Scottish & Southern Electricity Networks

Distribution

Network Innovation Allowance Summary Report

1 April 2020 to 31 March 2021

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

MAKE A POSITIVE IMPACT ON SOCIETY

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Foreword

Scottish & Southern Electricity Networks

The UK and Scottish Governments have set ambitious targets to achieve net zero greenhouse gas emissions by 2050 and 2045 respectively. These policies are driving radical change in how we need to plan, invest and operate our networks. The concurrent challenges of decarbonising both transport and heat will require significant and extensive electrification, with the Climate Change Committee (CCC) forecasting that demand on electricity networks could treble by 2050. Our approach to innovation facilitates the trialling, testing and development of new ideas and capabilities. This approach combined with learning by doing is critical to help deliver the ambitions of our stakeholders and our business.

We recently refreshed our Innovation Strategy which highlights the opportunities and challenges facing electricity distribution and sets out why we innovate, how we engage with stakeholders, how we develop and deliver our innovation programme and the challenges and areas of focus for the remainder of this price control.

Our Network Innovation Allowance (NIA) portfolio has been crucial in achieving our knowledge and delivering smart and innovative solutions which deliver value for our customers.

This year we have continued to work in collaboration with industry partners, government, customers and stakeholders to make innovation happen and deliver benefits in a timely manner. In 2020/21, we delivered over £3m of benefits from innovative solutions deployed into Business as Usual (BaU), which brings our total benefits to date in RIIO-ED1 to over £80m. This is comprised of £24m efficiency benefits and over £56m of deferred capital expenditure (capex) delivered from flexibility services. We have listened to our stakeholders who have asked for better channels for sharing our project learnings and, as a result, have developed a new website. If you have an idea or area where you think we should be focusing innovation, then we want to hear from you via **www.ssen-innovation.co.uk**

Stewart A Reid
Head of Future Networks
Scottish and Southern Electricity Networks

Our Portfolio in numbers to the end of 2020-21

Collaborations
Over 130 individual collaborations across our NIA portfolio

NIA Projects ED1
52 to date

Innovation Investment
£16m
NIA investment

Flexibility services
Over 468MW of flexibility contracted

Projects completed ED1
32 to date

Benefits of innovation in ED1

£24m efficiency benefits from innovation deployment

£56m deferred capex through the use of ANM schemes

460,000 customer interruptions avoided

72,800,000 minutes of customer minutes lost avoided

354,000 tonnes of carbon emissions avoided

Scottish & Southern Electricity Networks

Introduction

This report presents a summary of all Network Innovation Allowance (NIA) activities carried out in Scottish and Southern Electricity Networks' (SSEN) license areas: Scottish Hydro Electric Power Distribution (SHEPD) in the North of Scotland and Southern Electric Power Distribution (SEPD) in central southern England between 1 April 2020 and 31 March 2021. Our current portfolio consists of 26 NIA projects, 20 of which we are leading on and are summarised in this report. Of the other six projects, five are being led by other Distribution Network Operators (DNOs) and one by National Grid Electricity System Operator (NGESO).

In the last year and throughout RIIO-ED1, we have delivered a diverse and successful programme of innovation activities where we have led the industry with ground breaking projects such as TRANSITION and Local Energy Oxfordshire (LEO) to support the transition to DSO and to facilitate net zero. These large projects would not be possible if not for the learning gained from NIA projects such as; **Low Cost LV Substation Monitoring, MERLIN, ACCESS and Social Constraint Managed Zones**. At the same time, we have maintained our focus on driving efficiency, improving customer service, enhancing the customer experience and optimising asset performance. Innovation and NIA funding have played a crucial role, in helping to understand the impact net zero will have on the network as well as identifying the new options for delivering benefits for customers.

Co-creation and partnerships continue to form key elements of our innovation activities. Our new projects launched in 2020/21 included collaborations with over 21 different stakeholders. For example, in our **Equal EV** project, we are working with partners Disabled Motoring UK and Impact Research to understand the enablers and the barriers for disabled and vulnerable motorists to access Electric Vehicle (EV) charging infrastructure.

Since our last NIA Summary Report, SSEN has refreshed its Strategic Objectives as we prepare for RIIO-ED2. These are outlined in the diagram below. In response to this change, we have recently amended and updated our Innovation Strategy. The revised strategy outlines how we will deliver our innovation programme and how we will progress through the remainder of ED1 and into ED2.

This Summary Report details all of our NIA projects to date and identifies which of our strategic objectives each aligns to.

- TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS
- PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES
- ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD
- MAKE A POSITIVE IMPACT ON SOCIETY

SSEN Strategic Objectives

Why we innovate

Innovation has always played an important role as a key enabler within SSEN, and the need to innovate becomes imperative as we look to achieve our ED2 Strategic Outcomes. Specifically, we aim to use innovation to:

Support and enable the efficient delivery of new capabilities to meet consumer needs and deliver value.

Our wide-ranging approach to innovation includes:

- Engaging with a wide variety of stakeholders to identify new challenges and opportunities across the whole system.
- Co-creating innovation projects with partners from across the energy supply chain including other licensees, Original Equipment Manufactures (OEMS), innovators, academics etc.
- Identifying opportunities to share best practice and 'fast follow' to deliver benefits for both customers and stakeholders.
- Trialling new tools, techniques, systems and methods of work to improve reliability and deliver efficiencies.
- Developing new knowledge and gathering evidence to shape future plans.
- Widely disseminating and sharing the new knowledge we discover.
- Identifying and testing the functions to support the transition to DSO.
- Demonstrating new and emerging capabilities to de-risk and learn by doing.

Scottish & Southern Electricity Networks

Our development of innovation projects is shaped by a wide variety of sources. Whether in response to external trends, the needs and expectations of our customers, or changes in regulatory and government policy, the need for innovation is critical. We innovate to:

IMPROVE NETWORK RELIABILITY

- Investigating technologies and methods of working to support network security.
- Avoiding and reducing the impact of supply interruptions.
- Improving safety performance for our colleagues.

DELIVER VALUE AND IMPROVE SERVICE FOR CONSUMERS

- Maximising savings by implementing innovative solutions as Business as Usual (BaU).
- Adapting the services we offer to support our stakeholder needs.

FACILITATE NET ZERO TRANSITION

- Improving network access by reducing time and cost to connect low carbon generation, and energy storage technologies.
- Supporting the use of the flexibility and transition to DSO.
- Enabling the uptake of electric vehicles and electrification of heat.

DELIVER MEASURABLE SOCIAL, ENVIRONMENTAL AND SAFETY BENEFITS

- Developing new options for protecting our most vulnerable customers.
- Reducing our carbon emissions and delivering improvements in environmental and safety performance.

Our previous Innovation Strategy aligned with the RIIO-ED1 primary outputs · **1. Connections · 2. Customer Service and Social Obligation Priorities · 3. Environment · 4. Reliability · 5. Safety**. The following diagram shows how these outputs have been amalgamated into our new strategic objectives in our updated innovation strategy.

TO DELIVER A SAFE,RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

1 2 3 4 5

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

1 2 3 4 5

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

1 2 3 4 5

MAKE A POSITIVE IMPACT ON SOCIETY

1 2 3 4 5

Notable Innovations Benefits and Learning against our Strategic Objectives

All our innovation projects can be aligned to our strategic objectives.

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

Understanding the health of our existing assets is key to improving our overall network reliability through better coordination of remedial and investment actions. We are developing new approaches when monitoring the health of our assets to better understand condition and anticipate failure, allowing us to proactively intervene thus minimising customer disruption.

SUBsense applies an acoustic sensing system to monitor the health of our submarine cables. Real time monitoring of submarine cables will facilitate understanding of the condition of our cables. This understanding will support management of wear and tear of these cables, thus mitigating associated lost or interrupted supplies. Acoustic Monitoring will also give us an accurate fault location, (+/-10m) should a cable fault occur to allow SSEN to assess the most appropriate method of repair; and arrange for an enhanced inspection of the cable for damage in that location.

In the event of a cable movement, an alert is issued, ensuring preventative measures can be taken such as additional rock dumping to secure the cable prior to it failing.

The key learning from **SUBsense** will be information and alerts if we have excessive cable movement on the seabed which can lead to premature wear or environmental damage. Currently, submarine cable condition is not monitored in real time and is assessed by costly inspection by divers or Remote Operated Vehicles (ROV's). The aim of the project is for our customers to benefit from an extended life of submarine cables using the data and alerts provided by **SUBsense**.

We are a project partner on UK Power Networks (UKPN) **HV feeder Monitoring to pre-empt Faults** project, which is exploring the benefits of monitoring our overhead and underground High Voltage and Extra High Voltage Networks. The project aims to test a solution, "Distribution Fault Anticipation" (DFA), to monitor feeders to pre-empt faults. The DFA solution consists of a disturbance recorder which can be installed on HV or EHV feeders to monitor network characteristics and a "Master station" cloud-based service which provides the secure conduit and main data repository between the DFA and the DNO. This will be trialled alongside a network analysis tool (ASPEN Distriview) and Fault Passage Indicators (FPIs) to monitor a selection of HV and EHV feeders to identify the location of network issues before they materialise into faults.

SYNAPS 2 is exploring the benefits of monitoring our underground LV Networks through Waveform Analysis. The monitoring technique is looking to forewarn against faults on our LV underground system. The outcome of this project will not solely be a system that warns against pre-fault activity but will generate data to support the management of our LV underground assets within our Investment Management process.

LV Monitoring; in 2020/21 SSEN expanded BaU rollout of secondary substation monitors following the successful completion of the **Low Cost LV Substation Monitoring** NIA project. BaU rollout has been achieved through the LEO project and Load Managed Areas project.

Project LEO is based in the county of Oxfordshire, which is the focus area of our flagship DSO works, has installed 90 substation monitoring units, covering 450 LV feeders.

These units are returning insights into loading and consumption patterns. An additional 540 units are being installed across our network areas as a business as usual undertaking.

SSEN have also received Green Recovery Funding for around 150 units to cover Load Managed Areas in Dundee and Thurso, plus an additional £2m Green Recovery Funding to invest in around 1,500 units to be installed by the end of ED1. Once complete this will total around 2,280 LV substation monitors installed in ED1, which will provide insights across 11,000 LV feeders increasing our clarity and vision of network power flows.

The previous learning from the Low Cost LV Substation Monitoring NIA project and the impact that it had on the cost of deployment of monitoring impacted directly on the successful BaU roll out.

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

Co-creation and collaboration are essential to our innovation portfolio.

Working with partners ELECTRON, the award winning **TraDER** project is demonstrating how distribution constraint products can be traded in near real time. The output of this project will integrate markets, both horizontally (i.e with other, longer term DSO products) and vertically (i.e other trades within the same time period, such as the Balancing Mechanism). **TraDER** provides a platform creating a single access point, making it easier for distributed energy resources to provide valuable services such as balancing, stability, and network capacity, In this way, "whole system value" is maximised by enabling price-driven coordination between the NGESO, DSO and other market participants.

Our work in the **MERLIN** project brings together academia and industry to look at how power system economics will impact on future network operation, with a focus on the economic efficiency of flexibility products.

In our **Smart Hammer** project, we have partnered with a local SME based on the Western Isles, to develop a tool which can be used as a consistent and reliable alternative to wood pole inspection techniques.

The tool takes the form of a **Smart Hammer** that connects to the operator's smart phone, providing an asset score of the poles health. The project team have been analysing the importance of rot location specifically on the height of the wooden pole and how the location of the hammer strike affects overall pole health and condition.

Following a number of strikes, the data produced will provide a consistent output score that is weighted. This score is based on where on the pole deterioration has been found, with the end goal being a Red, Amber or Green status. This will give the operative a clear visual on the condition of the pole. Earlier detection of a deteriorating pole will enable proactive replacement and reduce unplanned supply interruptions, thus improving system reliability.

The **Smart Hammer** also has the potential to be used by our field staff to assess the safety risk more accurately before climbing a pole. The key learning has been the crucial integration of this data within our existing management systems, which will inform future planning.

SSEN actively participates in wider industry initiatives such as the Energy Networks Association (ENA) Open Networks project and works closely with other network licensees to maximise the efficiency and effectiveness of our innovation portfolio. We engage in a number of collaborative projects such as the Western Power Distribution (WPD) led **Wildlife Protection** project, which is looking to develop a risk assessment based methodology for the implementation of wildlife protection measures and also reviewing international

best practice to identify a wider range of potential interventions. SSEN is also involved in the Wales and West Utilities **Eye in the Sky** project which looks to develop a framework that will allow Beyond Visual Line Of Sight flight with drones (BVLOS). This project has potential environmental and societal benefits from a reduction in noise pollution through the elimination of manned helicopter usage and carbon savings, benefiting communities from fewer overhead helicopter flights.

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

In November 2020, we registered our **Equal EV** project, making us the first DNO to investigate accessibility of EV charging and suitable options which can improve services for current and future EV owners with disabilities. Alongside project partners, Disabled Motoring UK and Impact Research, SSEN has conducted a literature review, and a number of stakeholder interviews and focus groups have been held which included 14 different companies and organisations, such as local government, charities and independent start-ups leading the way in either accessibility, technology or EVs. The findings to date have identified the following barriers:

Access to charge points The physical act of using an EV charge point can be a real challenge for those with mobility problems, with different considerations depending on the charge point location.

Cost The initial outlay for an EV is applicable to all drivers. However, driving can already be more expensive for mobility-impaired drivers than for non-disabled drivers due to adaptions needed to the car, increased insurance costs, and additional mobility equipment needs.

Psychological barriers and range anxiety
Through the literature review, we have identified that mobility-impaired drivers are likely to be more risk averse than non-disabled drivers and are more likely to be affected by EV range anxiety. Being able to travel independently is key, and so journeys are often subject to a higher level of planning and preparation than for non-disabled drivers. Uncertainty about where and when they may be able to charge is a key barrier for many mobility-impaired drivers. The length of time needed to find a charger and charge their car is a further concern.

Lack of information on accessible charging
Specialist organisations such as Motability, Disabled Motoring UK and publications such as UCan2, the driving magazine, all provide information on driving EVs. However, this information is not presented unless drivers have reached the consideration stage of purchasing an EV and therefore actively search for it. In addition to this, many mobility-impaired drivers do not consider themselves disabled as such and wouldn't necessarily be exposed to specialist messaging. Without more widespread knowledge of and exposure to EVs, assumptions that EV charging isn't practical for these mobility-impaired drivers will be difficult to address.

The next steps for the project will investigate what new technologies are available which could support this group of people, what enablers are required to participate and what new services a DNO needs to offer under the Priority Services in the future.

We are also collaborating with SPEN on the **APPEAL** project which is trialling alternative preservatives to creosote for wood poles. Creosote is environmentally hazardous and is about to be fully banned in the UK. This ban will severely disrupt the supply of timber overhead line (OHL) supports (millions in the UK). A small increase in the cost of an alternative preservative will have a major impact on the cost of maintaining the network. The chosen alternative must also be able to protect the poles as effectively as creosote to avoid premature failures of our OHL.

DISABLED MOTORING UK

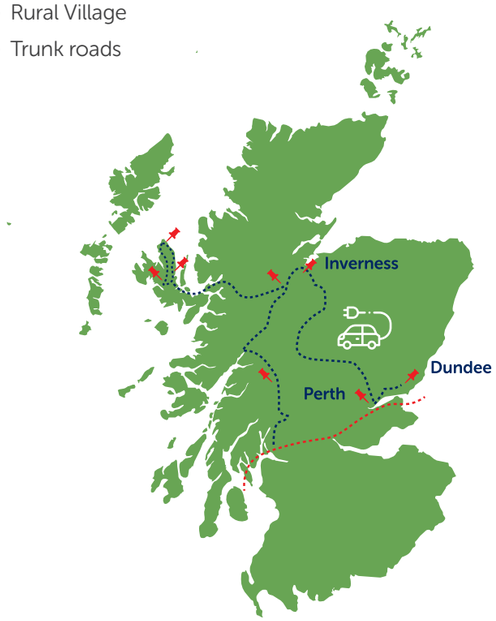
IMPACT FROM INSIGHT TO INFLUENCE

Scottish & Southern Electricity Networks

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

EV sales continue to increase, with over half a million ultra-low emission vehicles now on UK roads This brings increased demand and reliance on the electricity network. Our NIA portfolio is exploring future challenges for the network and identifying solutions and partnerships to address. Our E-Tourism project is exploring potential seasonal and geographical network challenges associated with EV charging points, which may arise from large volumes of EVs being driven by tourists. A desktop study was undertaken to understand the scale, location and impact on the electricity network of seasonal EV charging and particularly at locations where public transport was limited in the North of Scotland. The study investigated eight use cases which included:

- A Ferry Port
- Two Rural tourist attractions
- City Centre
- Rural Village
- Trunk roads



This allowed SSEN to identify where in these eight use cases the network would need to be either reinforced or managed through flexibility to cope with the seasonal peaks. Key outcomes to date have indicated:

1. Constraints are not expected at primary substation level, but some secondary substations could be constrained.
2. Isolated tourist sites and popular routes are predicted to be the worst affected. This highlights the need for a just and fair transition to ensure those in rural communities are not left behind.
3. The season when highest network demand is predicted depends on the balance between existing network demand and predicted charging demand. This needs to be explored further however this could be a significant challenge for the electricity network as transport and heat converge.

In addition to seasonal Impacts, we are also exploring new data sharing opportunities and partnerships through our **Skyline** project. **Skyline** is working with partners across the EV supply chain and UKPN, to explore how data can be used to give early visibility of new EV registrations and charge point connections. This gives an opportunity for DNOs to make timely and proactive network interventions, reducing costs for consumers and facilitating the changes necessary to support the transition to EVs.

Summary of progress

Up to the year ending 31 March 2021, there were 26 projects funded under SEPD and SHEPD Network Innovation Allowance (NIA). Of these, 20 projects were led by us and the remaining six were managed by other DNOs. Over the year, five of our NIA projects have been successfully completed and seven new projects have been registered.

Each project accumulates knowledge and learning which aligns with one or more Strategic Objective as outlined in Section 1. The appropriate primary Strategic Objective is denoted via the inclusion of its icon.

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Scottish & Southern Electricity Networks

3.1 NIA_SSEPD_0029 11kV Power Electronics Providing Reactive Compensation for Voltage Control

Key activities

This project demonstrates the deployment of a new power electronic reactive compensation unit capable of dealing with a range of potential voltage problems.

Expected benefits

The ability to improve power quality will reduce nuisance electrical disturbances such as light flicker for our customers as the 11kV Power Electronics equipment has the potential to reduce rapid voltage changes which can cause customers lights to flicker. Where the unit has been installed our customers have seen improvements in their quality of supply. This ability to better manage the network by limiting voltage and current fluctuation will also reduce the wear and tear on electrical equipment. The 11kV Power Electronics project also has the added benefit of being able to increase the output capacity from solar and small-scale wind generation connections.

Progress

Following initial testing and investigation of the devices at the Power Network Distribution Centre (PNDC), one 11kV Power Electronic unit was installed at a wind turbine site at Shawbost on the Isle of Lewis to specifically address customer complaints associated with voltage quality. This year the new unit has improved the voltage profile seen by our customers resulting in fewer sudden short losses of supply and a reduction in complaints associated with light flicker.

Primary Strategic Objective

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

Collaborating with

amsc

UNIVERSITY of STRATHCLYDE POWER NETWORKS DEMONSTRATION CENTRE

Funding

£732,000

Start/end date

June 2016 / September 2020

Website

www.smarternetworks.org/project/nia_ssepd_0029

3.2 NIA_SSEN_0034 SUBsense

Key activities

The project aims to install a real time monitoring system using Distributed Acoustic Sensing (DAS) on several new subsea cables. The DAS system will utilise the single mode fibre optics embedded within the cable. A DAS interrogator unit connects to the optical fibre which essentially turns the fibre into an array of virtual microphones. Short pulses of highly coherent light are transmitted down the fibre by an interrogator unit, and backscatter returns are observed. The backscatter observations detect minute cable strains induced by acoustic events, which when passed through to a processing unit can provide interpretations and visualisation of the signal. **https://www.subsense.co.uk**

Expected benefits

Real time monitoring of submarine cables will give SSEN a greater understanding of the conditions in which our cables operate and proactively manage mechanical wear and tear of the cable, thus preventing associated lost or interrupted supplies. This monitoring will notify us when there is an immediate concern to the health of the submarine cable or safety of nearby marine users. Submarine cables are one of the costliest assets within the distribution network. Being able to identify a fault location in real time will allow us to carry out repairs quickly and effectively before they pose a potential risk to other marine users.

Progress

Communications testing and system integration of the DAS systems have been completed. The DAS systems will be rolled out to the remote areas but the roll-out has been affected by Covid this year.

Primary Strategic Objective

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

Collaborating with

AP SENSING advanced photonic

Wireless innovation

Funding

£1,458,218

Start/end date

August 2018 / August 2021

Website

www.smarternetworks.org/project/project/nia_ssen_0034

3.3 NIA_SSEN_0035 Informed Lightning Protection

Key activities

Lightning strikes are known to cause a significant number of supply interruptions to our customers and damage to the network which is costly to resolve. In our Scottish Network, lightning strikes are the second highest cause of customer interruptions and minutes lost, whilst in our Southern Network it is the fifth highest cause. Therefore, avoiding the impact that unplanned outages have on our customers is an important issue for SSEN.

Expected benefits

The main benefit of this project is expected to be a reduction in lightning-related faults causing customer supply interruptions.

Progress

The data analytics phase of the project has been successfully completed, with the identification of a number of locations which are suitable for the installation of surge arresters aimed at protecting the circuits against lightning strikes. Up to March 2021, 150 surge arresters have been installed in our Southern Network and another 300 are planned to be installed in our Northern Network. Due to the initial performance success of these surge arresters protecting against lightning, there are plans to protect additional high risk circuits during RIIO-ED2 through BaU funding.

Primary Strategic Objective

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

Collaborating with

ElectraLink

Open Grid Systems

Tyco Electronics

Funding

£521,000

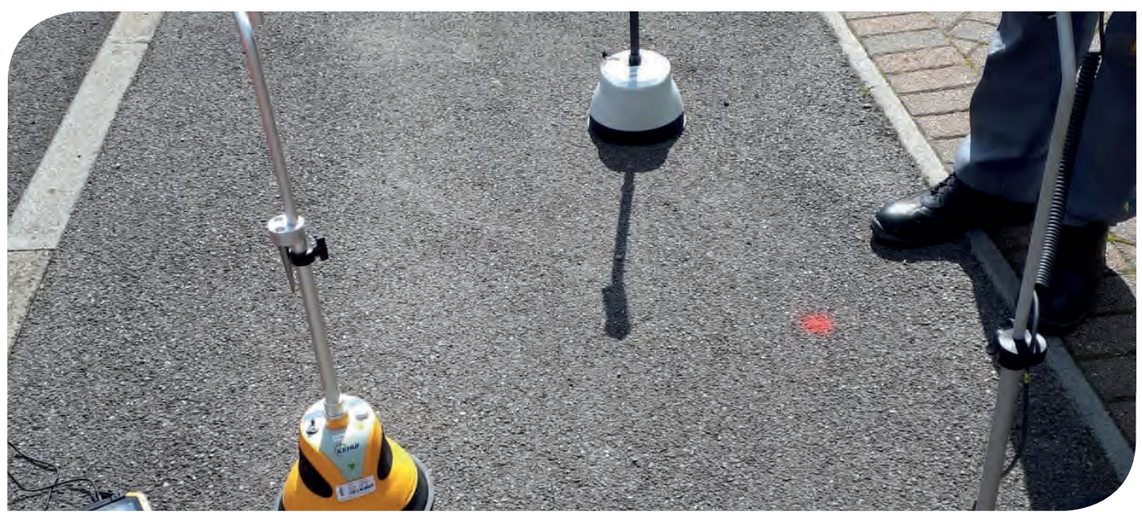
Start/end date

March 2019 / March 2023

Website

www.smarternetworks.org/project/project/nia_ssen_0035

3.4 NIA_SSEN_0037 LV Underground Fault Location Technologies



Key activities

The project looks to improve the accuracy of low voltage, underground, fault location techniques, reducing repair times and shortening outages for our customers. Initially a range of acoustic devices and fault passage indicators (FPIs) were trialled on a test network. The most successful devices were then passed on to the field teams for trialling.

Expected benefits

This project will establish the technical and commercial viability of a selection of acoustic cable fault location devices and fault passage indicators that can work in conjunction with existing proven LV fault location technologies. It will also look to maximise the portfolio of technologies available for LV fault location and make recommendations for optimal adoption of the suitable devices for BaU use. Environmental benefits will come from being able to more accurately pinpoint an underground cable fault, reducing the number of excavations and volume of spoil.

Progress

Successful test network trials identified the most technically capable devices, which have since been passed to a selection of field teams in both licence areas. As these teams cover different network topographies and cable types, this was a significant field test of the LV detection tools. Data from the field is being collected, analysed and compared with historical records to establish that there are quantifiable improvements in fault location detection. Pending the results of this analysis the business is now looking into larger deployment and use of acoustic devices and further development of the FPIs.

Primary Strategic Objective

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

Funding

£396,000

Start/end date

June 2019 / December 2020

Website

https://www.smarternetworks.org/project/nia_ssen_0037

3.5 NIA_SSEN_0038 E-Tourism

Key activities

The project's aim is to carry out traffic flow and network modelling to understand the impact of EV charging. It includes the design and development of specific network and local flexibility solutions to assist with security of electric supply to EV charging hubs to deal with highly seasonal charging peaks in the tourist season.

Expected benefits

The benefits of this project will be an improved understanding of how increased EV uptake, combined with tourist behaviour, will impact seasonal peak electric demand on the network, identifying the scale, location and duration of any increased charging followed by an in-depth study of specific locations. It will look to enhance stakeholder engagement by helping local community groups, local authorities and other organisations to understand the impact that heightened EV tourism will have on local demand. It will also benefit investment strategies for network development based on expected impacts of EV uptake and tourist patterns, thus coordinating future network capacity efficiently.

Progress

This project has published a report detailing findings from a North of Scotland based study which highlights the scale, location and impacts of seasonal EV charging.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Collaborating with

elementenergy

Scottish Government
Transport Scotland

Funding

£401,000

Start/end date

July 2019 / September 2022

Website

https://www.smarternetworks.org/project/nia_ssen_0038

3.6 NIA_SSEN_0039 Electric Heat Pathway

Key activities

A presumption has been made that any electrified heat should use heat pumps. However, it is essential to establish a pragmatic solution to the immediate problem of the Radio Teleswitching System (RTS) switch-off in March 2023 and a long-term model which will allow electric storage heating to play an appropriate role in heat decarbonisation and the shift to a smart, flexible electricity system. .

Expected benefits

A report titled 'An Electric Heat Pathway – Looking Beyond Heat Pumps report' was produced to help stimulate the public debate on storage heating, whilst also providing a better understanding of the opportunities and benefits of flexible heating demand and how best to implement them.

Progress

SSEN held two well-attended external webinars to share the findings of the report.

Internally, it is currently being considered how we move forward with the recommendations within the report. It will feed positively into the RIIO-ED2 planning, generating and supporting other innovation projects.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Collaborating with

Grid Edge Policy
Regulation · Energy · Consumers

Funding

£33,400

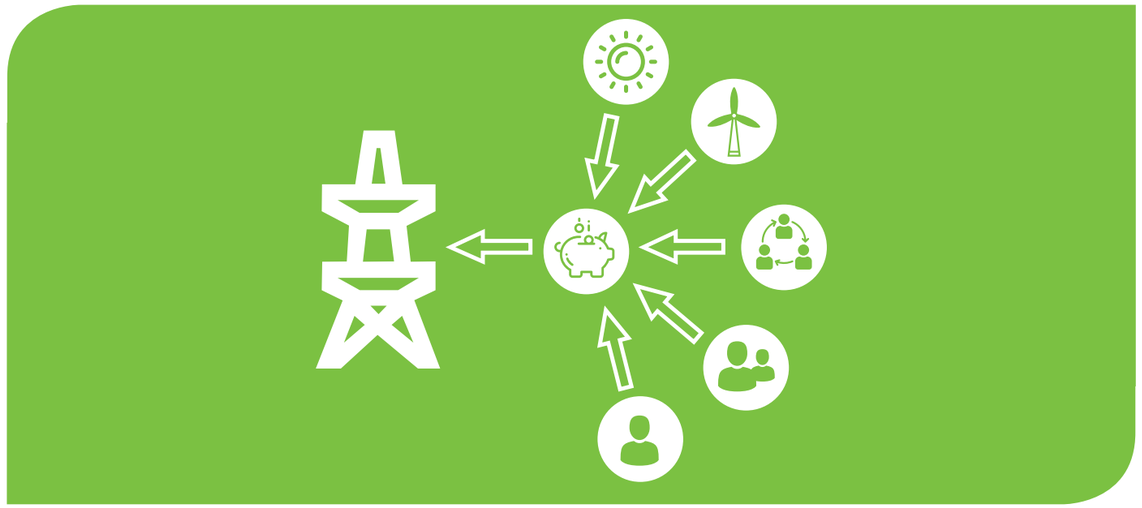
Start/end date

October 2019 / April 2020

Website

https://www.smarternetworks.org/project/nia_ssen_0039

3.7 NIA_SSEN_0040 Technical Interfaces to Scale as a DSO



Key activities

This project will determine the requirements for safely and securely communicating with customers' end point devices, such as small generation connections, to enable more flexible connections and flexibility services at a smaller scale and at a lower cost. Initially, investigation will take place into the existing international communication protocols and interface devices that could be used for distributed energy resource management. A subset of the protocols and devices identified will be assessed within laboratory-based trials.

Expected benefits

A key benefit of this project is the creation of a technical specification of requirements around communication with customers' end point devices, alternatively known as Technical Interfaces, that can be used by the electricity industry. The trial aims to assess the readiness of the selected protocols and devices for DSO applications, the compatibility of these interfaces with our existing systems and the cyber security implications of using these interfaces.

Progress

A report has been produced outlining the possible communication protocols and architectures for customers' end point devices. This has led onto further work assessing and analysing the cyber security strength of the protocols, including consultations with the ENA Open Networks Project.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Collaborating with

University of Strathclyde
SGN Your gas. Our network
wipro
UK Power Networks
University of Strathclyde Power Networks Demonstration Centre

Funding

£448,000

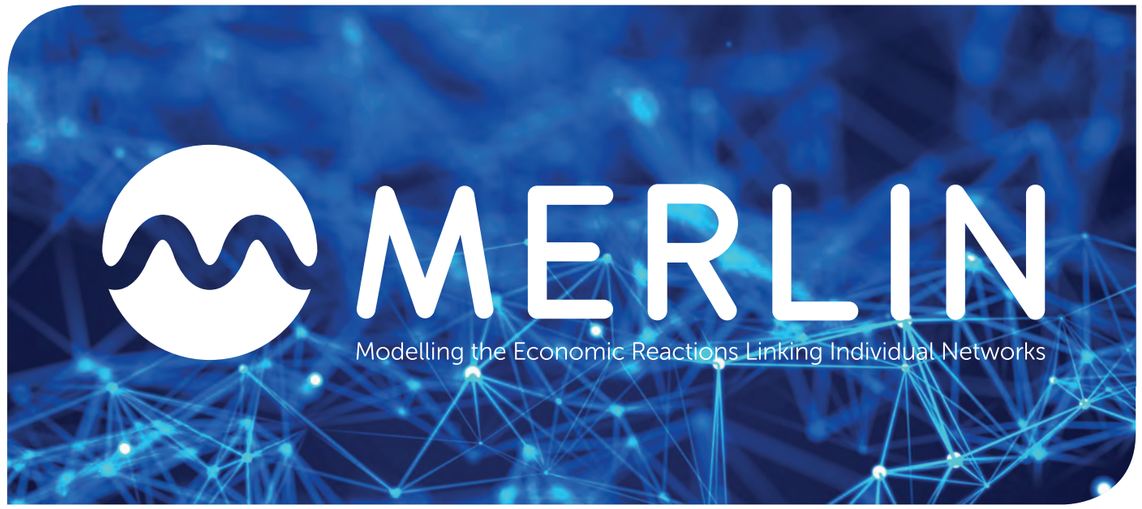
Start/end date

September 2019 / September 2021

Website

https://www.smarternetworks.org/project/nia_ssen_0040

3.8 NIA_SSEN_0041 Modelling the Economic Reactions Linking Individual Networks (MERLIN)



Key activities

The project is testing the economic impact that a variety of flexibility scenarios could have in a future DSO world. The objective is to inform the wider DSO work that is ongoing, especially the TRANSITION and LEO projects.

Expected benefits

The project will have a variety of benefits including:

- Improving the 11kV network design process by providing insight into automation through Common Information Models (CIM)
- Reducing risk of flexible service procurement through model studies
- Assisting with flexible service investment decision making processes

Progress

We have completed the first 5 of 8 Milestones for the project:

- **Milestone 1**: Creating an International Experience on Flexible Services Summary Report
- **Milestone 2**: Defining Investment Scenarios to Model
- **Milestone 3**: Reporting on Regulation & Policies
- **Milestone 4**: Creating Investment Scenarios
- **Milestone 5**: Developing an Operational Plan for Testing Day Ahead Market

The modelling phase of the project has now been completed and the cost benefit analysis (CBA) work has started. Detailed deliverables can be found at the project website: **https://project-merlin.co.uk**

Primary Strategic Objective

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

Collaborating with

Department for Business, Energy & Industrial Strategy

opus one solutions

Open Grid Systems

Hydro Ottawa

University of Cambridge Energy Policy Research Group

Funding

£338,600

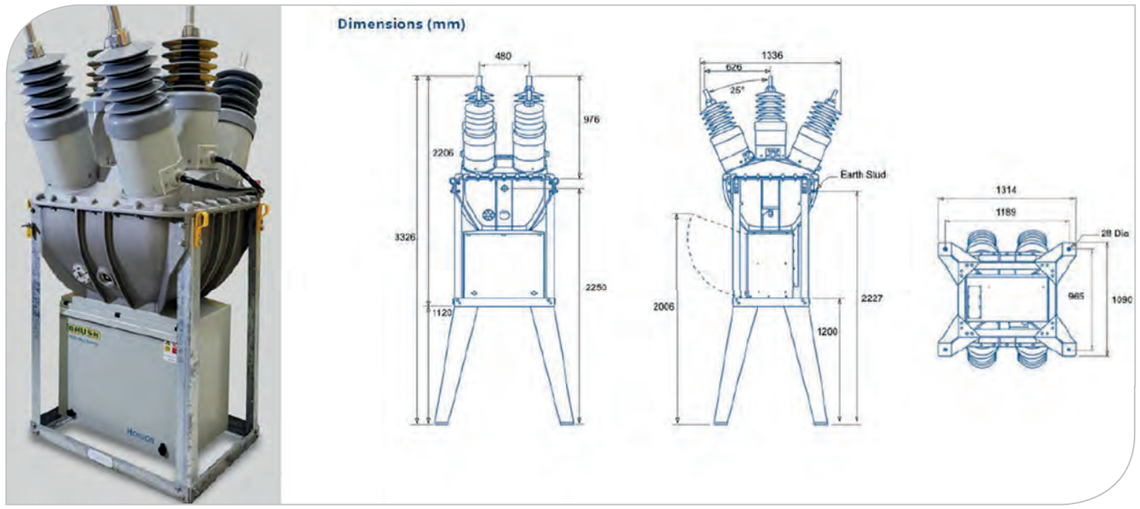
Start/end date

October 2019 / October 2021

Website

https://www.smarternetworks.org/project/nia_ssen_0041

3.9 NIA_SSEN_0042 Feasibility of Utilising Compressed Dry Air in 33kV Insulated Switchgear



Key activities

The environmental impact of Sulphur Hexafluoride (SF_6) means that its use in the industry is becoming increasingly regulated and restricted. SSEN has more than 10,000 items of switchgear that utilise SF_6 for both insulation and arc interruption. There are a variety of environmental implications associated with managing equipment containing SF_6. This project will determine the viability of utilising dry air as an SF_6 alternative.

Expected benefits

Benefits of this project has been the production of an appraising report of new SF_6-free 33kV switchgear technologies, inclusive of risk assessments, training requirements, operation and maintenance requirements, ensuring that any alternative is both safe for our staff to operate and maintains network integrity. The report will form part of the road map to deliver SF_6-free switchgear into BaU thus aiding the reduction in our operational Carbon Footprint. The report is available on request: **futurenetworks@sse.com**

Progress

The project was completed in 2020 by Threepwood Consulting Ltd. Threepwood were appointed to carry out the Desktop Study, on behalf of SSEN, aided by a very positive response from manufacturers. From these responses the report has been compiled detailing the feasibility of utilising compressed dry air as an alternative to SF_6.

Primary Strategic Objective

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

Collaborating with

Threepwood Consulting

Funding

£66,700

Start/end date

December 2019 / June 2020

Website

https://www.smarternetworks.org/project/nia_ssen_0042

3.10 NIA_SSEN_0043 Whole System Growth Scenario Modelling (Phase 2) known publicly as Regional Energy System Optimisation Planning (RESOP)

Key activities

To allow the UKs ambition to efficiently achieve its low carbon ambitions, a holistic whole system approach is required involving key external stakeholders as well as other energy vectors such as gas. There is a wider awareness of the climate emergency, which has resulted in national, regional and local government bodies beginning to set strict targets to reduce greenhouse gas emissions to net zero. Many of these targets rely on electrification of heat and transport. Individual local authorities are beginning to create their own strategies for low carbon technologies, e.g. EVs and heat, as well as detailed local energy strategies. This project is a partnership to help explore the range of whole system growth scenarios to both achieve net zero whilst facilitating the economic development plans of the local area.

Expected benefits

The benefit of this project will be the development of a methodology to improve coordination between local energy planning and network development, enabling the Distribution Network Operator (DNO) to engage with local authorities in a structured way. As part of that methodology the project will refine the initial model tool developed in the first stage of the NIA project to produce a local energy network model which will allow stakeholder information to be easily incorporated into network planning and for stakeholders to better understand the network implications of their decisions.

Progress

The project has held several requirement gathering workshops with key internal SSEN stakeholders, Dundee City Council, Scotia Gas Network, Scottish Government and Transport Scotland. A paper design has been published in draft form to record the direction and seek agreement with all key stakeholders before progressing to the physical design.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Collaborating with

Dundee City Council

Baringa Brighter together

CATAPULT Energy Systems

Funding

£343,000

Start/end date

January 2020 / July 2021

Website

https://www.smarternetworks.org/project/nia_ssen_0043

Scottish & Southern Electricity Networks

3.11 NIA_SSEN_0044 Smart Hammer

Key activities

The Smart Hammer project will develop a new hammer tool for testing and inspecting the asset health of wood poles. The project will field trial the Smart Hammer on completion of development across the SSEN Operational Regions. By striking the pole with the hammer it will measure the asset health of the pole and record this in an accompanying Smart Hammer app.

Expected benefits

Benefits of this project will be the establishment of a technically and commercially viable Smart Hammer, with accurate and repeatable results to help detect internal rot or damage to wooden poles. The project aims to identify if the Smart Hammer is a consistent and reliable alternative to the traditional method of wood pole inspections, which use a conventional hammer and the operators interpretation of the strike. Earlier detection of a deteriorating pole will enable proactive replacement, preventing unplanned electric interruptions due to broken poles thus improving system reliability. The Smart Hammer also has the potential to be used by our field staff to accurately assess the safety risk before climbing a pole.

Progress

This project is now in the process of testing the B-Model which is a 3rd generation prototype hammer. This will then lead onto the next stage to develop the final prototype hammers and carry out intense testing on our network.

Primary Strategic Objective

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

Collaborating with

Spectral Line System Ltd

Funding

£498,200

Start/end date

February 2020 / October 2021

Website

https://www.smarternetworks.org/project/nia_ssen_0044

3.12 NIA_SSEN_0045 Future Fiscal Forecasting

Key activities

This project will look to implement a new forecasting model to help inform future pricing decisions across SSEN and the wider industry. The project will test the hypothesis that the use of GB Settlement sourced 'fiscal' metering (referring to recording electrical energy flow for each half hour for Settlement (Half Hourly Metering Systems)) in combination with SCADA data and weather data will lead to more accurate forecasts for fiscal purposes. The project will use the above data to:

- Forecast energy consumption for a Distribution Service Area (DSA) and disaggregate this into the corresponding Grid Supply Points (GSPs) e.g. the SEPD DSA and 18 GSPs; and
- Forecast energy consumption for a sample of HV feeders with a high uptake of demand or generation (two generation-dominated, and two demand-dominated).

Expected benefits

Such a forecasting solution, utilising advanced data analytics techniques, has the potential to develop more detailed forecasting to help maintain accurate billing for customers. It could also improve the forecasting of Low Carbon Technologies; potentially facilitating their uptake.

Progress

This project has concluded by completing:

- An assessment of the availability and suitability of current and future data sources which could provide more detailed fiscal forecasting of energy volumes
- an assessment of methodology to be used; and
- a quantitative evaluation of the level of accuracy of the new forecasting model.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Collaborating with

innowatts

Funding

£131,500

Start/end date

March 2020 / December 2020

Website

https://www.smarternetworks.org/project/nia_ssen_0045

Scottish & Southern Electricity Networks

3.13 NIA_SSEN_0047 TraDER

Key activities

TraDER will provide a platform, creating a single access point, to make it easier for distributed energy resources to provide valuable services such as balancing, stability, and network capacity. In this way, "whole system value" is maximised by enabling price-driven coordination between NGESO, DSO and other market participants. Project TraDER will both develop and trade flexibility in as near real-time as possible. The solution will integrate the flexibility market both horizontally (i.e. with other, longer term Distribution System Operator (DSO) products) and vertically (i.e. other trades within the same time period, such as the Balancing Mechanism).

Expected benefits

There are significant learning benefits associated with the project as SSEN will act as a facilitator to TraDER by delivering data from the Active Network Management (ANM) system currently operating in Orkney and then facilitating changes to the ANM system in order to execute flexibility trades created by the TraDER platform. In return, TraDER will deliver outputs which will allow SSEN to assess the impact of how trades can be implemented on the ANM scheme, e.g., changes to Last In First Out (LIFO) connection order, and associated costs to SSEN.

Progress

To date, the project has successfully designed a process from which ANM data can be captured and transmitted to Electron in near real-time. Further work is being undertaken to deliver this active link from SSEN's ANM system prior to the project end.

TraDER has given SSEN a detailed insight into the types of data that will be requested both now and in the near future. These requirements have been captured as part of the lessons learnt and will be shared with larger DSO-related projects such as TRANSITION during the project closedown.

Primary Strategic Objective

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

Collaborating with

ELECTRON

Funding

£275,000

Start/end date

March 2020 / June 2021

Website

https://www.smarternetworks.org/project/nia_ssen_0047

3.14 NIA_SSEN_0046 Local Electric Vehicle Energy Loop (LEVEL)

Key activities

Increased use of EVs requires greater resilience of the electricity network. This project is investigating the specification of temporary and portable EV charging infrastructure devices to provide additional capacity to meet short-term demand in a location.

Expected benefits

This project will develop a standard and specification for portable temporary EV chargers to assist with network resilience and meet short term demand.

Progress

The project has identified use cases for mobile charging points ranging from emergency road closures, storms and sporting events. There is ongoing investigation into the practicalities of the connection and operation of the mobile change points.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Funding

£320,000

Start/end date

April 2020 / October 2021

Website

https://www.smarternetworks.org/project/nia_ssen_0046

Scottish & Southern Electricity Networks

3.15 NIA_SSEN_0048 Skyline

Key activities

To develop a central asset database of domestic electric EV charge-points, providing detailed visibility of their geographical emergence as early as possible. Early visibility will allow DNOs to use the lead times to better plan for the required network investments or alternative solutions to support the uptake of EVs in the locations in which they are most likely to connect.

Expected benefits

The earlier the DNOs can have visibility regarding new (or potential) EV charge point connections, the better they can:

- Be proactive in targeting where and when investment is needed to accommodate increasing EV uptake;
- Defer or even avoid the disruption and costs of reinforcing a network by using smart solutions like smart charging and flexibility first;
- Minimise delays and disruption for customers by making sure networks are already invested in before they look to have a charge point installed, allowing them to benefit from a quicker and potentially cheaper connection if having to apply.

Progress

The data requirements, for the notification system, have been identified by the project team. In addition, the key third-party data source companies (DSCs) have been identified. These DSCs are the main target of the engagement process as they are the primary source of information required for the system. Engagement with these companies is currently ongoing.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Collaborating with

UK Power Networks, ElectraLink, CrowdCharge, EIC Together we innovate

Funding

£811,623

Start/end date

September 2020 / June 2022

Website

https://www.smarternetworks.org/project/nia_ssen_0048

3.16 NIA_SSEN_0049 Equal EV

Key activities

There are over 2.4 million disabled parking badge holders in the UK, with approximately 630,000 vehicles registered through the Motability Scheme – a scheme focused on vehicle leasing for motorists with disabilities and their care providers. Disabled motorists are often overlooked with regards to EV charging. There is a need to investigate and understand the enablers for both public and domestic charging solutions, not just for drivers with a disability but also for a wider range of potentially vulnerable customers such as elderly people or those with chronic illnesses.

Expected benefits

The benefit of this project will be identification of solutions to overcome barriers for EV adoption and ensure 'no one is left behind' in the EV roll out.

Progress

The project has appointed Impact Research to investigate the enablers and barriers for drivers with disabilities adopting EVs. Stakeholder research is still underway, however to date there has been a literature review and two focus groups held which included 14 different companies and organisations, such as local government, charities and independent start-ups leading the way in either accessibility, technology or EVs.

Primary Strategic Objective

MAKE A POSITIVE IMPACT ON SOCIETY

Collaborating with

DM UK DISABLED MOTORING UK

IMPACT FROM INSIGHT TO INFLUENCE

Funding

£345,000

Start/end date

October 2020 / April 2022

Website

https://www.smarternetworks.org/project/nia_ssen_0049

Scottish & Southern Electricity Networks

3.17 NIA_SSEN_0050 Near Real-Time Data Access (NeRDA)

Key activities

NeRDA is a small scale demonstrator project which will make near real-time DNO network data available to stakeholders. This will be tested by engaging with stakeholders including those already involved in ongoing local energy innovation projects.

Expected benefits

The benefit of this project will be to make near real-time data for the Oxfordshire area available to stakeholders and assess its usefulness to them. This will be enabled through the implementation of a technology solution for near real-time DNO data to enable its collation and presentation through an Application Protocol Interface (API). The project will assess the benefits and usability of the data through this API with stakeholder groups such as local community energy action initiatives Local Energy Oxford (LEO).

Progress

To date extensive stakeholder engagement has been carried out with key stakeholders in the Oxfordshire region to understand their requirements for accessing near real-time data through an API and web portal. Business and technical requirements documentation have been developed for the project and architecture that will allow the data to be made available via an API.

Primary Strategic Objective

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

Funding

£447,035

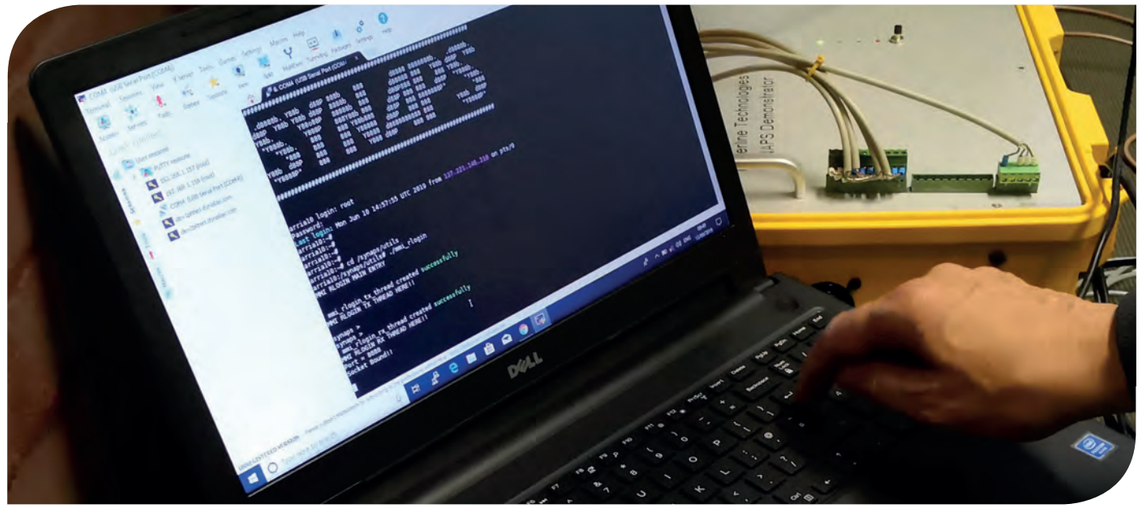
Start/end date

November 2020 / May 2022

Website

https://www.smarternetworks.org/project/nia_ssen_0050

3.18 NIA_SSEN_0051 Synaps 2 Fault Detection, Classification & Location Solution



Key activities

The SYNAPS Fault Detection, Classification & Location Solution (SYNAPS 1 NIA_UKPN0037) project was successful in trialling a solution which predicted fault locations from electrical waveforms gathered through monitoring equipment prior to any noticeable LV activity, detecting transient or "pecking" fault events of short duration and low energy that did not rupture a fuse or trigger an LV network circuit breaker. Whilst not yet ready for a wider rollout, this technology was certainly of interest and the Synaps 2 project is aimed at increasing the technical readiness level (TRL) to a commercially ready solution.

Expected benefits

The project has the potential to develop a commercial underground cable fault-finding device with improved accuracy, along with developing procedures for operational staff to use the technology.

Progress

SYNAPS 2 started in December 2020. So far, the procurement and legal activities have been completed regarding the contract with the Energy Innovation Centre (EIC), who will co-ordinate the project on behalf of the Distribution Network Operators (DNOs).

Primary Strategic Objective

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

Collaborating with

UK Power Networks

Powerline Technologies Limited

EIC Together we innovate

Funding

£661,140

Start/end date

December 2020 / July 2022

Website

https://www.smarternetworks.org/project/nia_ssen_0051

3.19 NIA_SSEN_0052 Low Voltage Feeder Cable Open Circuit Detection

Key activities

DNOs currently identify open circuit fault locations using equipment from different manufacturers with a variety of accuracy results, which sometimes requires an excavation for the equipment to work. This project will investigate different types and ways of sending signals during cable fault location events to investigate which of them is best at pinpointing and locating the position of the cable open circuit fault.

Expected benefits

During this project the following benefits could be realised:

- More accurate location of underground cable open circuit faults on a variety of cables; of various shielding construction, and understanding any limitations of the device;
- More efficient planning of remedial repairs and
- Greatly reduced Customer Minutes Lost (CMLs).

Progress

The project started in December 2020 and procurement and contracts are now in place with HAYSYS Ltd. Currently HAYSYS Ltd are starting the project development. Their first milestone will be finalising equipment specification for the detection of LV faults. The initial project meeting setting out the project framework in detail and preliminary reviews has been completed. The next stage will be facilitating User Group requirements meetings with field staff.

Primary Strategic Objective

PROVIDE A VALUED TRUSTED SERVICE FOR CUSTOMERS AND COMMUNITIES

Collaborating with

HAYSYS

Funding

£408,169

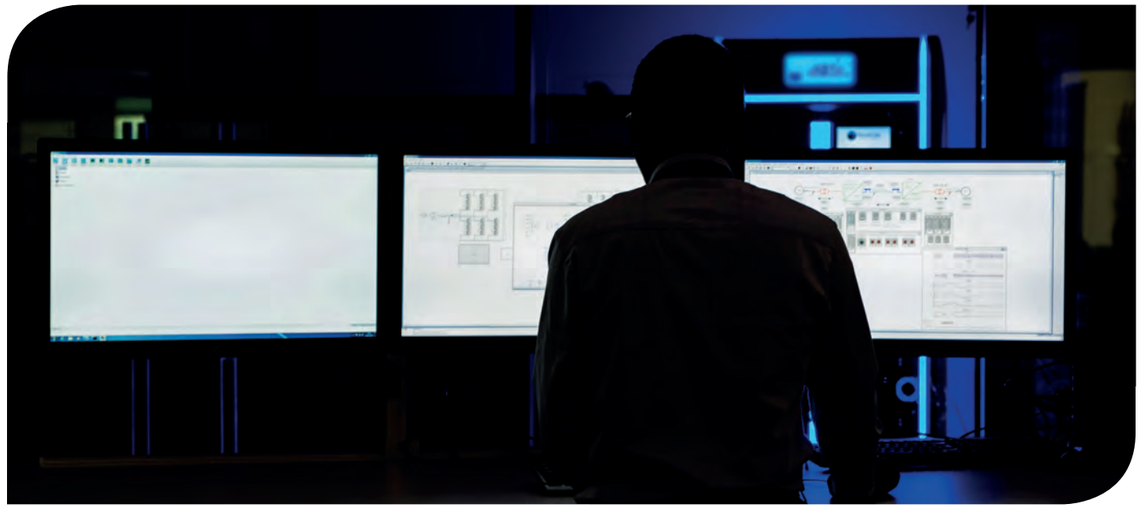
Start/end date

December 2020 / September 2022

Website

https://www.smarternetworks.org/project/nia_ssen_0052

3.20 NIA_SSEN_0053 Future Control Room



Key activities

The project will consider the requirements, the high-level architecture, operational need, and business impact of the future DNO control room. The outputs will also include an initial roadmap and architectural design for the future control room simulator. This NIA project will also make recommendations for future development, further work required, use cases and user requirements for the future DNO control room to assess any challenges, opportunities and ongoing benefits to the electricity industry.

Expected benefits

The project will provide new learning on the functionality and requirements of future control rooms, including: user requirements, technical architectures, data analysis and cyber security needs across a range of future operating scenarios. The project will also evaluate the potential use of new analytical techniques such as machine learning and artificial intelligence, to better maintain network resilience in a network which has widespread use of automation, Active Network Management (ANM) and flexibility, as well as a huge range of new monitoring/power flow data available from Low Carbon Technologies, smart meters and enhanced network monitoring. The project will also provide insights into the role of the DNO Control Engineer (HV and LV) when managing an increasingly complex network in the future. The project will also provide an overview of the research program required to develop a robust evidence base to allow for adoption of these new techniques into future control rooms.

Progress

The project has only recently started. Stakeholder engagement workshops have been held with UKPN & SSEN staff. These initial workshops were intended to understand the requirements and to identify use cases for a future distribution control room. A report is presently being compiled to document the workshops and will in due course be shared and verified by the wider industry.

Primary Strategic Objective

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK FOR ALL OUR CUSTOMERS

Collaborating with

UK Power Networks

Baringa
Brighter together

UNIVERSITY of STRATHCLYDE
POWER NETWORKS DEMONSTRATION CENTRE

Funding

£445,000

Start/end date

January 2021 / April 2022

Website

https://www.smarternetworks.org/project/nia_ssen_0053

3.21 Collaboration projects led by other Network Licensees

Below is a list of other projects that SSEN 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.

Project number	Project title	Lead party
NIA_SPEN_008	Appeal (Wood preservatives)	SP Energy Networks
NIA_WWU_045	Eye in the Sky	Wales and West Utilities
NIA_SPT_1801	Distributed Ledger Technology Enabled Distribution System Operation (Phase 1)	SP Energy Networks
NIA_UKPN_047	Feeder monitoring to pre-empt faults	UK Power Networks
WPD_NIA_044	Wildlife Protection	Western Power Distribution
NIA_NGO0033	Heat 4D	National Grid Electrical System Operator

4 Further information

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

Distribution Innovation Strategy

https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=7778

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

ENA Smarter Networks Portal – SSEN Projects

https://www.energynetworks.org/electricity/futures/network-innovation/electricity-networks-innovation-strategy.html

5 Contact Details

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