Network Innovation Allowance Summary Report

1 April 2015 to 31 March 2016

Scottish Hydro Electric Power Distribution

Southern Electric Power Distribution

FOREWORD

This report summarises the progress achieved by Scottish Hydro Electric Power Distribution (SHEPD) and Southern Electric Power Distribution (SEPD), both which are part of Scottish and Southern Energy Power Distribution (SSEPD), in Network Innovation Allowance (NIA) projects during the period between April 2015 and March 2016. Distribution NIA has been running since the onset of RIIO-ED1 in April 2015 and is targeted at smaller innovation projects which can deliver value to customers.

SSEPD's core value is to provide the energy people need in a reliable and sustainable way. This is complicated by the rapid evolution of networks which has been witnessed in recent years both within Great Britain and beyond. The ongoing shift towards lower carbon technologies and proliferation of large scale renewable sources of generation are presenting major challenges for our network infrastructure. In the face of these challenges, innovation has become an absolute necessity that has to be embedded within the culture of our everyday activities.

As of 31st March 2016, we have a portfolio of thirty eight live NIA projects at various stages in their lifecycles. Twenty seven of those projects are led by SSEPD with the remainder being led by our collaboration partners. As we are now going into the second year since the commencement of the RIIO framework in Distribution, our experience of delivering NIA funded projects is growing. This is reflected by the number of new projects registered in the just ended year.

Within SEPD and SHEPD, we believe success in innovation is measured through the benefits delivered from conversion into business as usual. We take any learning from our innovation projects seriously and seek any opportunity to exploit applicable learning.
In the same vein, we keep a constant lookout for learning generated by other network licensees to ensure that fast follower implementation can be done whenever feasible. We also continue to engage with our stakeholders and collaborate with other interested parties in the energy supply chain to ensure that our innovation efforts can deliver the best possible value to our customers.

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Table of Contents

1 NIA Project Portfolio

For the year ending 31 March 2016, there were 27 projects funded under SEPD and SHEPD Network Innovation Allowance (NIA). Six of these projects had completed whilst 23 had been registered during the year. A few of the new projects have yet to provide significant learning which can be shared hence their initial progress reports will be published at the end of the 2016/17 year.

A crucial aspect of the ongoing SSEPD NIA project portfolio is that it takes into consideration the 20 top innovations identified as part of the RIIO-ED1 Innovation Strategy. Where the projects do not map directly to the top 20 core innovations, each projects still maps onto at least one of the RIIO-ED1 primary outputs.

Table 1 below shows all the RIIO-ED1 primary outputs, the top 20 core innovations and the relevant registered NIA projects associated with each. These targets guide the entire Innovation programme for SSEPD including those not funded under NIA. Further details of how other projects are mapping onto our core innovations are covered in the update to the Innovation Strategy that was published in March 2016. The link to the update is provided here http://www.yourfutureenergynetwork.co.uk/wp-content/uploads/2016/04/Innovation-Stategy-update-ver-9.pdf

RIIO-ED1 PRIMARY OUTPUT	CORE INNOVATIONS FOR RIIO-ED1	RELEVANT NIA PROJECTS	COMMENTS
Connections	Active network management – generator constraint management	• NIA_SSEPD_0019 Western Isles Resilient Zone Utilising Embedded Generation – Feasibility Study	
	Demand side management – thermal energy storage	• NIA_SSEPD_006 Impact of Electrolysers on the Distribution Network • NIA_SSEPD_011 ACCESS – Local Constraint Management	
		• NIA_SSEPD_005 33kV Hot Glove Working, • NIA_SSEPD_012 Network Resilient Zone Utilising Embedded Generation – Feasibility Study	No core innovation is associated with these projects. However, these projects support the associated RIIO-ED1 primary output.
	Local smart EV charging infrastructure	• NIA_SSEPD_0026 Management of Plug-in-Vehicle Uptake on Distribution Networks	

Scottish and Southern Energy Power Distribution

RIIO-ED1 PRIMARY OUTPUT	CORE INNOVATIONS FOR RIIO-ED1	RELEVANT NIA PROJECTS	COMMENTS
Customer service	Advanced distribution automation – network reconfiguration	• NIA_SSEPD_008 PARADE, • NIA_SSEPD_009 Automated Loop Restoration	
		• NIA_SSEPD_002 SASensor High-Medium Voltage (HMV) Primary Substation Provider, • NIA_SSEPD_003 Network Damage Reporter, • NIA_SSEPD_007 Field Team Support Tool, • NIA_SSEPD_010 Mobile Generator Re-sync at 11kV and 33kV, • NIA_SSEPD_0021 Thermal Imaging Observation Techniques for Underground Cable Networks (TOUCAN) • NIA_SSEPD_0023 Fault Passage Indicators for SEF	No core innovation is associated with these projects. However, these projects support the associated RIIO-ED1 primary output.
Environment		• NIA_SSEPD_0014 Underground Cable overlay Cost Reduction, • NIA_SSEPD_0016 Alternative Cable Installation Methods, • NIA_SSEPD_0024 Network Optimisation Project • NIA_SSEPD_0025 Applied Integrated Vegetation Management (IVM),	No core innovation is associated with these projects. However, these projects support the associated RIIO-ED1 primary output.
Reliability		• NIA_SSEPD_013 Network Resilient Zone Utilising Standby Generation – Feasibility Study	No core innovation is associated with this project. However, this project supports the associated RIIO-ED1 primary output.
	LV network modelling	• NIA_SSEPD_0015 LV Connectivity Modelling	
	LV network monitoring	• NIA_SSEPD_001 DISCERN Knowledge Transfer • NIA_SSEPD_0027 Low Cost LV Substation Monitoring,	
Safety	Conductor sag and vibration monitoring	• NIA_SSEPD_0017 Overhead Line Vibration Monitoring Phase 2, • NIA_SSEPD_0020 Overhead Line Monitoring	
	Live line tree felling	• NIA_SSEPD_0018 Remotely Operated Forestry Mulcher	
		• NIA_SSEPD_0022 Ester Fluid Transformer Re-design	No core innovation is associated with this project. However, this project supports the associated RIIO-ED1 primary output.
Social Obligations	None at present		

Table 1: Mapping top 20 core innovations to registered NIA projects

2 Summary of Progress

2.1 NIA_SSEPD_001 DISCERN Knowledge Transfer

Start Date: February 2013

Duration: 39 months

Description:
This project facilitates SEPD's participation as a partner in the FP7 DISCERN project, providing access to the significant resources provided by the project participants themselves and the broad range of solutions implemented by DSO/DNOs in their demonstration site projects, with SEPD's participation drawing on the New Thames Valley Vision (NTVV) NIC project.

Various monitoring systems, including communications and algorithms, were installed at demonstration site locations within the DSO/DNO participant networks in order to:

- Collate information on the systems and devices used
- Investigate the replicability and scalability of the solutions implemented
- Develop and understanding of optimal solutions
- Investigate associated costs
- Make recommendations and provide communication tools to facilitate replicability of the solutions

SEPD's role is to provide data and information, inform project direction, and contribute to the development and review of project outputs. Rather than funding the installation of hardware, the IFI/NIA funding facilitates this participation.

Expected Benefits:
- Studies and research directly relevant to SEPD, which is beyond the scope of areas to be addressed within NTVV, is made available for incorporation into both business and innovation strategic thinking
- Knowledge relating to a range of Smart Grid sub-functionalities not yet being investigated within the business is made available from other FP7 DISCERN partners' research & demonstration sites and from simulations, supporting decisions on how networks are built, managed and operated
- Knowledge of such factors as systems architecture, Use Cases & Smart Grid Architecture Model, semantic models and Common Information Model, is improved across operational and innovation areas of the business, as well as Information and Communications Technology, such that it is possible to take a view on the potential development, relevance and applicability of such approaches within the business from a Business as Usual perspective

Progress:
This project has now completed successfully with the project outputs well received by external parties and the European Commission. The website developed for the project, www.discern.eu provides information on the objectives and work plan for the EU FP7 DISCERN project and has been maintained throughout the project to present the deliverables, tools, publications and final report created to document project activities. This site will remain active until March 2018. In addition, the closedown report published on the learning portal summarises the key outputs of this project and links to further information.

2.2 NIA_SSEPD_002 SASensor High Medium Voltage (HMV) Primary Substation Provider

Start Date: July 2012

Duration: 44 months

Description:
The project involves the first UK deployment of the Locamation HMV SASensor solution which has been successfully deployed in the Netherlands. This system uses a digital approach to protection and control of our substations, giving a central hardware processing approach (see figure 1 overleaf) in contrast to the individual relaying approach we currently practise. This system will allow us to connect remotely to the system to retrieve fault and maintenance information, and allow for remote programming of settings, reducing the need to travel to site, and improving the overall network for our customers.

Expected Benefits:
- Reduction in costs of installation due to reduced hardware
- Reduction of costs during storms if details can be extracted remotely about the type of faults that have occurred
- Being an open platform, it should be possible to integrate with other R&D providers for more savings

Progress:
The project has now completed. The project succeeded in proving the digitised approach to a central solution protecting the whole switchboard in a substation while providing access to accurate fault data for remote diagnostics. The project reached a conclusion that the Locamation solution is a viable option for adoption into business as usual (BaU) and may be considered for roll out. More details of learning from the project are covered in the associated close down reports.

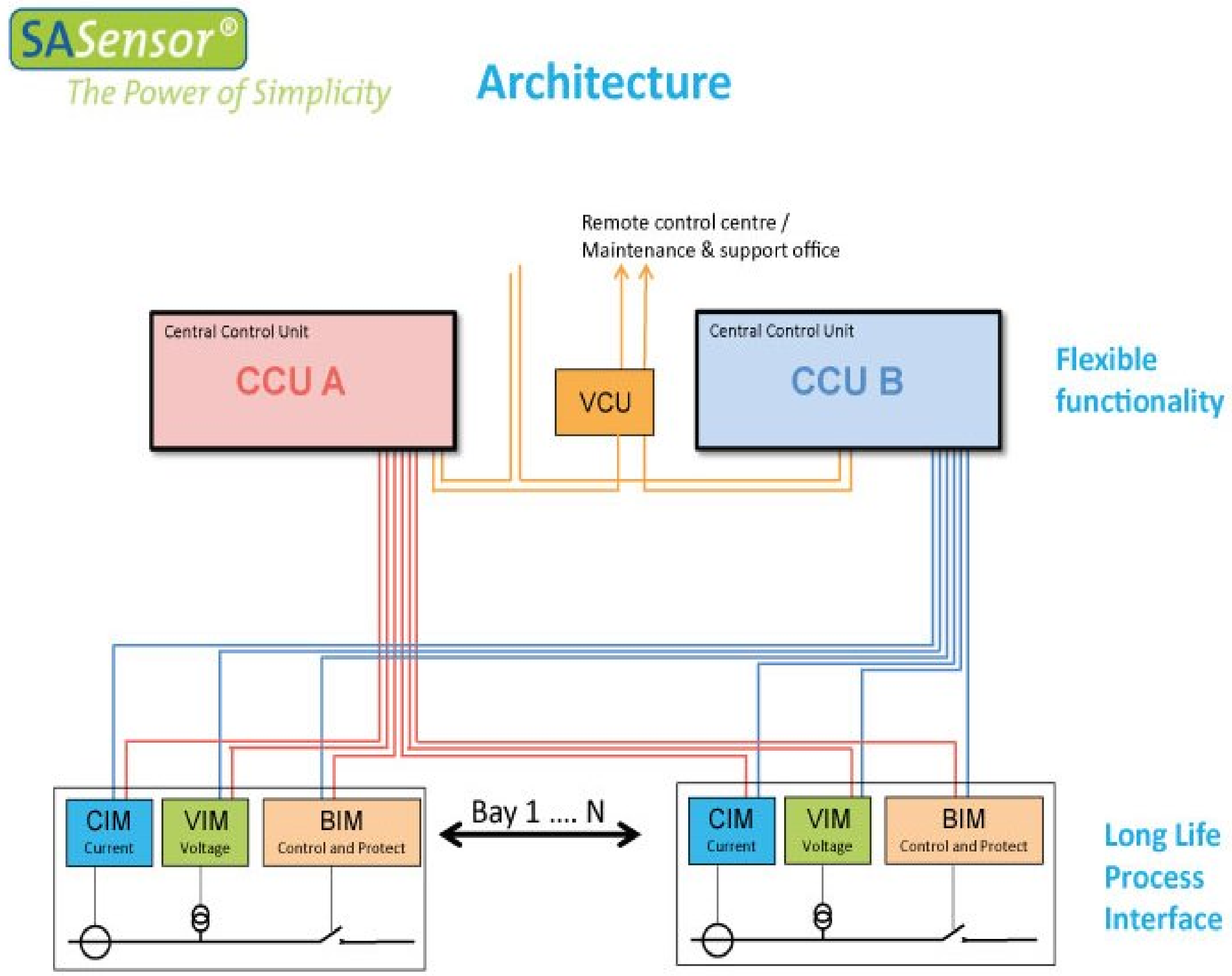


Figure 1: Architecture diagram for SASensor system

2.3 NIA_SSEPD_003 Network Damage Reporter

Start Date: April 2015

Duration: 20 months

Description:
The scope of the project is to produce a smartphone application that is able to work on Android and Apple devices that will allow third parties such as members of the public and the emergency services to easily provide us with reports of damage to our networks.

Expected Benefits:
- Develop new procedures and processes to make use of the data submitted by users, such that the fault report submitted is integrated into the company fault management system.
- Develop a publicity strategy to publicise the availability of the app.
- Evaluate the viability of fault reporting using smartphones.

Progress:
The application has been produced and its ability to deliver the necessary detail of network damage and provide a timely response has been demonstrated. At least 100 colleagues have downloaded the application and provided test reports which demonstrated that the expected functionality works in both the iOS and Android versions.

2.4 NIA_SSEPD_004 Ultrapole

Start Date: April 2015

Duration: 9 months

Description:
The purpose of this project is to determine whether it is possible to develop a non-intrusive product that ultrasonically determines the condition of a wood pole. To deliver this aim there is a need for an instrument that is easy to use in the field, takes non-intrusive measurements, and has the ability to operate from ground level but assess the entire length of the pole. Such an instrument would prevent the need for digging around the base of the pole disturbing previously good ground conditions, or climbing the pole to make measurements at height.

Expected Benefits:
The device made through this project could reduce the need for pole replacement with significant cost savings.

Progress:
The project has now completed. The outcome is that there is an increased understanding of the use of ultrasonic methods to determine the condition of a pole. Underlying physics have been proven and a prototype at laboratory level has been developed. During the project, software was developed which showed that a void (corresponding to a dry rot) or wet rot inclusion could be detected with a high enough signal to noise ratio. The outputs from this project are contained in reports which are available on request.

2.5 NIA_SSEPD_0005 33kV Hot Glove Working

Start Date: May 2014

Duration: 34 months

Description:
The purpose of this project is to determine whether work can be safely carried out on live 33kV overhead lines. If it is found that 33kV hot glove working can be carried out in a safe manner, this will then provide the justification required to the HSE to get dispensation to be able to perform this task and produce the relevant technical, safety and procedural documents associated.

Expected Benefits:
- Financial savings through reduced labour costs
- Financial savings in reduced mobile diesel generation usually needed to provide alternative supplies under outage
- Quicker connection times for customers
- Reduced pollution from diesel generation

Progress:
The safety case for 33kV hot glove working has been produced and presented to the responsible authority. The entire hot glove programme is currently under internal review. There has been a change request in the project due to unforeseen circumstances. Details of the change can be seen in the updated project registration document on the online learning portal.

2.6 NIA_SSEPD_0006 (AHP) Impact of electrolysers on the distribution network

Start Date: October 2013

Duration: 30 months

Description:
The scope of this project is to design and test an operational system for the safe, efficient operation of a hydrogen electrolyser connected to the distribution network and establish a commercial framework for carrying out trials. This will enable assessment of the impacts of a large scale electrolyser on the network and produce a technical design for the ANM system which will allow a full range of trials to be undertaken.

Expected Benefits:
The benefits from this project will relate to the learning from the following:

- Factors influencing siting of electrolysers and their connection requirements, including practical and technical characteristics
- Electrolyser operating profiles and their impacts on network peak demand
- Potential for developing operational and commercial strategies for electrolysers to minimise any network impacts
- Potential for electrolysers to provide other network services

Progress:
This project has now completed. The project has provided valuable learning on the capability of electrolysers to operate under a constrained connection agreement for managing load or to provide services to generators in the generation constrained network. The project has produced reports which can be viewed alongside the standard NIA close down report.

2.7 NIA_SSEPD_0007 Field Team Support Tool

Start Date: April 2015

Duration: 15 months

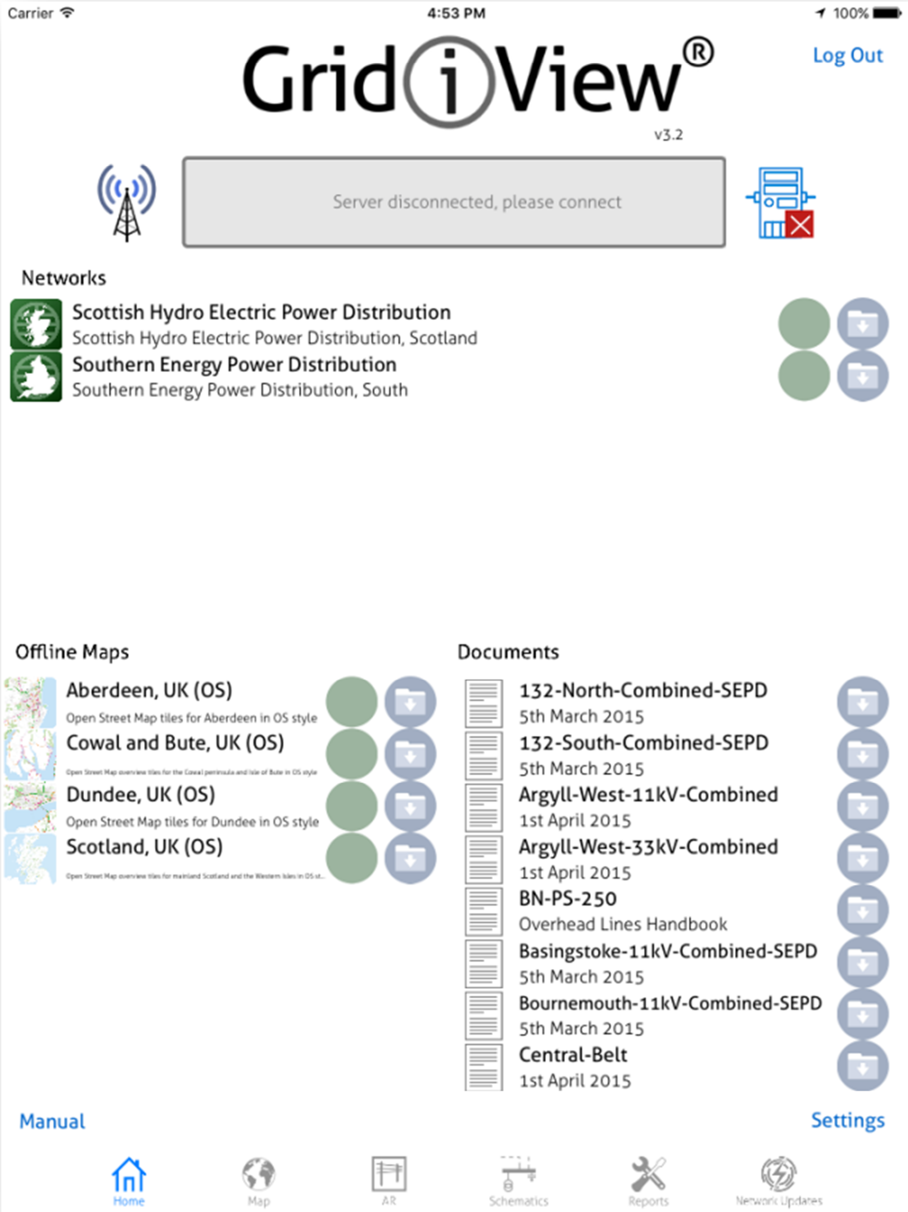
Description:
This is a continuation of an IFI project looking at providing field staff with a tablet device that can hold the necessary documentation, can be updated in real time, and provides a visual display of the power network, overlaid on to a geographic map, or through augmented reality techniques, on live images displayed on screen. This project will further develop the tablet device so that it can be used to report task progress and issues back to supervisors and managers, and to ask for advice and further documentation if necessary.

Expected Benefits:

- Improvements in efficiencies of everyday working thereby cutting down costs
- Improvement in level of customer service through increased productivity and speed of resolution of faults to decrease time off supply.

Progress:
The project is still progressing and so far, user interfaces as the one shown in Figure 2 below have been developed and tested by field staff. The objective to demonstrate that data can be transferred between the tablet and the server in a standardised and secure format that is immune to external interference has been successfully met with data transfers maintaining integrity using data encryption. A requirement to produce a Windows version was identified and further development work carried out.

Figure 2: Application home page



2.8 NIA_SSEPD_0008 Pole-mounted Auto-Recloser Automated Distribution Evaluation (PARADE)

Start Date: April 2015

Duration: 24 months

Description:
Thirty two pole-mounted Intellirupter PulseClosers, supplied by S&C Electric, have been installed on eleven distribution feeder lines on the 11kV network on the southern and western half of the Isle of Wight as part of IFI project 2007_07 Distribution Automation. This project will evaluate their advanced functionality, including the Intelliteam automatic post-fault circuit restoration capability which minimises the interruption of supply to customers caused by faults. This phase of work aims to evaluate the technical operation of, and business case for, the Intelliteam distribution automation technology in the SEPD and SHEPD regions.

Expected Benefits:
The method in this project is expected to reduce customer interruptions and customer minutes lost (CI/CMLs).

Progress:
A new radio type has now been installed on all Intellirupter switch locations, repeater stations and substation nodes. Operation of the mesh radio communications is good in most areas. Intellirupter commissioning is underway and a programme of live line work has been planned to complete the commissioning.

2.9 NIA_SSEPD_0009 Automated Loop Restoration

Start Date: June 2015

Duration: 45 months

Description:
This is an automation scheme for reducing customer interruptions and customer minutes lost (CI/CMLs) by automatically restoring supply to sections of the network initially affected by a fault but not actually having a fault. This project makes use of loop reconnection which does not rely on communication links to transfer data to enable automatic restoration of supplies. Seven pole mounted circuit breakers will be installed on two sections of 11kV overhead line networks on the Kintyre Peninsula to create an overall scheme of eight sections.

Expected Benefits:
The method in this project is expected to reduce CI and CMLs.

Progress:
Equipment for this project has been procured and work has been ongoing to integrate communications between this equipment and the SHEPD control systems. There is insufficient learning to date to publish a progress report for the project this year.

2.10 NIA_SSEPD_0010 Mobile generation re-sync at 11kV and 33kV

Start Date: June 2015

Duration: 22 months

Description:
SEPD and SHEPD are increasing use of temporary mobile generation to allow work to be carried out on distribution networks without supply interruption. Mobile generation can currently be synchronised between the main network and a portion of network to be worked on without interrupting supplies to customers. However, a short interruption is necessary at restoration to the main network as there is currently no provision for synchronising across the switch used for disconnecting the isolated portion of the network. This project involves trial of a pole mounted circuit breaker (Intellirupter) which removes the need for temporary supply interruption during reconnection of an isolated portion of the distribution network.

Expected Benefits:

- Reduction in CI/CMLs
- Reduction in CO2 emissions through a small saving in fuel consumption

Progress:
So far, an Intellirupter has been successfully mounted on a frame for position within the proximity of an air break switch on a pole. The Intellirupter has been used to synchronise a generator to the 11kV network. A live line procedure to enable connecting the Intellirupter has been written and is under review by relevant internal stakeholders. Work is ongoing to achieve the other objectives.

2.11 NIA_SSEPD_0011 ACCESS – Local Constraint Management

Start Date: July 2015

Duration: 24 months

Description:
The project involves the creation of a technical and commercial framework to allow generators to manage generation and demand within a pre- determined network area. Specifically, this is intended to link local controllable demand, such as heating systems, with intermittent local generation. This is in response to policy drivers put in place to facilitate locally owned community generators to be used to supply local customers in an attempt to address fuel poverty in rural areas.

Expected Benefits:
The new local demand side management will have the potential to avoid or defer network reinforcement to allow connection of new renewable generation. This is also anticipated to allow increased utilisation of existing assets and reduction of network losses.

Progress:
DNO requirements for local demand side response have been defined and understood with lessons learnt concerning the definition of a set point. A functional specification was also produced at the project inception and has been followed since. Communications with heating elements in participating dwellings has been proven. Work to achieve the other objectives is ongoing.

2.12 NIA_SSEPD_0012 Network Resilient Zone Utilising Embedded Generation – Feasibility Study

Start Date: July 2015

Duration: 2 months

Description:
The project is to determine the potential to improve the resilience of supply to remote communities by undertaking a feasibility study on the viability for the electricity supply to the community on the island of Gigha to be supported by the local embedded renewable generation. The concept of operating isolated networks in island mode has been considered previously but full implementation of an islanded network zone is not common practice.

Expected Benefits:
The method in this project is expected to reduce customer interruptions and customer minutes lost (CI/CMLs).

Progress:
This project has now completed. The feasibility study that was produced contains invaluable information for understanding the complexities of operating remote networks in island mode. Although the study will not lead to any immediate modifications to network operations, it may inform modification of future operations and connection agreements for renewable generation. The close down report and the accompanying feasibility report can be viewed on the online learning portal.

2.13 NIA_SSEPD_0013 Network Resilient Zone Utilising Standby Generation – Feasibility Study

Start Date: July 2015

Duration: 7 months

Description:
The proposal is to explore alternative ways of improving the resilience of supply to remote communities by undertaking a feasibility study on the viability for the village community at Arinagour on the island of Coll to have a back-up source of supply in the form of a standby generator. Technical and commercial options will be considered such as whether the generator is permanently connected or be brought to site when required or connected over the winter period.

Expected Benefits:
The method in this project is expected to reduce customer interruptions and customer minutes lost (CI/CMLs).

Progress:
The project has now completed. The project established that the approach of providing auto-start local generation is technically feasible. However, it also showed that the project method is not presently financially viable. Further details of the learning from this project can be found in the associated close down report on the online learning portal.

2.14 NIA_SSEPD_0014 Underground Cable Overlay Cost Reduction

Start Date: September 2015
Duration: 19 months
Description:
Underground cable overlay is the activity through which a certain part of the underground net work is replaced or reinforced. The current method involves open cut trenches which is a costly operation and causes disturbance to the public and businesses due to site activities. The project aims to investigate whether the two identified innovative cable overlay methods could reduce the cost and disturbance caused to the customers due to the cable overlay activity.
Expected Benefits:

- Potential reduction in costs due to avoidance of open cut trenches
- Reduction in disturbance to the public and local businesses
- Improvement in environmental performance

Progress:
The project is progressing and has successfully completed the trial stage 1. Currently, the performance of the trialled methods is being evaluated. Two knowledge dissemination and demonstration events for interested parties have successfully been held. Work aimed at meeting the other objectives of the project is ongoing. The associated progress report has more details about the work completed so far.

Figure 3 Demonstration of method at knowledge dissemination event

2.15 NIA_SSEPD_0015 LV Connectivity Modelling

Start Date: October 2015
Duration: 9 months
Description:
This project will develop a LV connectivity model using software to align meter supply points with local substations so that the links between substation feeders and user premises can be shown. These results can then be compared with the existing LV model, to give a level of confidence in using data analytics for this requirement.
Expected Benefits:
If network connectivity can be determined through data analysis instead of the current labour intensive method then there is potential for significant financial savings.
Progress:
The project is progressing with several iterations of development having taken place. The overall project objective is yet to be fully met and the learning from the project is still insufficient at this stage for the publication of a progress report.

2.16 NIA_SSEPD_0016 Alternative Cable Installation Methods (ACIM) – Phase 1 (Feasibility Study)

Start Date: October 2015
Duration: 11 months
Description:
The project proposes to identify innovative methods for installing cables either within ducts or direct laid that could offer reduction in cost and could increase the length of cable that can be installed without joints.
Expected Benefits:
It is expected that the cost of cable installation could be reduced through:

- Reduction in number of joint bays
- Reduction in the need for a receiving bay at the end of the route
- Reduction in construction time

Progress:
The project is progressing as expected and all the objectives have been partially met. Two significant lessons regarding horizon scanning and installation with techniques using water are covered in detail in the associated progress report.

2.17 NIA_SSEPD_0017 Overhead Line Vibration Monitoring Phase 2

Start Date: October 2015
Duration: 9 months
Description:
This project will complete the development of wire-mounted sensors incorporating electronics for detecting change in angle, wire sag and impact of wire strike. This work commenced in a previous IFI project and in this phase, a sample of the prototypes will be installed on representative sections of live overhead lines and their performance as well as that of the server to which they communicate will be evaluated.
Expected Benefits:
The method in this project is expected to reduce CI and CMLs due to overhead line impacts.
Progress:
So far, testing of the sensors and the server has been undertaken at the Power Network Demonstration Centre (PNDC). The project is on track to achieve its aims and objectives. Details about lessons learnt so far are in the associated progress report.

2.18 NIA_SSEPD_0018 Remotely Operated Forestry Mulcher

Start Date: November 2015
Duration: 12 months
Description:
The purpose of this project is to investigate if using remotely operated forestry machinery can significantly reduce the cost and the potential for safety incidents during forestry mulching.

Expected Benefits:
The benefits from this project will be in the savings gained through reduction in labour costs as well as an improvement in safety performance.
Progress:
Remotely operated forestry mulching machines have been procured and delivered to two sites in SHEPD and SEPD respectively. Training in the use of these machines has been completed. Work is still in progress to meet the remaining objectives of the project. The picture in figure 4 overleaf shows one of the machines ready for transportation in a trailer.

Figure 4 Remotely operated forestry mulching machine

2.19 NIA_SSEPD_0019 Western Isles Network Resilient Zone Utilising Embedded Generation – Feasibility Study

Start Date: November 2015
Duration: 6 months
Description:
The aim of this project is to determine the potential to improve the resilience of supply to customers in the Western Isles and to reduce the use of diesel generation by incorporating the output from embedded renewable generation. This project will consider options to make use of embedded wind turbines on the islands of Harris, Lewis, North Uist, South Uist and other islands forming part of the Western Isles located off the northwest coast of Scotland.
Expected Benefits:

- Potential benefits to turbine owners through greater use of embedded generation
- Potential financial savings through reduction in diesel and increased contribution of local embedded wind generation
- Improved environmental performance through reduction in carbon emissions

Progress:
The project has now completed with the production of a feasibility study as planned. The project concluded that the scenarios studied were not compliant with SHEPD's frequency response requirement in their current form. Further details can be accessed in the detailed report published alongside the standard NIA closedown report.

2.20 NIA_SSEPD_0020 Overhead Line Monitoring System

Start Date: November 2015
Duration: 15 months
Description:
Under IFI project 2014_08 Monitoring of Conductors and Poles, a prototype sensor system, comprising line mounted sensors, and a communications system was developed to operate on overhead lines up to 11kV. This was done to mitigate susceptibility of rural overhead lines to damage by wind debris, inadvertent collision by farm and forestry vehicles, kites etc.
This project will take that work further to produce a production ready system. The newly developed sensors will be encased within environmental protective cases, and are powered by solar panel, which trickle charges a backup battery within the case. They will then be installed on overhead lines in several areas of the distribution network and left for an extended period of time to determine the suitability for use, in terms of effect on the installed infrastructure, ability to withstand weather events, and ability to maintain power on during the winter months

Scottish and Southern Energy
Power Distribution

Expected Benefits:
There will be potential cost savings through:

- Reduction in costs due to damage from vegetation
- Reduction in costs due to not undergrounding in high risk areas

There will also be better safety performance through reduction in the risk of safety incidents due to wires drooping close to the ground due to pole movement or collisions with the wires by vehicles.

Progress:
The project is progressing but a modification has been required to deal with the effects of heat generated by the conductor on the sensor. This has resulted in re-design of the sensors. Installation of the sensor is due to begin in the coming winter.

2.21 NIA_SSEPD_0021 Thermal Imaging Observation Techniques for Underground Cable Networks (TOUCAN)

Start Date: January 2016
Duration: 20 months
Description:
This project investigates a technical method using thermal imaging solutions as complementary tools in the context of locating underground cable faults in the power distribution network. Thermal imaging equipment has traditionally been specialised and very expensive but thermal sensing technology has advanced to the point where it is relatively inexpensive to manufacture and is more readily available. Within the context of rapid location of underground cable faults trials and investigations with a range of imaging devices and solutions will be carried out and, if successful, recommendations made for equipping repair operatives and depot staff.

Expected Benefits:
There are potential significant cost savings through reduced time spent locating cable faults and reduced outage times.

Progress:
The project is progressing to plan with several lessons having already been learnt around camera procurement, camera design preference and benefits accruing to the business as usual environment. More details are covered in the NIA project progress report.

2.22 NIA_SSEPD_0022 Ester Fluid Transformer Re-design

Start Date: December 2015
Duration: 57 months
Description:
This project seek to investigate the potential of designing power transformers for use at distribution level to IEC 60076-14 limits which will allow the using of an ester-based fluid as an insulating medium at higher running temperatures. Completion of this project should provide a solution which can be used in situations where there are high safety and environmental concerns whilst providing a unit which can be reduced in size and cost.
Expected Benefits:
It is anticipated that the learning from this project would lead to

- A reduction in the cost of using an ester-based fluid transformer so that it is comparable in cost to conventional transformers which use mineral oil insulation.
- Further cost savings can be achieved through the removal of the requirement for new oil containment works on site.

Progress:
The project is progressing with design of the new transformer having been agreed. At this point, the project has not generated sufficient learning for the publication of a progress report.

2.23 NIA_SSEPD_0023 Fault Passage Indicators for Sensitive Earth Faults (SEF)

Start Date: December 2015
Duration: 18 months
Description:
The aim of this project is to establish the magnitude of reduction in Customer Minutes Lost (CMLs) achievable by locating SEF faults with a revised fault passage indicator (FPI) supplied by Bowden Brothers and modified to be sensitive to currents as low as 4A through tests at the Power Network Demonstration Centre (PNDC), field trials and a post-trial evaluation.
Expected Benefits:

- Improved customer service through reduction in CMLs
- Reduced costs due to reduction in CMLs

Progress:
The project is progressing as expected. The revised FPIs have been tested at the PNDC and have performed as expected. Training has been carried out and the field trial has begun. The project is on target to achieve the outstanding objectives in due course.

2.24 NIA_SSEPD_0024 Network Optimisation Project

Start Date: January 2016

Duration: 9 months

Description:

The project aims to address the problem of undergrounding overhead lines in a trial site. The method proposed will utilise an optimisation tool in order to produce optimal routes for undergrounding the overhead lines. The optimisation tool will optimise routes against a weighted balance of cost, time to construct, social acceptance and other parameters that will be defined during the course of the project.

Expected Benefits:

The anticipated benefit is the reduction in the cost of undergrounding of overhead lines.

Progress:

The project is progressing as planned. As a beneficial side effect, the project's method will now also establish an answer as to whether an entire section of the target overhead network or only parts will be cost-effective to underground. This will be done without additional computational overheads on the optimisation algorithm. More details of further learning already gained in this project can be found in the NIA project progress report.

2.25 NIA_SSEPD_0025 Applied Integrated Vegetation Management (IVM)

Start Date: January 2016

Duration: 87 months

Description:

The project addresses the problem of trees in the vicinity of overhead electricity lines and also ensuring that regulatory standards are met. One of the potential solutions is the use of machine mulchers to clear all vegetation but this is costly and is not desirable from either an ecological or landscape point of view. This project proposes the use of integrated vegetation management (IVM). This is the practice of promoting desirable, stable, low-growing plant communities that will resist the invasion by tall-growing through the use of appropriate, environmentally sound, and cost effective control methods.

Expected Benefits:

- Financial savings through reduction in use of cost-intensive mulching methods
- Environmental benefits due to reduced disruption to protected wildlife species

Progress:

The project is progressing as planned and the first objective to determine current knowledge about IVM strategies in the USA and elsewhere has largely been achieved. Other objectives will be addressed as the project progresses further.

2.26 NIA_SSEPD_0026 Management of plug-in vehicle uptake on distribution networks

Start Date: March 2016
Duration: 22 months
Description:
This project will seek to inform an ENA Engineering Recommendation (or equivalent) for the connection, charging and control of new, large, plug-in vehicle (PIV) load to domestic properties. The focus of this project is on the collaborative approach required to achieve consensus on a solution that can be used to facilitate the roll out of controlled PIV charging.
Expected Benefits:
There are financial savings expected if network reinforcements necessitated by uptake of plug-in vehicles can be deferred based on implementing the monitoring and control methodology proposed in this project.
Progress:
The project has only just commenced but there is already some progress in achieving some of the objectives. Although there have been no significant lessons so far, an NIA project progress report will be published to share progress on engagement with various stakeholders within the energy supply chain.

2.27 NIA_SSEPD_0027 Low Cost LV Substation Monitoring

Start Date: March 2016
Duration: 24 months
Description:
This project proposes a technical method to develop and test a quantity of low cost devices from different manufacturers which will measure voltage and current at the outgoing feeders from a number of secondary substations. Data will be transmitted via the GPRS network from each substation to a central data centre where it will be available to the network planners and other relevant licensee staff. This will be in order to allow informed decisions to be made by network planners and other staff with respect to operational decisions, network planning and customer service.
Expected Benefits:
Improved visibility of the LV network will help in the identification of areas where smart technologies can be implemented. Such technologies will allow deferral of underground cable reinforcement which will result in financial savings.
Progress:
The project has only just commenced and the two providers of the monitoring equipment are progressing with the design of their respective solutions. The project has so far not produced any significant learning hence the NIA project progress will not be published at this point.

2.28 Collaboration projects led by other Network Licensees

Below is a list of other projects that SSEPD is participating in. The projects are led by our collaboration partners hence further details of those projects can be found in their relevant summaries and project progress reports. To provide some indication of where those details can be found, the leading parties are given below next to each project.

- NIA_NGGD0072 Futurewave Phase 3 – National Grid Gas Distribution
- NIA_NGN_142 Project Concur – Northern Gas Networks
- NIA_NPG_001 VONAQ Utility Pole Strength Measurement – Nothern Power Grid
- NIA_SPEN_008 Appeal (Wood preservatives) – Scottish Power Energy Networks
- NIA_SGN0035 Beyond Visual Line of Site – Southern Gas Networks
- NIA_WWU_025 Project Futurewave – Phase 2 (Digital Prototype) – Wales and West Utilities
- NIA_WPD_008 Improved Statistical Ratings for Distribution Overhead Lines – Western Power Distribution
- NIA_NGET0154 Smart Grid Forum Work Stream 7 – DS2030 – National Grid Electricity Transmission
- NIA_NGET0100 Reactive Power Exchange Application Capability Transfer (REACT) – National Grid Electricity Transmission
- NIA_ENWL003 Review of Engineering Recommendation P2/6 – Electricity North West

3 Highlights of the year: Areas of significant new learning

3.1 A new approach to expediting fault location on the LV network

Our TOUCAN project recognises that the rapid and accurate pinpointing of LV underground cable faults is a key factor in minimising supply interruption time and repair costs. This project is carrying on from an earlier project which deployed an auto-recloser for detecting certain types of low voltage cable faults. Since its inception, this project has already produced invaluable learning on how the proposed method could be expedited for business as usual implementation. These lessons include the knowledge that expensive high end cameras are no longer a necessity for this application as the features that attract the higher premium have no direct impact on the heat signature detection capability of the devices. This lesson is deemed pivotal for informing the future roll out of this method. The operational stakeholders within SEPD have kept keen interest in this project and as a result the use of the devices obtained as part of this project is being widened to other network maintenance activities in order to leverage on the potential extra benefits.

3.2 Learning the lessons of Smart Grid implementations through international collaboration

When SEPD joined the EU FP7 DISCERN project, this provided access to the significant resources represented by the project participants and the broad range of solutions implemented by DNO/DSOs in their demonstration projects. Although the NIA project in itself is not a formal collaboration, it has enabled participation in a project which gives SEPD an opportunity to share its learning from the New Thames Valley Vision (NTVV) project as well as access to a consortium of ten other partners including the following DNO/DSOs:

- Iberdrola (Spain)
- RWE (Germany)
- Union Fenosa Distribution (Spain)
- Vattenfall (Sweden)

From this wide collaboration, a wealth of information has already been generated which can be used by all Distribution Network Licensees in GB to help inform how they can implement smart grid solutions for their distribution networks. A website developed for the project, www.discern.eu provides further information on the work involved in the EU FP7 DISCERN project. The close down report published as part of the SEPD's NIA project shares a great deal of learning with links to numerous other documents for reference on specific associated subjects.

3.3 Furthering knowledge on optimal management strategies for distribution networks

SEPD and SHEPD have carried out and completed several NIA projects aimed at developing operational strategies for minimising the impact of a changing energy climate on our distribution networks. One such project is the ‘Impact of Electrolysers on the Distribution Network’. The report published alongside the standard NIA project closure report shares more details of the findings but one major highlight is that the findings obtained are not conclusive and further work will be necessary to ascertain the likely range of electrolysers that can be managed from the network perspective. The project also highlights the need to create a commercial environment which will provide the right levels of incentives for owners or operators.

Another project entitled ‘SSEPD_NIA_0012 Network Resilient Zone Utilising Embedded Generation – Feasibility Study’ looked at how islanded networks could be operated using four wind turbines and a DECC funded Vanadium Redox Flow Battery on the island of Gigha. The project successfully concluded that theoretically it is feasible to operate the island of Gigha in island mode and hence making it possible to restore supply to the island prior to repair of fault situations. The feasibility study has also identified the need for other equipment to make practical implementation viable. Further details are in the associated reports but this highlight is deemed to provide useful precedent that can be useful for managing networks such as the island networks in parts of GB.

In another similar study, ‘SSEPD_NIA_0013 Network Resilient Zone Utilising Standby Generation – Feasibility Study’, there was focus on a small village on the island of Coll. In this project the intention was to find out how the village could benefit from the use of community level standby generation as a means of improving resilience especially under weather induced faults. Although technically this was found to be feasible, the cost-benefit was found to be difficult to justify although an implementation of the methodology would have a positive impact on customer satisfaction.

3.4 Minimising the environmental impact of cable overlays

Our project ‘Underground Cable Overlay Cost Reduction’ has been running for a few months but there has been significant learning to date. As a result, at least two knowledge dissemination and demonstration events were held for stakeholders. These two events provided stakeholders from all interested parties a chance to see the two different methods being trialled as well as to see their performance in different environments. One event involved a demonstration for use of the method on an 11kV XLPE cable installed on agricultural land on a pig farm. The other project demonstrated use of the method on a 33kV oil filled cable installed in a residential street. The different environments were chosen to trial the range of conditions under which the methods could be implemented.

From the progress so far, it has become clear that several suppliers are exploring innovations to provide environment and customer-friendly overlay methods. However, the challenges in implementing the new methods in business as usual are still significant. For instance, the reduced visibility associated with extracting and installing cables without open cut trenches increases the effort required to establish details of underground obstacles or other services by other technologies. In addition, cable joints, cable burial depths and concrete tiles, all parts of the cable infrastructure affect viability of the proposed methods in different ways. These challenges are exacerbated by the fact that in some cases records may not be available or completely up to date. The project progress report shares some recommendations of possible ways to minimise the impact of the foregoing challenges.

Further Information

The complete Innovation Strategy for SEPD and SHEPD can be found on the link below:

http://www.yourfutureenergynetwork.co.uk/12_innovation2014.pdf

Innovation Strategy Update published in March 2016

http://www.yourfutureenergynetwork.co.uk/wp-content/uploads/2016/04/Innovation-Stategy-update-ver-9.pdf

Further information on all of the NIA projects summarised above can be accessed through the following link:

ENA Smarter Networks Portal

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