws on the work undertaken by the project including substation surveys and data matching between the customer management and GIS systems.

Distribution Management System

(Core learning outcome: Anticipating)

The Distribution Management System (DMS) takes the principles of SCADA management and control from the HV network and applies it to the LV network. The DMS has been built and the LV network imported from the NME, and an interface using the CIM (Common Information Model) has been implemented with the following classes:

- IEC 61970 / Core: contains the core PowerSystemResource and ConductingEquipment entities shared by all applications.
- IEC 61970 / Wires: is an extension to the core package that models information on the electrical characteristics of transmission and distribution networks.
- IEC 61968 / Assets: contains the core information classes that support asset management applications.

Over the reporting period the DMS has been transitioned from the project support IT department to business as usual support groups and the systems have passed all the defined criteria for Operational Acceptance Testing.

The DMS has been configured to manage the ESMU devices once installed. All of the objects have been created and the mechanism to automate the deployment of the objects and SCADA points has been concluded. In addition a link between the NTVV DMS and the operational SEPD SCADA system has been implemented to ensure critical alarms from the ESMUs are monitored by the control room on a continuous basis.

Some modifications had to be made to the imported LV network in order to assign the correct control zone to this network and to amend the naming convention of substation objects. The project team are now moving to the trials of the DMS alongside the operational teams that manage the network in Bracknell to understand the most effective level of control for the LV network.

Aggregation and Forecasting of energy profiles

(Core learning outcome: Anticipating)

Aggregation analysis allows the use of relatively sparse data from only a handful of end points to be 'buddied' with unmonitored customers to predict their energy use such that the power flows across an entire section of the LV network can be assessed – or conversely, substation level demands to be calculated where only end point level data is available. Forecasting analysis involves running a number of scenarios (varying in both timescale and application) to support forward looking power flow analysis or voltage variations based on low carbon technology uptake.

During this reporting period all domestic customers connected to all substations have had a load profile assigned to their service point. Each profile consists of 48 half hourly estimations of the consumption of the customer for each day. These detailed load profiles have been extensively used in the trials investigating the effect of low carbon technologies on the LV network.

Automatic Demand Response (ADR)

(Core learning outcome: Supporting)

The ADR demand response system under trial provides a machine to machine interface for triggering demand reduction events as agreed with the customer in advance and initiated by the DNO. The project has agreed all 30 of the required ADR installations in Bracknell; 20 buildings have had their ADR systems installed and commissioned with the remaining 10 being installed over December 2014 and January 2015 in line with and on track for the submission of SDRC 9.1c in April 2015.

The 30 customers have been signed up without any financial incentives and to date no payments have been made to encourage participation in load shed events. The effect of incentives on participation will commence in 2015 in accordance with the bid submission.

Certain customers showed a reluctance to allow the ADR controller to be placed on their IT networks and have access to the online demand response portal. A simple and low cost mitigation to this issue has been to install a GPRS router at the site to bypass the customers' internal computer network and expedite the commissioning process.

The demand response trials being performed in NTVV, alongside other DSR and energy storage trials performed by SSEPD and the wider DNO community have allowed SSEPD to develop and the business as usual concept of a Constraint Managed Zone (CMZ). The specification and tendering processes for CMZs are underway with a RFI due to be issued in late December 2014.

Additionally during this reporting period the project has released a large report on the evaluation and assessment of how network operators can engage with customers to encourage demand reduction to identify the role this technology could play in reducing overall network demand in SDRC 9.8a (2 & 3). The report also includes the technical and functional aspects of creating an ADR programme and the early indications on how customers behave when a request from a network operator to reduce load is received. Further detail on the conclusions of this work can be found in section 7.2 below.

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 team are intending to install these devices on the LV network and have agreed a revised deployment plan with Ofgem through change request (CR003) committing to a July 2015 delivery of all units as per SDRC 9.4c.

Change request 003 sets out that due to the provision of two key components, the cabinets and the interposing transformers, being provided by secondary supply chain manufacturers to the specification required by the primary supplier, Electrovaya, the deadline could not be achieved. As a result the project revised the manufacture, international shipment and installation dates of the devices and a revised delivery date of July 2015 was agreed internally and by the supplier and the revised approach was approved by Ofgem.

The manufacture reports additional delays to production and delivery as the result of further final design reviews. The potential for non-delivery against the revised schedule remains. However, at this stage the revised delivery schedule remains on track to deliver and units within the revised timeframe although the contingency for weather related delays has now been exhausted. The project has clear milestone events whereby the supplier must meet the deliverables to ensure the installation remains achievable.

Smart Control

(Core learning outcome: Supporting)

Over the past six months the work to create the smart control system to manage the ESMUs has progressed well. A test system was created to ensure that the proposed interfaces between the smart control system known as Active Distribution Device Management (ADDM), the data historian and the NTVV DMS. The interface to the data historian has been proved and all relevant data artefacts have been incorporated into a database schema that has been set up to receive data from the historian for processing. The interface between the ADDM service and the DMS has been configured to allow a

web service call to initiate a control to be sent to the ESMU. The ability of a third party system to send control systems via a SCADA system presents significant information security challenges and as a result a large proportion of architectural effort and security scrutiny has been placed on the design to ensure that the system delivered meets the required internal IT and control system security standards.

The code being delivered is an agent based system whereby individual agents make a request for an operation to be performed and these must be validated by an alternate process known as the gateway. The creation of the code has progressed with all of the functional requirements of the gateway agent fully described.

The academic project partners have identified the base forecasting scenario for the customers who reside on an LV feeder where the ESMU will be installed. This forecast will provide an offline smart control algorithm by charging during the period with the lowest demand and discharging during the period with the highest demand. As the techniques for forecasting are already proven the project will trial other variations that could lead to probabilistic forecasts for every customer both upstream and downstream of an installed ESMU.

The team at the University of Reading have been running simulations using OpenDSS. The simulations show that the management of LV voltage constraints and fluctuations can be better achieved by using the phase to phase balancing mechanism rather than the direct injection of current onto a single phase. These simulations will be validated when the trials of the installed ESMU are progressed.

Hot Thermal Storage

(Core learning outcome: Supporting)

The NTVV project is exploring the use of EMMA management units to divert peak solar power into customer hot water tanks as an efficient way to enable the connection of large volumes of solar panels onto the existing network. Over this period the project team visited all customers with an EMMA unit installed to ensure they were satisfied with the overall performance, to present them with the analysis of their data and to ask them to complete a survey to assess their opinion of the technology.

As discussed in the previous progress report, findings based on the result of a separate project which seeks to confirm that there will be no other unexpected network issues associated with at scale deployment (such as switching frequency related distortion) ascertained that there is a small chance of an adverse effect should a large number of these units be deployed in coordination on a lightly loaded network. As such the NTVV project will only install next generation units which feature an alternative power electronic design in concentrated areas. There have been a proportion of device failures of the existing installed 3G units. There are no safety issues and the devices have been replaced under warranty in an expedient manner without impact to the overall testing plan. The project is actively engaged with the supplier to address reliability concerns and use of alternative designs as the project progresses.

A full review of the data collected from the first 31 units has been performed and reported on in SDRC 9.8a (4), a synopsis of which can be found in Section 7.2 of this report.

Cold Thermal Storage

(Core learning outcome: Supporting)

The NTVV is exploring the use of ice cooling storage units to defer the peak daytime demand associated with air conditioning units. 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 and interact with these devices through incentive-like payments. However work to date has not identified any such units deployed in Bracknell or likely deployment across the UK.

In response to an analysis of the current uptake of cold thermal storage in the study area and drawing on insights from successful large scale deployments in the United States of America and Canada, the project has developed a new deployment approach for cold thermal storage which modifies the quantity, size and recruitment approach. This deployment approach has been designed to ensure relevant learning is generated with regards to the coordinated installation and operation of cold thermal storage. It is believed this revised approach will successfully demonstrate a mechanism which will ensure targeted and efficient installations that will deliver predictable and reliable reductions in peak demand.

Over this reporting period the project has been engaging with project partners and with all other DNO's to ensure that the learning from the revised project direction was equivalent to the original bid submission and is relevant to the UK market. The responses from other DNO's regarding this change request have all been positive and fully support our approach. Some valuable suggestions have been made that will aid our thinking that we will take into account; such as the addition of diversity factors to benefits analysis. Change Request 002 associated with the revised approach is undergoing review with Ofgem.

Low Carbon Promotions

(Core learning outcome: Supporting)

The NTVV is assessing 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, appropriate to the role and obligations of a DNO. Over this reporting period the focus of the project has been on engagement with local schools. The work here has on been describing the role undertaken by a DNO but also setting out the problem of how network operators have to manage with alternate low carbon technologies being installed and how our network must accommodate these potentially disruptive technologies.

Local Authority

(Core learning outcome: Supporting)

Over the past six months the project has been working with the local authority to investigate how the tools developed for the NTVV project could be used to support other stakeholders. One such group is the local authority town planning function in their management of new developments either in the private sector or via large social landlords. To understand how network operators could support the town planning and development decisions by utilising modelling of the network a workshop was held and the outputs of this have been reported in SDRC 9.8a (8).

Industry Governance & Analysis of Commercial impacts

(Knowledge dissemination)

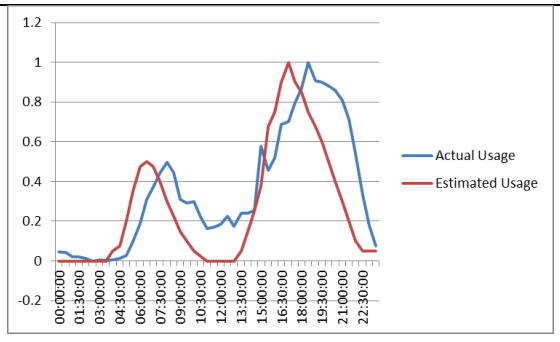
Over this reporting period the project has engaged with a dedicated commercial manager with a background in DNO charging models and has a good understanding of the UK and European innovation projects. Work is ongoing to establish the commercial framework for DSR, the potential impact of pricing signals with individual customers and consideration has been given to wider industry effect regarding the use of DSR. At the current level of load shed being achieved the volume of reduction achieved does not have an impact on wider industry stakeholders such as suppliers or National Grid. We foresee that for there to be a noticeable impact that may have detrimental impacts to others a far greater density of installations would be required.

Low Carbon Community Advisory Centre, www.thamesvalleyvision.co.uk and Stakeholders

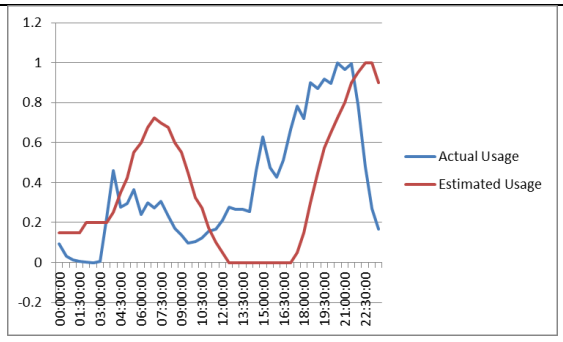
(Knowledge dissemination)

The 'Your Energy Matters' Low Carbon Community Advisory Centre has now closed, drawing this mechanism for customer engagement to conclusion. Whilst the formal report on the effectiveness of the centre in engaging the local community is not formally due until November 2016 as part of SDRC 9.8c (2), the project has begun to compile this report in anticipation of early release.

Over this reporting period the data gathered from customers at the two 'Your Energy Explained' events has been analysed. The analysis focused on how closely the customers perceived average energy use matched the actual averages measured by the end point monitors. The analysis was based on Spearman's rank correlation coefficient. This analysis has identified that certain customers have a very good understanding of their daily usage profiles and have a Spearmans rank of nearly 0.8 as per the illustration on the left. Other customers did not match their actual energy usage with as much precision, as per the illustration on the right:



Spearmans Rank: 0.795



Spearmans Rank: 0.206

Structured interviews have been held with the internal project team that worked in the low carbon community advisory centre as well as with the Bracknell Forest Council staff who ran the energy efficiency advice desk at the centre to ensure that key learning was captured upon the closure of the centre and while the experiences were fresh in the mind.

The NTVV employs a variety of channels to engage with stakeholders and disseminate knowledge, including the www.thamesvalleyvision.co.uk website and social media channels to promote knowledge dissemination.

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

(Knowledge dissemination)

During this reporting period EA Technology have used the SDRC reports on end point monitoring, substation monitoring and the commissioning of the DMS to identify whether the outputs can be considered extensive enough to be incorporated into formal policy and procedure documents. The initial results indicate that there is a high degree of confidence that the material produced could form both policy and procedure documents as well as technical work instructions and on site commissioning procedures. This external verification of the documents being produced has given the project team additional assurance that the documentation being produced would meet the needs of the business if the technology were to be transitioned to business as usual.

Learning & Dissemination

The outputs of activities in association with this Package of Work are covered in detail in section 7.

Project Governance

The Project Partner Review Board and Project Steering Group[1] met on:

- 6th June 2014 Project Steering Group
- 26th June 2014 Project Partner Review Board
- 4th July 2014 Project Steering Group
- 31st July 2014 Project Partner Review Board
- 1st August 2014 Project Steering Group
- 25th September 2014 Project Partner Review Board
- 3rd October 2014 Project Steering Group
- 30th October 2014 Project Partner Review Board
- 7th November 2014 Project Steering Group
- 27th November 2014 Project Partner Review Board
- 5th December 2014 Project Steering Group

[1] The Project Steering Board meets as part of an overall SSEPD Innovation Steering 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: 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 and interact with these devices through incentive-like payments. However work to date has not identified any such units deployed in Bracknell or likely deployment across the UK. In response to an analysis of the current uptake of cold thermal storage in the study area and drawing on insights from successful large scale deployments in the United States of America and in Canada, SEPD have developed a new deployment approach for cold thermal storage which modifies the quantity, size and recruitment approach. This deployment approach has been designed to ensure relevant learning is generated with regards to the coordinated installation and operation of cold thermal storage. It is believed this revised approach will successfully demonstrate a mechanism which will ensure targeted and efficient installations that will deliver predictable and reliable reductions in peak demand. The proposed change request has been validated internally by project partners and by all other UK DNOs to ensure that the understanding that will be gathered by continuing with the revised trial has value to the wider community and maintains value for the customer. Change Request 002 is undergoing review with Ofgem.	S5-a and S5-b
2	Supporting: Hot Thermal Storage	The first 31 thermal storage management units to divert peak solar panel export have been installed as planned. Having reviewed the initial performance of these units and the effect on individual and aggregated installations it is now understood that additional units will need to be installed to validate the early findings of the analysis on the network effect of the EMMA device. Work undertaken over this reporting period, engaging with developers and the local authority has identified that developers are not installing PV as there is no particular	T4-d

		demand for micro generation systems. As a result a modified strategy for engaging with PV owners in other local authority areas in the Thames Valley to obtain the additional project participants to validate the early results of hot thermal storage as a means of reducing PV peak generation onto the LV network has been devised.	
3	Supporting: ESMUs	The ESMU units were due to be installed under the revised schedule and strategy as agreed in change request 001 to install the 25 by units to be installed before the end of November 2014. The project has worked closely with the supplier of the units to meet this revised date. However, it became apparent that the provision of two key components was not on schedule and as such the November date would not be achieved. As a result the project revised the manufacture, international shipment and installation of the devices and a revised delivery date of July 2015 was agreed internally and by the supplier and the revised approach approved by Ofgem.	S3a & S3b

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, The Universities of Oxford and Reading, Honeywell, DNV GL, EA Technology and Bracknell Forest Council. The register is reviewed at the monthly Project Partner Review Boards with key risks reported to the SSEPD Innovation Strategy Board. 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 five risks that fall into this category, two further risks are also listed below which are 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
u1-h	Customer recruitment for second phase of monitoring not available in high-enough densities		2		3			3	12	1. New engagement approach agreed 2. Trial of new approach underway with target zones selected 3. Review uptake success and assess against analytic requirements 4. Review uptake success and identify areas for improvement"		2		3			3	9

		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
U1-e	Smart meter installation programme (by others) delayed. Suppliers unable/unwilling to share data	2	3		3			5	15	1. Regular engagement with supply companies - though all project-level requests declined to date - often on the basis of resources fully deployed to achieve UK roll-outs. Note: at least one supplier remains very engaged but has had minimal deployment in target area to date. 2. Escalate the level of request to all suppliers highlighting the shared benefits of combined use of data. 3. Mitigate impact on learning and schedule by targeting end-point monitoring to support analysis 4. Support through access to existing data flows	2	1		2			5	10
A2-f	ADR event triggers not integrated in POF	2	4		2				12	1. Prototype early. 2. Establish sample algorithms in workshops to validate approach	2	3		3			4	12
S3-a	Availability/readiness of Energy Storage and Management Units – Ongoing design, manufacturing and testing concerns (software/hardware response and IP rating of outer housing) present actual delays.		5		2			5	15	1. Second Change Request defining new deployment approach agreed - July 2015 2. Twice Weekly calls implemented 3. Site installation works prepared and field installation plan being prepared 4. Delivery schedule from supplier is being prepared, although SDRC is under threat.	4	5		2			5	25
S3-b	Locations for ESMU are still pending sign off from BFH & licence approval.	2	4		2			3	12	1. Sites have been sympathetically chosen to take advantage of natural opportunities 2. Close engagement with BFC and BFH as land owners 3. Wayleaves officers reviewing statutory	1	4		2			2	8
S5-a and S5-b	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 evolved	2	3		3			5	15	1/2. Evaluation into Bracknell and UK deployments complete 3. Review of international/USA experience complete and proposal to implement a new deployment method with utility-funding established. Supplier selected 4. Presently under going Change Request review to establish if new deployment approach represents best use of LCNF T2 funds.	1	3		2			2	6

		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
T4-d	The envisioned deployment of PVs with BFHomes will not materialise - due to a change of BFHomes development plans and ideas (as well as a change to the Enevix 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			3	9	1. Technical aspects of thermal storage established through existing 31 units in domestic properties. 2. Adapt engagement with RSL to include wider pool of RSLs (and equivalent) to identify drivers - explore propensity for alternative options (for example solar tiles) 3. Explore options with other volume building suppliers, for example new build housing developers.		2		1			2	6

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 table 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 2014) and into the next reporting period (up to June 2015).

	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 9.8a 1	30/11/2015	Prepare final report on the trials carried out on End Use and Network Monitoring Evaluation	
SDRC 9.8a 2 & 3	30/11/2015	Prepare final reports on the trials carried out on Demand Side Response Evaluation& Energy Efficiency	
SDRC 9.8a 4	30/11/2015	Prepare final reports on the trials carried out on LV Network Storage (Hot Thermal Storage)	
SDRC 9.8a 5	30/11/2015	Prepare final reports on the trials carried out on EV Chargers Usage Evaluation and Issues	
SDRC 9.8a 6	30/11/2015	Prepare final reports on the trials carried out on Smart Meter Performance	
SDRC 9.8a 7	30/11/2015	Prepare final reports on the trials carried out on Integration Solution Control Evaluation	
SDRC 9.8a 8	30/11/2015	Prepare final reports on the trials carried out on the Overall Proven Benefits of modelling both financial and customer service	
SDRC 9.1c	30/4/2015	30 Customers signed up to Automatic Demand Response (ADR) programme and host customer event-renew new arrangements	
SDRC 9.4c	31/07/2015	Install 25 LV connected batteries as defined in 9.4a.	
SDRC 9.4d	30/10/2015	Produce learnings from energy storage and power electronic deployment to assess the hypothesis as defined in 9.4a.	

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

SDRC	Due	Description
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.

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 Formal Learning Capture

All reports available in full at http://www.thamesvalleyvision.co.uk/project-library/published-documents/

End Use and Network Monitoring Evaluation (as reported in SDRC 9.8a 1)

This report shares the key learning gained from the deployment of end point monitoring and substation monitoring deployments undertaken to date on the NTVV project to date. The first devices were installed two years and as such the project has access to a significant period of data and experience of operating the devices.

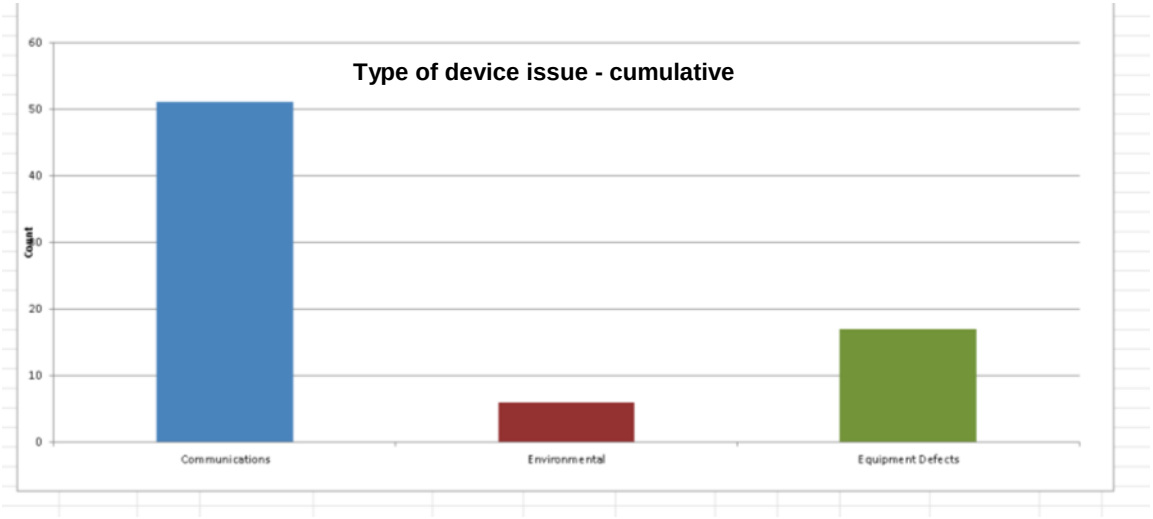
Having this quantity of data and time of head end system operation on the project has enabled the analysis of the performance and reliability of the devices selected for NTVV. Some key metrics based on the performance of the advanced meter reading functionality of the devices are:
The overall performance of the end point monitor communication has seen a 95.2% success in retrieving stored customer data. For the project this has meant that 12 monitors deployed have never sent any data for analysis. On a small scale this does not represent an issue but at scale would be a significant failure rate. If this failure rate were experienced in the entire SEPD region this would relate to an estimate of over 140,000 devices.

- 56% of currently installed monitors have not experienced any missing reads.
- 95% of installed monitors are working with less than 5 missing reads.

- 92% of reads were received on day one on the first attempt. The vast majority of the remaining 8% were collected after day two resulting in only 5% of meters having more than 5 missing days between March 2013 and November 2014.

As the devices selected have up to 24 months internal storage, missed reads do not pose an issue to the collection of data from customers.

The report also reports on the installation, operation, reliability and performance of substation monitors. The reliability of the devices has been analysed based on their types of failure to date; communication issues, environmental issues and defective units. The table below identifies the failures to date on the project.



Extensive use has been made of cellular networks (GSM and UMTS) in the project and this has been found to be effective for transmission of data after extensive adjustment of settings and altering the physical arrangements (e.g. antenna positions). In reality, the signal strength and network characteristics are constantly changing in line with environmental conditions and network operators preferences; it follows that some devices will always struggle to stay connected at some times. A larger scale deployment of monitoring would need to consider the use of an alternative and additional communications methodology to ensure adequate coverage.

Demand Side Response Evaluation and Network Controlled Automated Demand Response Evaluation & Energy Efficiency (as reported in SDRC 9.8a 2 & 3)

This report outlines the steps that were taken to establish the necessary tools related to the demand side response evaluation and the network controlled demand side response evaluation & energy efficiency.

The trials associated with this SDRC report have focused on 11 customers that have been participants for the longest time in a test plan designed to assess the impact of load-shed duration, time of load shed and notice period. The average load reduction achieved across these sites was 11.3% with a maximum aggregated load shed of 623.4kW. The system-wide response rate has been 73%, with two customers opting out during the initial period.

In addition the report looks at a phenomenon known as ‘bounce back’. This relates to demand associated with heating/cooling that is more likely to be shifted to another time and may even include a peak as buildings operate to bring temperatures back to their normal running operation. For some customers there is clear and consistent evidence of bounce-back, whereas for others it is less clear cut. For these other customers the project looked at whether the length or the size of load shed events had any correlation to the occurrence of a bounce-back. At this stage more data from load shed events needs to be obtained before any definitive conclusion can be drawn.

The report discussed the engagement strategy and consent process to sign customers onto the ADR programme. Project partners, particularly the council were integral to supporting customer engagement across the Bracknell area, providing the project with 12% of contacts in other organisations for engagement.

LV Network Storage - Hot Thermal Storage (as reported in SDRC 9.8a 4)

The NTVV project explores energy storage solutions, including hot thermal, cold thermal and battery storage. The hot thermal storage part of the project involves the installation of Hot Thermal Storage devices. Under this project, units have been installed to limit the peak export of PV micro generation on to the LV network, whilst allowing customers to consistently store and benefit from the energy their PV systems have produced by using it to heat water for normal use in their properties.

The assessment of the performance of hot water thermal storage is ongoing and scheduled to be completed in autumn 2016. At this stage, there is a good body of evidence to suggest that this method of peak PV export mitigation can be effective on an individual and a clustered basis.

Participants immediately benefitted from the installation of the EMMA’s, both through better use of their individual solar generation and the diversion of 2-3KWh of energy daily into their respective hot water storage tanks. Prior to the installation of the units, the participant’s solar generation would typically have been exported to the DNO’s LV network.

The project team has assessed the application of this technology with ‘new-build’ domestic property developers. Whilst property developers are supportive of different or emerging technologies there is no particular demand for micro generation systems and if there were the marginal cost at installation stage of a larger network to avoid generation constraints would be less than the installation effort associated with this storage technology. As such, it is clear that there would be no advantage to the developer to apply this technology under this use-case.

EV Chargers Usage Evaluation and Issues (as reported in SDRC 9.8a 5)

This report focussed on an evaluation of EV charger usage in terms of the localised effect on the network and an assessment of the impact on the network as a whole. There are four key factors that determine the impact of EVs on the distribution network: number of charging points, type of charging points and EVs, spatial distribution of charging points relative to the network and the temporal distribution of electricity demand. All these factors can be influenced by the developments in the commercial model and new technologies that will emerge.

The NME was used to model the uptake of EVs in the project area. A high clustered EV scenario was selected and the outputs showed that there were no issues with voltage drop. There was high confidence that EVs did not cause severe overloading of any parts of the network and any marginally overloaded sections were seen to be at the mains cables nearest to the substations.

Initial results indicate that smaller voltage networks with fewer customers may face less impact from EV uptake. Moreover, they show that impacts from EVs during summer may be more severe compared to winter due to the reduced thermal capacity of the feeders. All the above results should be interpreted taking into account that EVs are charged primarily during night with fast chargers (7kW).

Smart Meter Performance (as reported in SDRC 9.8a 6)

This report makes observations on Smart Meter performance based on interactions with Energy Suppliers, direct engagement with distribution network customers, the project roll-out of smart-meter like equipment, management of data through a head-end system and storage and manipulation of data using a data historian.

During the data collection period of the end point monitors, there were naturally some technical issues with the communications that meant that data was not automatically transferred over the NTVV GPRS link that was established. 13 of the monitors installed were unable to achieve full end to end data transfer; this equates to 5.31% of our devices suffering from some sort of communications failure. If this type of monitoring were to be rolled out with same communications to all 2.8 million customers in the regulated area of Southern Electric Power Distribution (SEPD) then these rates suggest 148,680 devices would have communication-related problems.

The effectiveness of the advanced meter read functions of the end point monitors show that 92% of reads were on time. Of the 8% that were late, the vast majority were subsequently read successfully.

NTVV has collected approximately 1,124,565 kilobytes of data for each full year stored in our historian. This equates to an average of 4,745 kilobytes per customer per year.
If this approximation were to be applied to SEPD's 2.8 million customers the estimated amount of storage needed would therefore be 12.4 terabytes for a year. It is worth noting that the system being used by the project only stores the data points needed for research purposes (described above) whereas a wider smart metering deployment would want to store alarms and/or other useful pieces of informational of which would incur extra storage costs.

Integration Solution Control Evaluation (as reported in SDRC 9.8a 7)

The report on the DMS analysed the effect of replicating the system and scaling the system to cover an area nearly 100 times larger in terms of customer connections. It has been shown that the system would be able to scale to accommodate an LV network for a licence region.

A limitation of the system may be experienced if the level of substation monitoring at 5 second intervals was scaled and rolled out and a new methodology to accommodate this level of scanning would need to be implemented to ensure core system SCADA functionality was not impacted.

The report also looks at data availability. The majority of the time and effort to establish the system is associated with source data preparation. As much time as possible must be devoted to source data improvement to ensure that the fewest number of iterations of source data import are required before the data can be considered in a production ready state.

In addition the report looks at the integration and interfaces delivered into the system. The DMS has been shown to be flexible in terms of interfacing to other systems using standard protocols. Whilst the CIM standard for distribution networks is used to share information on the LV network there are certain constraints around the number of objects that are defined. For HV networks this would not represent an issue but on the LV network where similar plant may have various ways of being operated a compromise must be made and additional manual post import work is required to define the operating procedure at individual sites.

Overall Proven Benefits of modelling both financial and customer service (as reported in SDRC 9.8a 8)

The NTVV project has established a Network Modelling Environment (NME) which is based on the existing SSEPD Graphical Information System (GIS) network data, and linked to a modelling tool that is well suited to calculating electrical network parameters using energy profiles. An improved modelling tool loaded with relevant energy profile data should give confidence to a DNO that calculated headroom at each point on the network is a good assessment of the loading of the network, and when presented in a red/amber/green type of comparison with the capacity of the network this will allow targeted investment decisions to be made.

This report also defines the outputs of the trials of the NME to verify use of the tool with energy profiles, the use of the tool with profiles that represent disruptive technology penetration, and the application of short term forecasts.

The NME has been demonstrated to be able to correctly calculate the electrical loading and voltage drop on the low voltage network, based on the energy profiles with which it is loaded. The advantage of the NME compared to traditional modelling and power flow analysis tools is that it already holds the network data (connectivity, circuit and equipment types, and their characteristics) and that the calculations carried out are based on the half hour energy profiles assigned to each end point.

Additionally, following the application of forecasted energy profiles for some customers projected to have adopted low carbon technologies such as electric vehicles, the NME can be used to identify the areas of the network suffering from thermal loading or voltage drop issues. This can be used to inform the DNO where investment in the network is required, taking account of the context of the forecast. A specific study looking at the take up of electric vehicles revealed that by 2022, using DECC Scenario 3 for EV uptake, some feeder circuits will be vulnerable to overloading, particularly on the sections of cable nearest to the substations, and during the spring and summer periods of the year.

Increased use of the NME is improving confidence that when the forecasts are refined full studies can be run and the outputs used to inform short term operational decisions as well as medium and long term investment decisions.

7.3 Learning Moments

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

Knowledge gained from substation monitoring installations and environmental considerations

The installation of substation monitors was impacted by the failure of a small sample of units. When these units were investigated on site it became apparent that at certain sites this was due to water ingress into the substation monitor casing. Based on this understanding, to prevent flooding in the devices they were relocated to be installed on brackets raised off the ground and the orientation of the devices was amended to allow good air flow in the summer. This could have been factored into the initial installation if known. The project now takes environmental conditions into account when installing field based devices.

The business case for Demand Side Response (DSR) must look at all voltage levels

The IceBear units for Cold Thermal Storage have been assessed for the business case for cold thermal storage as a mechanism for DSR. Demand Reduction does not just help the point of connection where the demand side response is installed but all the way up the electricity voltage levels back to source. This has been noted to be similar to the ADR being deployed and the load shed events being run could also have an effect all the way up the network. When performing cost benefit analysis on DSR technologies the effect on the entire network and upstream markets should be considered rather than just at the point of installation.

Definition of functional requirements for delivery of new software

When performing the coding of the functional requirements to manage and control the ESMU devices the IT developers were struggling to translate the functional requirements into a language they could understand and convert to functioning Java code. The engineering team revisited the requirements and simplified the wording to ensure that there was common understanding. In future all requirements will be defined in pseudo code and closer engineering support will be given to IT developers during the initial code creation.

Uncertainty over the level of anticipated EV uptake When defining the trials for the uptake of EV and the outputs of the EV workshop there was a lot of uncertainty of the number of EV's likely to be adopted and how many may be connected to the network. There would particularly cause additional uncertainty in the scenario of shared ownership as this would dramatically change the charge patterns and prove very challenging to model.
Clear and concise wording and expectation in customer contracts Certain customers on the ADR programme voiced a concern over a specific line item in the agreement to participate. The line read that "that the customer will bear their costs for installation". Certain customers had queried that statement and whether it referred to the physical ADR equipment and needed to be reassured that the only cost was for internal staff time and no other costs would be incurred as part of the ADR installations. This could be made clearer for customers for a wider BAU deployment of ADR but has not proved an obstacle for the NTVV project to overcome.
The accuracy of creating 'buddied' profiles using a smaller data set It was identified by the University of Oxford that the creation of buddied profiles for 105 phases (35 feeders) showed that the profiles created from using data from a 4 week period was as accurate as using data from an entire year. This is based on early results and more needs to be completed on a wider sample and with the probabilistic forecasts added but early results are very promising. This could lead to a vital piece of knowledge to identify the optimal placement and time to deploy secondary substation monitoring information.
Assumptions of ADMD minimum of zero could change based on customer numbers When reviewing the end point monitoring for SDRC 9.8a (1) and looking specifically at the proven benefits to date for a DNO, one clear area is to inform ADMD information. Historically DNOs assume that ADMD minimum load is 0 on a feeder and this drives decisions on how much distributed local embedded generation is permitted and the size of this generation. Analysis has shown that for a phase of a feeder with greater than 20 customers there is never zero load and this can assist network planners when making decisions on generation connections based on the quantity of customers on a particular network.

7.4 Dissemination Activities

A dissemination log is maintained to capture details of activities project staff have undertaken to share learning from the project. Staff members 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:

Leading Partner	Date(s)	Description
SSEPD	June 2014	**School Assembly Presentations** Presenting to a local school on the project at year group assemblies on the project and how the students can get involved. These talks aimed at promoting awareness of low carbon technologies and energy efficiency measures.
DNV GL	July 2014	**EV Workshop** A workshop was arranged on the effects of electric vehicles on the LV network with network operators, businesses and academic researchers to support analysis and modelling trails for the project.
SSEPD	August 2014	**Bracknell Street Barbecue** A street barbecue event was held to meet local residents and engage customers with a view to arrange high density monitoring
SSEPD	August 2014	**LCNF project progress presentation to DECC** An event held to inform DECC of the progress of the Tier 2 projects being run by SSEPD
SSEPD	September 2014	**Local School Engagement** A focus group was held with the 'Eco-Group' at a local school which was targeted at energy reduction domestically and the importance this has on the overall carbon reduction possibilities of the wider UK.
University of Reading	September 2014	**Poster on LV Energy Storage** A poster on the ESMU was presented at the HubNet Smart Grid Symposium describing the development and integration of agent-based smart control system.
University of Oxford	September 2014	**LV Network Workshop** A day of presentations of academic papers relevant to the LV Network was hosted by the project at Oxford University. Three papers on NTVV were presented based on clustering of SME, EV uptake and ESMU smart control.
SSEPD	September 2014	**IMechE Presentation** A presentation given to IMechE on energy storage being deployed by SSEPD across all innovation projects including the planned ESMUs for NTVV.
SSEPD	September 2014	**ITN News Interview** An interview given to ITN on the projects Automated Demand Response (ADR) programme that is being trialled by the project to curtail peak demand based on agreed load shed strategies.
SSEPD	September 2014	**Participant Tour of 'Green' Facility** A tour of a flagship green Waitrose store for project participants was arranged to see how energy efficiency measures are being implemented on the high street.

SSEPD	September 2014	**Energy storage, the route of least resistance?** A presentation given to the IET on energy storage across all of the SSEPD innovation portfolio and how it can be introduced into BaU.
GE	October 2014	**DSI Demonstration** A demonstration of the integrated NME and DMS to a Turkish network operator was given to show global network operators how the project is informing how systems of tomorrow may be created and utilised to improve customer service and assist the management of low carbon technology penetration.
SSEPD	October 2014	**LCNI Conference 2014** Three presentations were given at the LCNI conference on ADR, data and analytics and energy storage.
SSEPD	October 2014	**LCNI Conference 2014** A poster was presented on hot thermal storage at the SSEPD stand at the LCNI conference in Aberdeen highlighting the benefit to the network operator of diverting solar energy to a customer's hot water tank to prevent peak PV generation being exported onto the LV network.
SSEPD	November 2014	**IET Presentation** A presentation was given to the IET on the chemical energy storage aspects of projects being trialled on NTVV, NINES and the Orkney Energy Storage Park.

7.5 NTVV Website

Web traffic for the website during this reporting period (06/12/2013 - 26/05/2014) was:

Total visits:	1,881
Unique visitors:	1,389
Pageviews:	5,526
Pages per visit:	2.94
Avg visit duration:	2:37 mins
% New Visits:	73.79%

An interesting highlight of the analytical analysis of the NTVV website has been the range of global visitors to the site. After the UK, the country with the most visits to the www.thamesvalleyvision.co.uk website is Brazil with 9.72% of the total site visits over the reporting period. The next four countries by number of site visits are; India, Italy, France and the USA. This shows that the NTVV project has a truly global audience.

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.

SSEPD's 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 commercial), 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 alongside 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.

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[2]. Projected variances are also listed for changes >5%.

				Projected Variance (at project conclusion)		
	Budget	**Expenditure ITD (£K)**	**Comparison with expected expenditure**	Value (£K)	%age	#
LABOUR	**5,932.76**	**3,541.24**	**-8.4%**	**160.00**	**2.7%**	
Project and ICT management	1,236.45	953.20	-0.6%	0.00	0.0%	
Project engineering (monitoring, energy management and network design)	1,387.60	1,216.95	4.8%	0.00	0.0%	
Network Field Resources	610.00	118.71	-47.1%	0.00	0.0%	
Customer, commercial and knowledge management	826.10	474.52	-12.0%	160.00	19.4%	3
ICT architecture	358.13	228.09	-10.3%	0.00	0.0%	
ICT field resource	1,514.48	549.77	-24.5%	0.00	0.0%	
CONTRACTORS	**8,710.71**	**6,160.79**	**-12.5%**	**153.15**	**1.8%**	
LV network monitoring installation	718.00	372.23	-36.0%	0.00	0.0%	
HV network monitoring equipment	65.00	0.00	-	-65.00	-100%	4
Battery storage installation	458.00	35.52	-91.7%	0.00	0.0%	
Communications	100.00	0.00	-	0.00	0.0%	
Smart analytics	1,926.80	890.25	-5.5%	0.00	0.0%	
Integration of monitoring, modelling and management	3,844.07	4,015.42	0.0%	171.35	4.5%	2
Automatic demand response	333.88	252.55	-20.0%	-18.20	-5.5%	1

[2] 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.

Learning dissemination, website and low carbon community centre	203.00	154.10	-5.2%	0.00	0.0%	
Integration activities to support DNO business as usual	785.70	202.65	-36.2%	0.00	0.0%	
Real-time systems and information technology equipment	122.76	101.51	-9.9%	0.00	0.0%	
Customer, commercial and knowledge management	80.00	62.45	-9.2%	0.00	0.0%	
ICT field resource	73.50	74.11	0.0%	0.00	0.0%	

EQUIPMENT	**4,526.44**	**3,188.76**	**-14.2%**	**-219.92**	**-4.9%**	
LV network monitoring equipment	1,318.92	1,333.79	0.0%	114.05	8.6%	2
HV network monitoring equipment	111.20	0.00	-	-111.20	-100%	4
Communications	417.00	141.89	-52.5%	0.00	0.0%	
Battery storage equipment	1,100.00	605.56	-36.8%	0.00	0.0%	
Integration of monitoring, modelling and management	435.75	234.99	0.0%	-200.76	-46.1%	2
Automatic demand response	755.87	562.12	0.0%	-53.21	-7.0%	1
Thermal storage	80.00	25.09	-44.6%	0.00	0.0%	
Real-time systems and information technology equipment	307.70	285.31	0.1%	0.00	0.0%	

IT	**4,043.53**	**1,957.84**	**-0.8%**	**288.99**	**7.1%**	
Integration of monitoring, modelling and management	2,650.37	1,178.75	0.0%	217.59	8.2%	2
Automatic demand response	909.44	472.49	0.0%	71.41	7.9%	1
Learning dissemination, website and low carbon community centre	1,432.97	51.80	-55.9%	0.00	0.0%	
ICT Field Resource	328.92	254.80	24.7%	0.00	0.0%	

TRAVEL & EXPENSES	**335.22**	**39.86**	**812.6%**	**-222.22**	**-66.3%**	
Integration of monitoring, modelling and management	222.22	0.00	-	-222.22	-100%	2
General	113.00	39.86	812.6%	0.00	0.0%	

PAYMENTS TO USERS	**591.00**	**0.00**	**-99.8%**	**0.00**	**0.0%**	
Payments to Users	591.00	0.26	-99.8%	0.00	0.0%	

DECOMMISSIONING	**392.00**	**0.00**	**-**	**0.00**	**0.0%**	
Network field resources	50.00	0.00	-	0.00	0.0%	
LV network monitoring decommissioning	332.00	0.00	-	0.00	0.0%	
Customer, commercial and knowledge management	10.00	0.00	-	0.00	0.0%	

OTHER	**988.38**	**353.87**	**-35.2%**	**-160.00**	**-16.2%**	
Land	160.00	0.00	-	0.00	0.0%	
Learning dissemination, website and low carbon community centre	272.60	151.87	-43.1%	0.00	0.0%	
Real-time systems and information technology equipment	423.03	165.87	-24.0%	-160.00	-37.8%	3
ICT field resource	132.75	36.14	0.0%	0.00	0.0%	

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.

4. Extensive and successful LV monitoring and access to industry half-hourly data flows mean that HV monitoring is not required to fill gaps.

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 November 2014)
Electricity North West Limited	£870,000.00
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% contribution)	£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	£83,426.43
Payments out of account	-£16,674,163.24
Balance	**£9,844,317.32**

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 June 2014 – December 2014 reporting period. No Relevant Foreground IPR is anticipated 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) components required for trial replication and, 2) knowledge products required for trial replication. Likewise in configuring the overall system architecture and underlying business processes 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 Manager and reviewed by the Project Delivery Manager before sign-off by the Director of Engineering, who sits on the Board of SEPD.

This report has been corroborated with the monthly minutes of the Project Steering Group[3] 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:	Gordon Hewitt	Project Manager
Reviewed by:	Nigel Bessant	Project Delivery Manager
Final sign-off:	Alan Broadbent	Director of Engineering

15/12/14

[3] The Project Steering Board meets as part of an overall SSEPD Innovation Steering Board

Appendix - Redacted copy of bank account transactions

Bankline

RBS
The Royal Bank of Scotland

Statement for account xx-xx-xx xxxxxxxx from 01/06/2014 to 30/11/2014

Short name:	SEPD PLC-TVV PROJECT	Currency:	GBP
Alias:	SEPD PLC-TVV PROJECT	Account type:	SPECIAL INT BEARING
BIC:	XXXXXXXX	Bank name:	NATIONAL WESTMINSTER BANK
IBAN:	XXXXXXXXXXXXXXXXXXXX	Bank branch:	READING MKT PLACE

Date	Narrative	Type	Debit	Credit	Ledger balance
	CLOSING BALANCE				**9,844,317.32Cr**
03/11/2014	SOUTHERN ELECTRI NTVV COSTS	EBP	410,706.71		9,844,317.32Cr
30/09/2014	30SEP-GRS 90252721	INT		7,670.51	10,255,024.03Cr
29/09/2014	SOUTHERN ELECTRI NTVV COSTS	EBP	1,946,578.32		10,247,353.52Cr
30/06/2014	30JUN-GRS 90252721	INT		8,085.96	12,193,931.84Cr
	OPENING BALANCE				**12,185,845.88Cr**
Totals			**2,357,285.03**	**15,756.47**	