

Transmission

NIA Annual Report

2020 – 2021



**SP ENERGY
NETWORKS**



Enquiry please contact

James Yu, Future Networks Manager

SP Energy Networks,
320 St Vincent St, Glasgow, G2 5AD

Email: James.Yu@spenergynetworks.co.uk

Foreword

.....

SP Energy Networks is committed to maintaining an electricity transmission network that can help deliver the Net Zero future that is so important to our business, our society and indeed to the survival of our planet.

This is our eighth Network Innovation Allowance (NIA) Annual Transmission Report and is an overview of on-going Transmission related projects during the regulatory year 2020-21.

The various outcomes from our NIA and Network Innovation Competition (NIC) projects have informed our RIIO-T2 business investment plan for 2021 to 2026, which can be viewed at:

https://www.spenergynetworks.co.uk/pages/our_riio_t2_business_plan.aspx

It was an extremely challenging year, which began with lockdown and the onset of the coronavirus pandemic. But our people have risen to the challenge, ensuring that we continue to deliver value for money, a secure and stable electricity supply, and supporting our most vulnerable customers.

As we moved ahead with our innovation portfolio in 2020-21 we remain focused on transitioning our innovation projects into Business as Usual (BaU) in order to realise their full value. We have continued to engage with our key stakeholders, ensuring that the knowledge and learnings we take from these projects are shared more widely for the benefit of other networks operators.

NIA projects are not only important to our business in their own right, they also support our bids for NIC funding (and its Strategic Innovation Fund (SIF) replacement) and feed into our RIIO-T2 business plan, which came into effect earlier this year and takes us up until 2026. T2 is the regulatory settlement which captures our investment, income and the targets we need to deliver. A key element of our business plan is the Transmission Innovation Strategy and this reflects both the greater focus on innovation in comparison to T1, and the ambition needed if we are to tackle the challenges we face in the next five years.

During the coronavirus pandemic there have been periods of low demand with renewable sources of power dominating the energy mix. Maintaining stability in the system has become a major concern within the UK transmission network. The spinning mass located within conventional thermal power stations, which has provided stability in the past, are being replaced by renewable energy, such as windfarms. Flagship innovative projects like our Phoenix project are not only important for network stability but are key to the green recovery and our net zero and climate change ambitions. Despite the recent coronavirus pandemic and the challenges it has brought, the world's first hybrid synchronous condenser (H-SC) reached a key milestone following the commencement of its live trial. We are constantly looking for smarter ways to manage stability and demand of our transmission network and Phoenix is a big part of this.

During the reporting year, we have continued to develop our strong innovation culture within our business, spearheaded by our Delivering Real Innovation and Engagement (DRIVE) culture of innovation campaign.

A critical component of DRIVE has been the launch of our innovation platform, iHub, used to generate ideas from colleagues on strategic challenges identified by the business. One such example has been a new NIA project on Landslide Protection Asset, this was generated through an iHub campaign looking at "What big efficiencies can we deliver in SP Transmission?" This project will study the vulnerability of the transmission network to damage from landslips and landslides and prove the use of a landslide protection system, further details of which can be found within this report.

The UK energy and networks sectors are being placed under the spotlight like never before this year as our home city of Glasgow gears up to host the COP26 climate conference. Net Zero will be top of the agenda and rightly so. It is a positive development that Net Zero is now driving the decisions made by governments, regulators and businesses, and this too is reflected in RIIO-T2.

With a greater focus now also on decarbonisation and environmental sustainability, our innovation activity will be crucial to ensure we can connect more renewables, create more capacity in our existing assets before they need to be reinforced or replaced, and help to facilitate the decarbonisation of transport and heat.

I have no doubt that more challenging times lie ahead but we have demonstrated that we can adapt to changes in our operating environment in order to continue focusing on what we do best – maintaining safe and resilient electricity networks, focusing on innovation and delivering the highest levels of customer service. If we continue to focus our effort in these areas then SP Energy Networks will be at the forefront of efforts to drive a Green Recovery and help deliver that Net Zero future.

In support of our innovation ambitions, SP Energy Networks welcomes third parties to submit innovative ideas for potential NIA and SIF projects.

Colin Taylor
Director
Processes and Technology



Colin F Taylor
.....

Contents Page

Foreword.....	3
Executive Summary.....	6
1 Introduction.....	9
2 Progress Summary.....	10
2.1 NIA SPEN 0038 System Health Map.....	10
2.1.1 NIA SPEN 0038 Project Progress.....	12
2.2 NIA SPEN 0044 400kV Dynamic Cable Rating Retrofit Project Utilising RPMA Communications Technology.....	12
2.2.1 NIA SPEN 0044 Project Progress.....	13
2.3 NIA SPEN 0051 All Terrain Low Ground Pressure Access Vehicle with 34m Boom.....	13
2.3.1 NIA SPEN 0051 Project Progress.....	14
2.4 NIA SPEN 0053 Project Synthesis – Effective Regional Inertia Monitoring and Automatic Control with a Whole System Approach.....	14
2.4.1 NIA SPEN 0053 Project Progress.....	15
2.5 NIA SPEN 0054 Transmission OHL Crossing Protection Stage 1.....	15
2.5.1 NIA SPEN 0054 Project Progress.....	15
2.6 NIA SPEN 0057 Project Conan.....	16
2.6.1 NIA SPEN 0057 Project Progress.....	17
2.7 NIA SPEN 0059 Landslide Protection Asset.....	17
2.7.1 NIA SPEN 0059 Project Progress.....	17
3 NIA Activities Linked to SP Transmission Innovation Strategy.....	17
3.1 SP Transmission Innovation Strategy.....	19
3.2 ENA Innovation Strategy.....	20
3.3 Culture of Innovation.....	21
4 Areas of Significant New Learning.....	23
4.1 Project Learning: NIA SPEN 0038 System Health Map.....	23
4.2 Project Learning: NIA SPEN 0044 400kV Dynamic Cable Rating Retrofit Project Utilising RPMA Communications Technology.....	25
4.3 Project Learning: NIA SPEN 0051 All Terrain Low Ground Pressure Access Vehicle with 34m Boom.....	25
4.4 Project Learning: NIA SPEN 0053 Project Synthesis – Effective Regional Inertia Monitoring and Automatic Control with a Whole System Approach.....	25
4.5 Project Learning: NIA SPEN 0054 Transmission OHL Crossing Protection Stage 1.....	26
4.6 Project Learning: NIA SPEN Project Conan.....	26
4.7 Project Learning: NIA SPEN 0059 Landslide Protection Asset.....	26
Contact Us.....	28



Executive Summary

.....

Our eighth Network Innovation Allowance (NIA) Annual Transmission Report has been compiled in accordance with Ofgem's Electricity Network Innovation Allowance Governance Document which sets out the regulation, governance and administration of the Electricity NIA.

This eighth NIA Annual Statement presents an overview of the projects we have initialised during the regulatory year 2020-21 and an update on those projects reported during 2019/2020 which are still active.

The progress of each project aligns with the following key objectives:

- Innovation meeting the needs of stakeholders;
- Innovation opportunities are identified in a timely manner, which will benefit these stakeholders;
- Innovation is managed in an efficient and proactive manner;
- A balanced portfolio of innovation is pursued which includes commercial, process and technology innovation; and
- The outcome of innovation activity is adopted by the wider business to ensure that customers benefit at the earliest opportunity whilst minimising the risk to the integrity of the network.

Our NIA innovation project portfolio will continue to be shaped by on-going stakeholder engagement, both internal and external, with a view to maintaining a balanced portfolio that will address not just the near/medium term transmission issues, during the current price control period (RIIO-T1), but also those anticipated beyond 2021.

In addition to funding smaller projects, we will continue to utilise NIA Transmission funding, where appropriate, to prepare for future Strategic Innovation Funding (SIF) submissions.

In addition, we will aim to maximise knowledge transfer with other licensees and facilitate useful outcomes into BaU at the earliest opportunity.





1 | Introduction

SP Transmission has obligations to meet the Special Condition 3H (The Network Innovation Allowance) of the Electricity Transmission Licence, which was introduced as one of the key innovation proposals for the RIIO-T1 (Revenue = Incentives + Innovation + Outputs, 2013-21) model for price control. The purpose of the NIA is to encourage Network Licensees to innovate to address issues associated with the development of their networks.

NIA is to provide a consistent level of funding to Network Licensees to allow them to carry out smaller innovative projects which meet the criteria set out in the NIA Governance Document

From that point of view, NIA plays an important and integrated role in uplifting the technology readiness levels (TRL), preparing for flagship demonstrations at national level and knowledge sharing.

It is acknowledged that the transmission network will experience unprecedented change in response to realising the low carbon ambitions for the UK. In order to meet the associated challenges, innovative techniques, technologies and processes will be required to develop the transmission network. This is recognised by the fact that Innovation is a key element of the RIIO-T1 model for price controls with the introduction of the NIA.

This report presents SP Transmission's NIA activities during the eighth year of its introduction, summarises progress made against objectives and highlights areas of significant new learning.

Developments in our transmission network over recent years have fundamentally been driven by an ongoing process of stakeholder engagement. SP Transmission has identified a number of key themes as a result of our ongoing stakeholder engagement which are the principal drivers behind our innovation strategy.

Following a comprehensive stakeholder mapping activity, which formed part of our Transmission Innovation Strategy published in 2011 (and subsequently reviewed in 2014) the key outputs from subsequent stakeholder engagement to date have been:

- Communicating with stakeholders to understand their needs and expectations more effectively;
- The connection of customers (demand and generation) onto the network to deliver sustainable low carbon energy through fair, clear and accessible processes;
- Maintain security of supplies and maximise long term value for end-users through improved network availability and reliability processes; and
- Minimise the environmental impact of our operations.

In 2018 work began on the further development of this strategy to align with RIIO-T2 aspirations. Following extensive engagement with all key stakeholder groups, the resulting feedback significantly influenced the current Transmission Innovation Strategy, which was released in December 2019, for further details please see Annex 6: Innovation Strategy in our RIIO-T2 Business Plan.

https://www.spennergynetworks.co.uk/pages/our_riio_t2_business_plan.aspx

This Transmission Innovation strategy represents a step-change in ambition and approach commensurate with the significant challenges and opportunities that RIIO-T2 represents.

SP Transmission recognised that consideration needed to be given to not only the RIIO-T1 period and stakeholder's immediate needs, but also how we address the longer-term issues which the transmission network may face.

This is being addressed through a balanced portfolio of innovation projects where we are considering some of the longer-term issues which may involve technology and techniques at a lower technology readiness level as well as immediate challenges to be faced over the next decade. This is considered in detail in our Transmission Innovation Strategy.

2 | Progress Summary

During the reporting year 1st April 20 to 31st March 21 SP Transmission registered the following NIA projects:

- NIA SPEN 0051 All Terrain Low Ground Pressure Access Vehicle with 34m boom
https://smarter.energynetworks.org/projects/nia_spen_0051/
- NIA SPEN 0053 Project Synthesis – Effective Regional Inertia Monitoring and Automatic Control with a Whole System Approach https://smarter.energynetworks.org/projects/nia_spen_0053/
- NIA SPEN 0054 Transmission OHL Crossing Protection Stage 1
https://smarter.energynetworks.org/projects/nia_spen_0054/
- NIA SPEN 0057 Project Conan
https://smarter.energynetworks.org/projects/nia_spen_057/
- NIA SPEN 0059 Landslide Protection Asset
https://smarter.energynetworks.org/projects/nia_spen_059/

The following sections provide a short overview of each active NIA project and summarises the progress that SP Transmission has made on them. Further details on SP Energy Networks Innovation activities can be found on our website (www.spenergynetworks.co.uk/pages/innovation.asp) and on the ENA Smarter Networks Portal (<https://smarter.energynetworks.org>). Key learning associated with these projects is summarised in **Section 4**.

2.1 | NIA SPEN 0038 System Health Map

SP Transmission is developing a 'System Health Map' which collates multiple existing separate data sources from the Transmission Network into one centralised platform. This platform uses trending and analytics to allow early intervention and an overall improvement in asset management.

Many of the online monitoring data sets have no mechanism to collate the data gathered or to support engineers in processing or analysing this data. Many of these sets solely rely on man-power to import, analyse and generate outputs from the raw data. As a result, there are three key growing issues which make the current business practices for network data management impractical:

1. The volume of data – Monitoring equipment is increasingly being installed throughout the network to identify potential problems. This data includes:

- **Power Quality Data:** The large increase in Low Carbon Technologies (LCT) in recent years has significantly increased the requirement for power quality data in order to maintain compliance with standards. As the number of LCT continues to grow, this increases the volume of data, making it increasingly difficult to regularly and meaningfully assess the data extracted from assets and possibly allow non-compliant network conditions to continue undetected.

- **Condition Monitoring Data:** With an aging and developing asset population more emphasis is being made on delivery of lifetime extension and the safe and efficient operation of these assets. This has led to an increase in the delivery of asset condition monitoring equipment producing a large and diverse data set with increased need to automate the collection, collation and analysis of this data.

2. The diversity of data – The variation in the incoming data is extraordinary with the complexity of managing different sample rates, formats, supplier software and user interfaces being compounded by the fact that different disciplines have installed monitoring equipment to address different issues. The data also requires expertise to build analytics and understand outcomes.

3. The diversity in user interfaces – As each supplier presents their bespoke hardware and software to address a specific issue, this leads to a number of issues. Firstly, the number of interfaces becomes unmanageable when looking to capture a system view, meaning technical staff will need to use each software package individually and build up a system picture manually. Secondly, the different software packages provide different levels of access; this ranges from full data access to web-based platforms which allow 'read only' access.

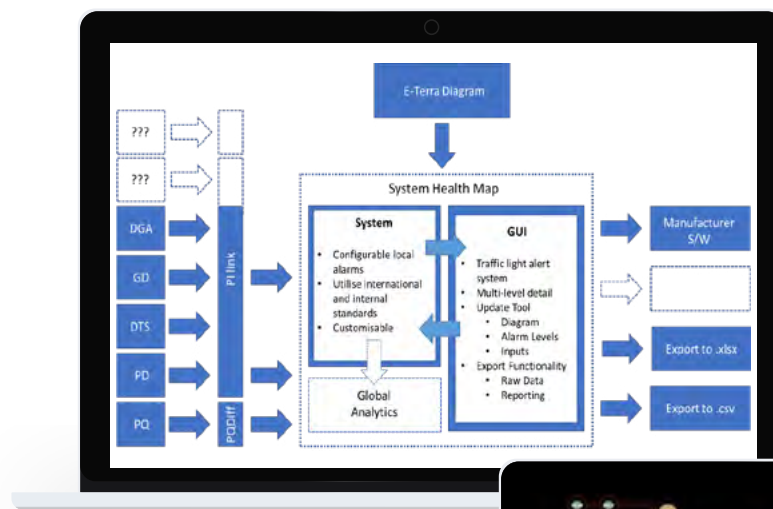
The project is now in its final reporting stage, with technical work being complete. A prototype modelling, simulation and analysis environment has been developed which allows the adequacy of distribution networks, and also transmission networks at the transmission/distribution boundary, to be evaluated under uncertain future conditions in terms of the day-to-day behaviour, low-carbon technologies such as renewable generation, and also the level of deployment of such resources at different scales.

This evaluation therefore involves consideration of both long-term and short-term uncertainty. Long-term uncertainty is represented by describing scenarios of uptake and deployment of technologies of interest within the network to be studied. Multiple scenarios can be considered, representing both different development and deployment paths, and different points in time along those paths. The modelling environment manages the application of these scenarios to underlying mathematical models.

This platform will be able to extract data from pre-defined sources (such as PI Historian) and display this on a graphical interface. This interface will include a system diagram with indicative system conditions (Traffic Light) and the ability to plot and export data.

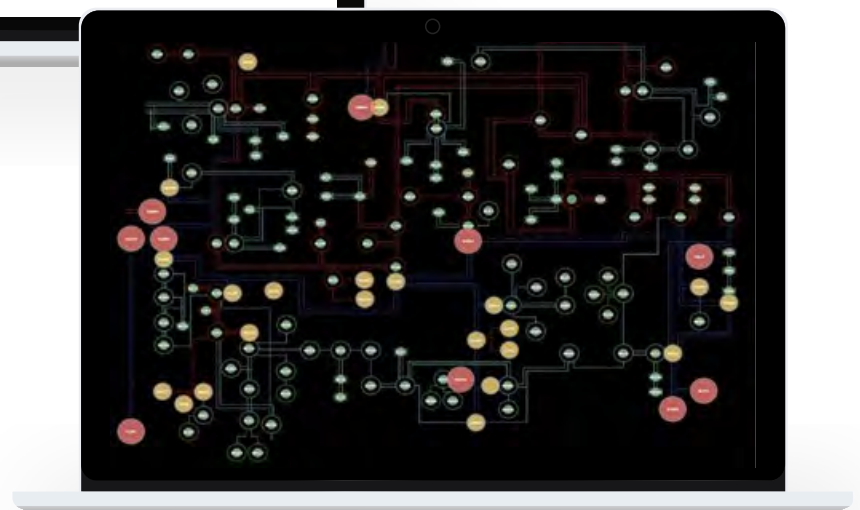
The five use cases which have been defined for Phase 1 are:

1. Power Quality (PQ) including harmonics, voltage flicker, and voltage imbalance;
2. GIS Gas Density (GD) SF6;
3. Dissolved Gas Analysis (DGA);
4. Partial Discharge (PD); and
5. Distributed Temperature Sensing (DTS).



System Health Map Platform

.....



System Health Map – Prototype Heat Map

.....

2.1.1 | NIA SPEN 0038 Project Progress

During the reporting year the following accomplishments were realised:

- Requirements Specification – A supplier specification was drawn up identifying the full requirements that the System Health Map platform must contain; and
- Functional Prototype – A supplier demonstrated a functional prototype with working example of each use case and the exporting functionality determined in the Requirements Specification.

The following next steps have been identified:

- Production of a Functional Design Specification;
- Factory Acceptance Test;
- Site Acceptance Test; and
- Reporting and Wider Business Workshop and Dissemination – final phase.

2.2 | NIA SPEN 0044 400kV Dynamic Cable Rating Retrofit Project Utilising RPMA Communications Technology

As the penetration of LCT increase in the UK greater circuit loading will be experienced on the transmission network. Under certain loading scenarios the power flow on transmission circuits may need to be constrained, which can result in multi-million-pound constraint payments. Rather than undertaking costly network reinforcement schemes, with long lead times and environmental impacts, one option is to operate the network using dynamic ratings.

One such circuit where the declared capacity is likely to cause future constraint issues is the Torness to Thornton Bridge (Crystal Rig) 400kV circuit. In order to defer or avoid network reinforcement one potential option to increase circuit capacity is to operate and plan the carrying capacity of the cable circuits based on their real-time thermal behaviour.

An optical fibre laid alongside a power cable can be used to determine real-time thermal behaviour. Installing a fibre optic temperature sensing circuit at the same time as laying a power cable is relatively cost effective; however, if you have to excavate an existing circuit then the costs escalate. The problem to be addressed, therefore, is finding a cost effective retrofit dynamic capacity rating (DCR) solution with supporting communications technology that can be deployed easily.

To ensure that the measured data is securely transmitted Random Phase Multiple Access (RPMA) wireless communications technology is proposed. While RPMA technology has not been used by SP Energy Networks before it does provide significant advantages for ultra-rural, isolated, hard-to-reach or targeted meter locations. Utilizing globally available unlicensed spectrum in the 2.4GHz band, RPMA's properties of robust interference tolerance, wide geographic coverage, high network capacity, and low power support, allow devices to be connected more efficiently than ever before.

The project will investigate the feasibility of using the RPMA wireless technology coupled with point sensors and integrated with a DCR scheme to provide a cost effective retrofit dynamic rating solution to evaluate real-time thermal behaviour of strategic cable circuits.

The key business benefit is the potential to determine additional headroom capacity on a cable circuit which could eliminate or defer network reinforcement, and avoid the various costs and risks during the associated outages, and extend the life time of network assets.



Sensor Unit

.....



Telemetry Post

.....

2.2.1 | NIA SPEN 0044 Project Progress

Project activity was delayed during the reporting year due to travel and site restrictions in response to the coronavirus pandemic. Once restrictions were relaxed the telemetry units were wired to the sensor units and measurements of outputs taken to confirm the local operation of each sensor. The telemetry units were each fenced off to protect them from livestock damage.

A new telecoms server hosting the RPMA software was installed in SP Energy Networks Head Office.

During the reporting period no field data has been received remotely and the dynamic cable rating software has been working on temperature simulation data awaiting "live" temperature sensor data from the telecoms server.



2.3 | NIA SPEN 0051 All Terrain Low Ground Pressure Access Vehicle with 34m Boom

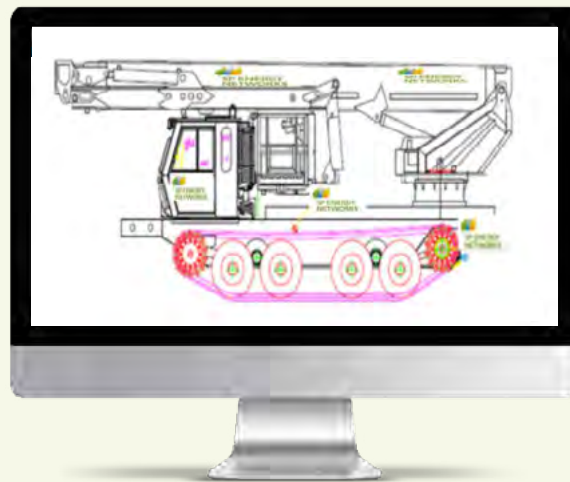
Many of SP Transmission's power lines pass through very remote and inaccessible locations, particularly in the upland areas. In the event of an unplanned outage on these circuits (caused by a failure, environmental incident, 3rd party damage etc) they can cause major disruption to customers and the subsequent repairs can be both time consuming, technically challenging and expensive. Accessing conductors mid-span or accessing a damaged structure can be particularly challenging.



This project aims to develop a high capacity/high reach access platform (Hybrid MEWP) mounted on a high performance all terrain tracked vehicle that will vastly improve response to faults and repairs.

Key specifications for the vehicle are as follows:

- High capacity basket (over 250kg);
- Long/high reach (34m);
- 8 to 10 months to manufacture from approval agreement;
- The vehicle should be transportable by low-loader without the need for police notification;
- Ideally under 3m wide/25T gross weight;
- Ground bearing pressure of less than 5psi (pounds per square inch);
- Smooth track bars to allow passage over tarmac and farm roads; and
- Fully CE marked, tested and certified.



The objectives of the project are as follows:

- Increase efficiency on outage times on faults and repairs reducing network financial constraints and down time;
- Greatly reduce risk during work at heights;
- Commitment to stakeholders in fast repairs and response time on overhead line windfarm connection routes;
- Grantor commitment using advanced technology to eliminate/reduce land damage; and
- Environmental commitment to reducing stone road requirements and wagons required to bring the stone in. Reduction in muscular skeletal injury to work force by allowing two men to work from a very generous 250kg basket on repairs needing heavy equipment.

2.3.1 | NIA SPEN 0051 Project Progress

Design work has been undertaken by the project manager, PLPC and Bronco trucks to establish a viable solution and the Hybrid MEWP is now in production after some modifications were made. The manufacturing process is nearing completion. Once it is ready, the vehicle will remain under the responsibility of PLPC for storage, maintenance and Lifting Operations and Lifting Equipment Regulations (LOLER) certification purposes in a state of readiness for rapid deployment by Scottish Power exclusively. The vehicle will remain the property of PLPC.

2.4 | NIA SPEN 0053 Project Synthesis – Effective Regional Inertia Monitoring and Automatic Control with a Whole System Approach

The power network industry has made it their mission to be ready for zero carbon electricity by 2025 in order to support the UK's commitment to achieve net zero carbon emissions by 2050 and a similar commitment made by the Scottish government. Realising these targets has a significant impact on the technical performance of the power system, impacting the requirements for services to sustain stable and secure operation of the grid.

Increasing penetration of renewable generation and power electronic connections to meet these targets for zero carbon electricity results in lower rotating inertia and faster frequency changes. It is, however, critical that limits of frequency deviation and rate of change are respected to avoid customer outages and cascading failures. This is particularly relevant in certain areas such as Scotland where the regional effects caused by long transmission distances and low regional inertia can affect the network stability as well as causing high rate of change of frequency in the area.

Advances in digital and communication technology enables a coordinated but distributed and effective local control which can lead to a more effective response and improved operational coordination. The integrated design and implementation of a location sensitive, wide area protection and control system have not been demonstrated anywhere yet.

Presently, electricity generated from renewables is often subject to curtailment across Scotland due to constraints in the transmission network, particularly on the boundary between Scotland and England. This curtailment results in significant constraint payments to wind generators to refrain from producing power. This project will explore the potential for Green Hydrogen to mitigate this issue, enabling more renewable generation to be utilized, while also representing a useful option for decarbonisation of the heat and transport sectors.

The overall aim of this project is to work to enable a system by which fast, high definition synchronised measurements in the high voltage electricity network are used with advanced analytics and real-time control to identify system disturbances and apply response rapidly and at good locations for grid stability. Within half a second, the system calls on flexible loads such as EV charging points to deliver a fast re-balancing response to ride through the event, having minimal impact on the energy use of providers of the response. The approach avoids installing large batteries or heavy machinery required by alternative solutions.

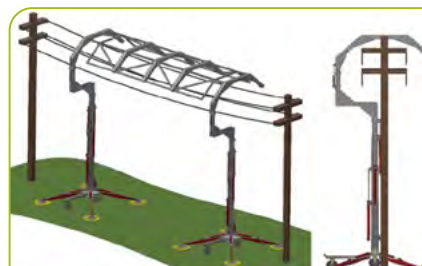
Key innovations of this overall approach would be: extraction of regional effective inertia from high resolution measurements, the control algorithm and the optimisation of aggregate responses using probabilistic methods, combining to enable a new market for fast frequency response. It would be the first system of its kind to draw on multi-vector energy resources to enable a regional service to contribute to zero carbon electricity.

2.4.1 | NIA SPEN 0053 Project Progress

Due to factors outwith our control the start date of this project has been delayed to the Summer 2021, when SP Energy Networks expect to start work on the development and staged trials of the enabling technology components.

2.5 | NIA SPEN 0054 Transmission OHL Crossing Protection Stage 1

During the reconductoring of transmission overhead lines there can be issues when the transmission line crosses a section of distribution overhead line. Action must be taken to ensure that the transmission overhead line cannot drop and make contact with the distribution line and therefore become re-energised, as this could cause harm to the operatives who are working on the isolated line. This is, currently, avoided by undergrounding the section of distribution line, but this can be very expensive once costs such as outages, excavation and reinstatement are factored in.



This project will consider a system to prevent contact with the distribution overhead line by covering it from above. This will be a system installed using live line methods, and will initially be used to protect 132kV systems. A feasibility study has been carried out, and this project will develop a detailed design for the system.

This project will cover the design of the protection system which will be designed to allow a large proportion of distribution crossings to be protected on the current planned reconductoring projects. This project will cover only the design to allow assessment against the requirements of the transmission business, and to ensure that it can be applied to a sufficient number of these crossings to make its use cost effective.

2.5.1 | NIA SPEN 0054 Project Progress

RED Engineering (RED) was appointed to take over the concept design and further develop it after REECE Innovation, who were awarded the project through a competition, withdrew. RED's first review of the original concept developed by REECE indicated that clarity was needed on expected loads for critical analysis. After several meetings with Scottish Power's project team, RED carried out a quick analysis with specialist software to gain clarity on load cases from cable failure. RED has assessed the current concept against load cases and identified significantly higher loading. In addition, lateral loading was not considered in the concept and RED raised concerns that the top section cannot be manufactured as intended and that the system is not deployable. In addition, relying on hydraulics to maintain structure is not best practice. Therefore, a development of new concept is currently underway and internal review of the new concept will be carried out for review and approval by Scottish Power.

2.6 | NIA SPEN 0057 Project Conan

This project will look to develop a replacement device (Conan) for the Cormon overhead line conductor conditioning monitoring device.

The aim is that the condition measurement accuracy, reliability, number of points measured and processing capabilities will be far better than currently possible.

The majority of overhead line conductors in the UK are of Aluminium Conductor Steel Reinforced (ACSR) conductors with the rest, predominantly All-Aluminium Alloy Conductor (AAAC) type. Once ACSR conductors are proven to be in poor condition, a replacement with an equivalent AAAC is usually specified.

To ensure accurate and efficient condition-based replacement, rather than based on age, it is essential to utilise the best science and technology available to obtain reliable conductor condition data.

Devices that are currently used for non-destructive testing, have significant limitations, either with obsolete and inefficient, unreliable technology or lacking in ability to predict end-of-life before it arises.

This project will look to develop the first device which reliably and efficiently provides non-destructive conductor assessment information suitable for predictive condition-based intervention. It will also develop concepts or methods for measurement of AAAC condition and develop the first body of scientific information to provide a reliable basis for interpreting the condition of ACSR or AAAC results, upon which to make consistent, traceable condition-based decisions.

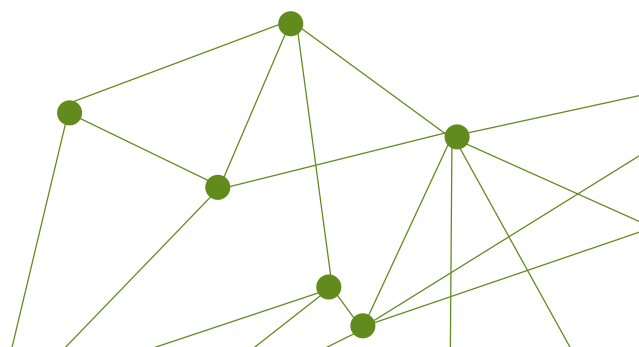
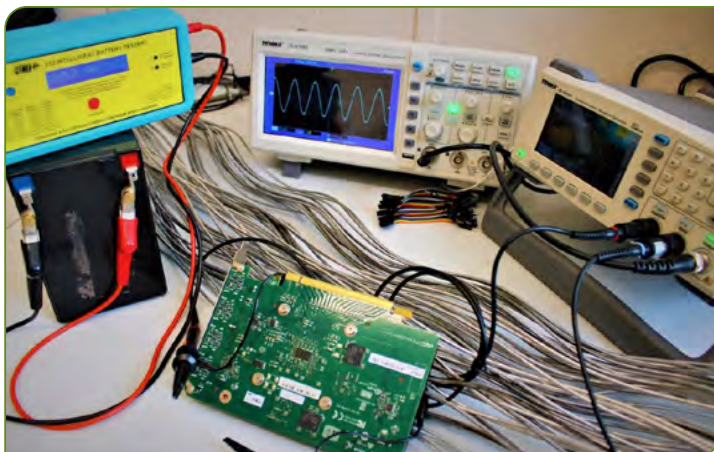
The main outputs from the project will be:

- New device with the capability to accurately and efficiently assess conductor conditions, ready for commercialisation;
- New scientific method for making conductor replacement decisions, which will be supported by documentation; and
- Device that is compatible with the working prototype of AAAC detector head.

Main benefits will be:

- Reduction in costs associated with network downtime;
- Greater visibility of conductor condition;
- Greater understanding of conductor condition;
- Reduced network downtime;
- More efficient condition surveying, with less disruption to local community; and
- Safely extending asset life/reducing asset risk of failure through more effective assessment.

It is planned that the unit will be deployable either manually or by drone. The final unit is expected to be 5-10kg which is well within the payload of readily available and inexpensive drones.



2.6.1 | NIA SPEN 0057 Project Progress

Project Conan commenced in March 2021. Initial tasks have included setting up contractual agreements with the Supplier, Energyline Science and Technology (EST) and the Energy Innovation Centre, who will act as the Project Manager. EST has now started their programme of works.

2.7 | NIA SPEN 0059 Landslide Protection Asset

A landslide in the vicinity of overhead transmission assets can result in costly repairs and put the network integrity at risks. This Landslide protection project will enhance our knowledge of areas of the Transmission network vulnerable to landslides and prove that mitigation measures can be deployed safely through a trial on a selected pylon.

The objective of the project is to:

- Develop a RAG database of assets which are highly vulnerable to impact from landslides.
- To prove that installing mitigation measures can be done safely to a selected pylon.

To realise these objectives the project will be undertaken in the following two stages:

1. GIS tiling work to develop a Red, Amber, Green (RAG) database identifying assets which are high risk.
2. Trial deployment of a steel netting or mesh system at a selected pylon identified as high risk.



The project is expected to realise the following benefits:

- Improved knowledge of network vulnerabilities;
- Improved network resilience;
- Preventing risk of future events;
- Lower repair costs; and
- Improved safety to staff and public.

2.7.1 | NIA SPEN 0059 Project Progress

Mott MacDonald has prepared a draft methodology for initial discussion which will provide geotechnical assessment services relating to a landslide hazard assessment for pylons along a trial route, YW Route Windyhill to Cruchan Dam from YW001 to YW229. The output of the assessment will be a RAG risk rating for each tower location.



3 | NIA Activities Linked to SP Transmission Innovation Strategy

3.1 | SP Transmission Innovation Strategy

SP Transmission's Innovation Strategy drives the direction and development of all innovation projects and initiatives, and has been strongly influenced by the views of a wide range of external stakeholders and collaborators.

The SP Transmission Innovation Strategy was released in 2011 as part of the RIIO-T1 Business Plan submission, and has provided the consistent, coherent and coordinated platform upon which all SP Transmission T1 innovation has been founded. This strategy has been reviewed annually, remaining robust despite the accelerating transformation of the energy landscape. It received an update by exception in 2014, and in Q3 2018 work began on the further development of this strategy to align with RIIO-T2 aspirations. Following extensive engagement with all key stakeholder groups their feedback significantly influenced the latest Strategy, which was released in December 2019. This strategy represents a step-change in ambition and approach commensurate with the significant challenges and opportunities that RIIO-T2 represents. The six key transitional challenges identified are:

1. Improving the sustainability of our network and business processes and empowering our consumers;
2. Whole System Approach: overcoming boundary restrictions between electricity and gas transmission owners (TOs) and distribution network operators (DNOs), transport and telecommunications sector with increased customer engagement;
3. Integrating new technologies and enabling digitalisation, standardisation and cyber security;
4. Challenges related to black start;
5. Maintaining system security and stability: in light of reduced grid services, lower system strength, and increased grid dynamics and interactions; and
6. Evolution of our transmission network and associated uncertainties: including new requirements for reinforcement and the replacement, operation and maintenance of aging assets.

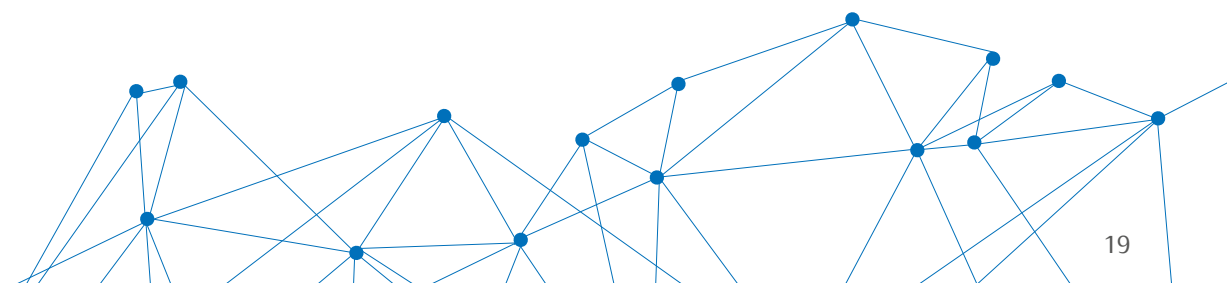
Also crucial to the step-change in our Innovation approach is a greater emphasis upon enabling a Whole System approach, empowering consumers, addressing consumer vulnerability and achieving sustainability through innovation.

These advancements are supported by equally important step-changes in SP Transmission's innovation process and culture, together with a more robust strategies for translating innovation into BaU and collaborating with third parties.

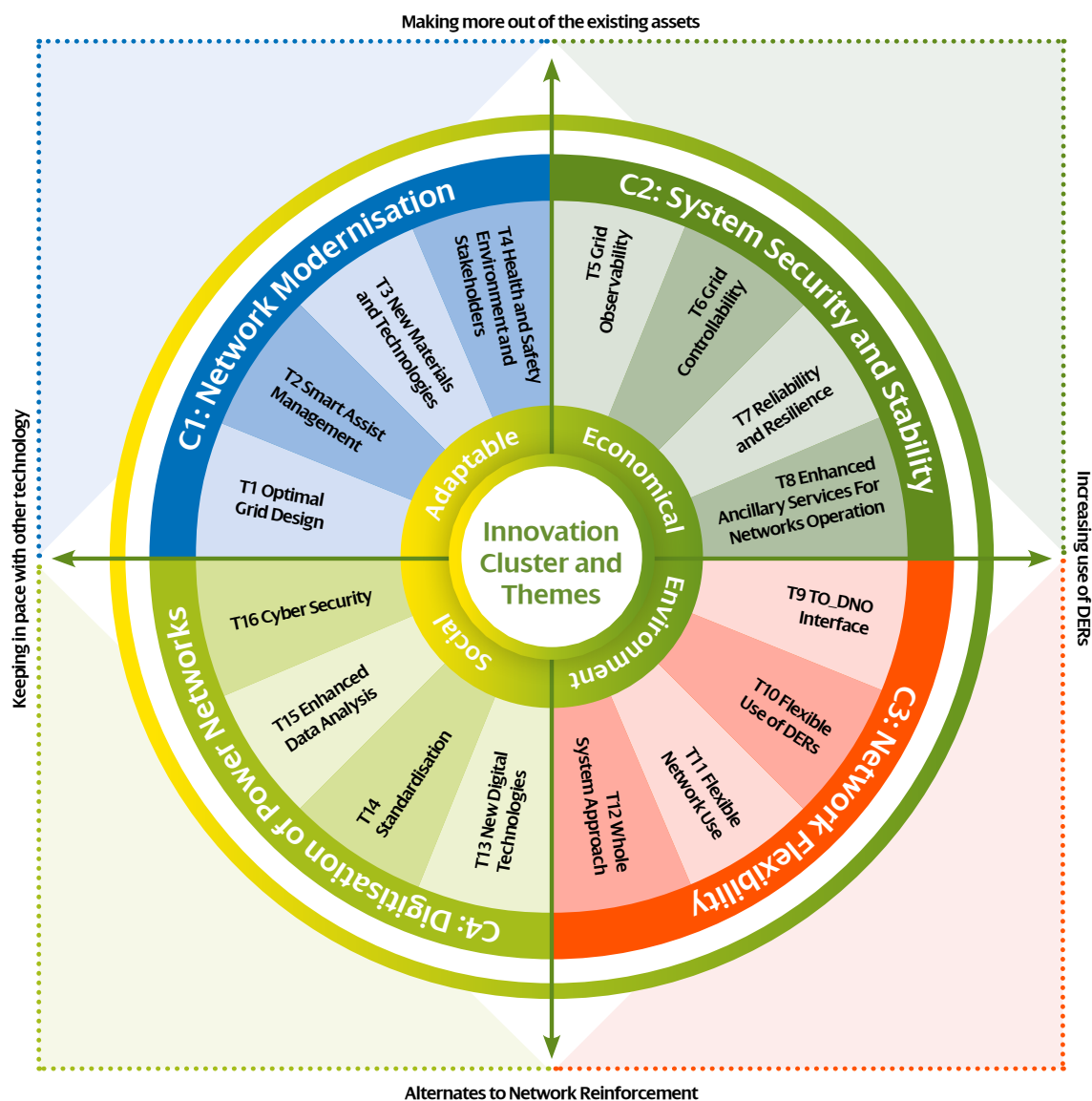
Benchmarking against other innovative organisations led us to select the ENTSO-E Research and Innovation framework to structure the current strategy, leading to a shift from a project-based approach towards a cluster-based approach, creating groups of innovations to solve key system transition challenges in a holistic, interconnected way.

These clusters cover:

- **Cluster 1:** Network Modernisation (Themes 1-4)
- **Cluster 2:** Security and System Stability (Themes 5-8)
- **Cluster 3:** Network Flexibility (Themes 9-12)
- **Cluster 4:** Digitalisation of Power Networks (Themes 13-16)



Energy System Transition Challenges for the Future Transmission Network



3.2 | ENA Innovation Strategy

SP Energy Networks has been actively working with the ENA and contributed to the collective innovation strategy for the GB energy sector.

https://www.spenetworks.co.uk/userfiles/file/Electricity_Network_Innovation_Strategy.pdf

With regards to the ENA Innovation Strategy, we are looking to ensure that our existing and new projects can contribute directly to the five focus areas in the near-term:

- Facilitate the adoption of flexibility and smart systems;
- Facilitate and enable the electrification of heat and transport;
- Facilitate the efficient connection of low and zero carbon electricity generation;
- Understand the operational impact of long duration reserve services on the network; and
- Contribute to a UK-wide methodology for calculating the cost of carbon.

3.3 | Culture of Innovation

Following the successful launch of the Year of Innovation in 2019, we have rebranded this initiative to DRIVE, focusing on embedding an innovation culture across the company. We have seen colleagues suggest ideas on strategic business challenges and deliver innovative solutions that are benefiting our customers and embedding innovation in BaU activities.

Over the last 12 months, the importance of creating an innovation culture has been even more critical, with restrictions imposed due to the coronavirus pandemic resulting in the business adapting to new innovative ways of working.



A critical component of Drive has been the launch of the innovation platform, iHub, used to generate ideas from colleagues on strategic challenges asked by the business that has to date delivered 10 innovation challenges on strategic themes to the wider business, resulting in the generation of over 275 ideas and engagement with over 1200 colleagues.

One such challenge came from SP Transmission, looking at *"How can we use HD video to improve our processes and efficiency?"*

Following the success of the campaign, one project that has been funded and delivered by the business is using Drones to conduct pre-condition site assessments, which has reduced time required on site by up to 60%. Recorded footage will additionally provide a visual record of the condition pre-access and used as evidence to compare land conditions once the work has been complete.



The ideas generated through iHub are reviewed by the Innovation team and fed into the NIA governance process. One such example which is detailed within this annual report has been a new NIA project on "landslide protection asset". This was generated through an iHub campaign looking at *"What big efficiencies can we deliver in SP Transmission?"* This project will study the vulnerability of the transmission network to damage from landslips and landslides and prove the use of a landslide protection system. In addition, we plan to consider nature based solutions to address high risk areas.

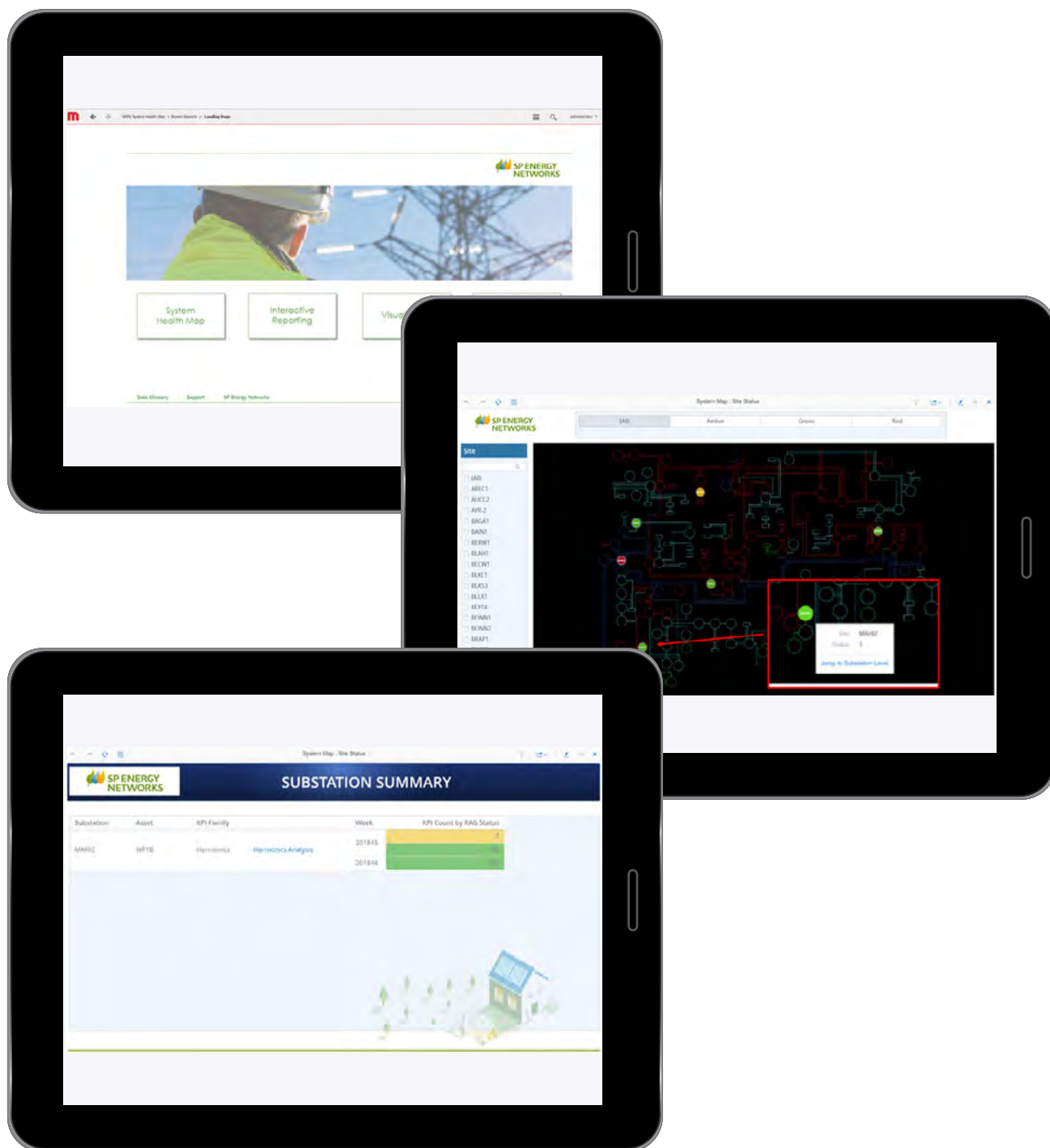
An integral part of the Drive initiative has been the network of Innovation Champions across the business, supporting our innovation projects transitioning into BaU. Another critical component of their role has been generating ideas, which is evident from both projects highlighted above (Drones for pre-condition site assessments and landslide protection asset) both ideas submitted by Innovation Champions.



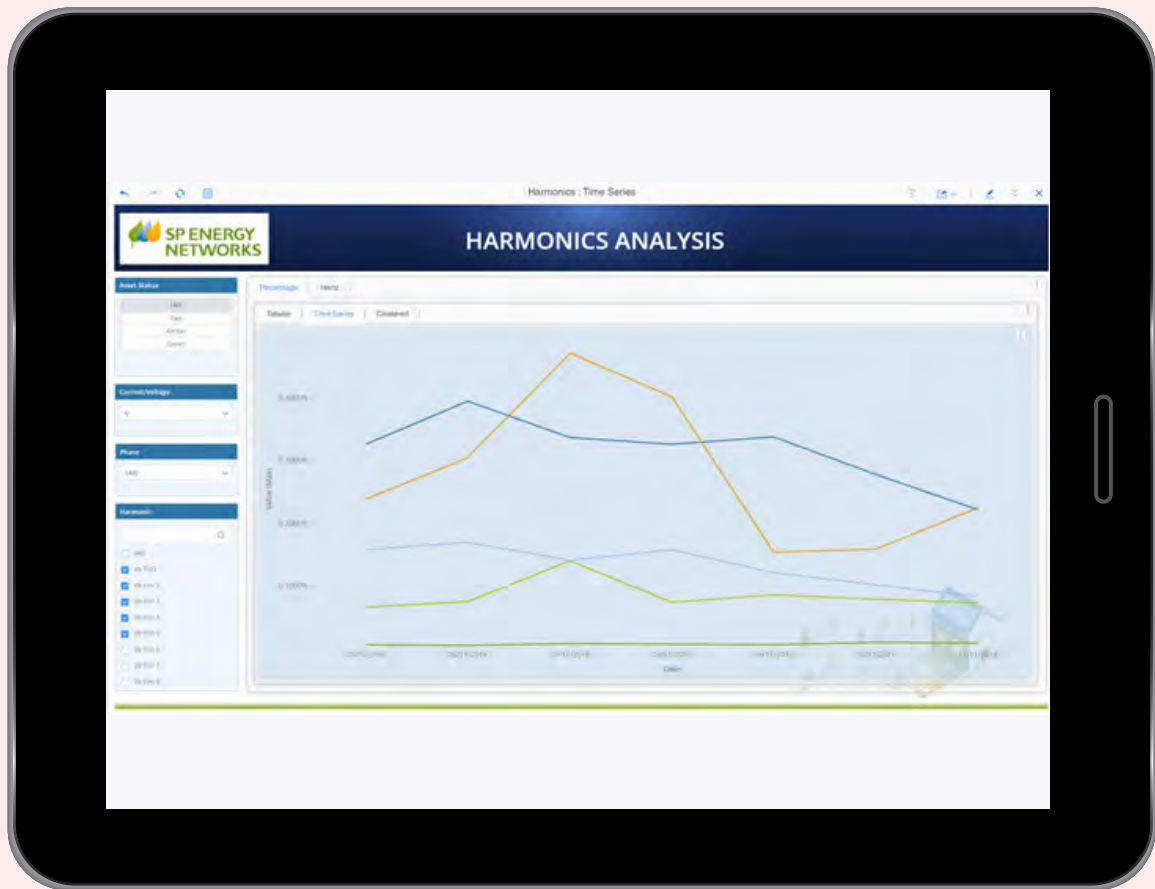
4 | Areas of Significant New Learning

The following identifies area of learning on a project by project basis:

4.1 | Project Learning: NIA SPEN 0038 System Health Map



Some examples of the dashboard process and visuals – showing home page, the system health map and substation summary portals with condition RAG status



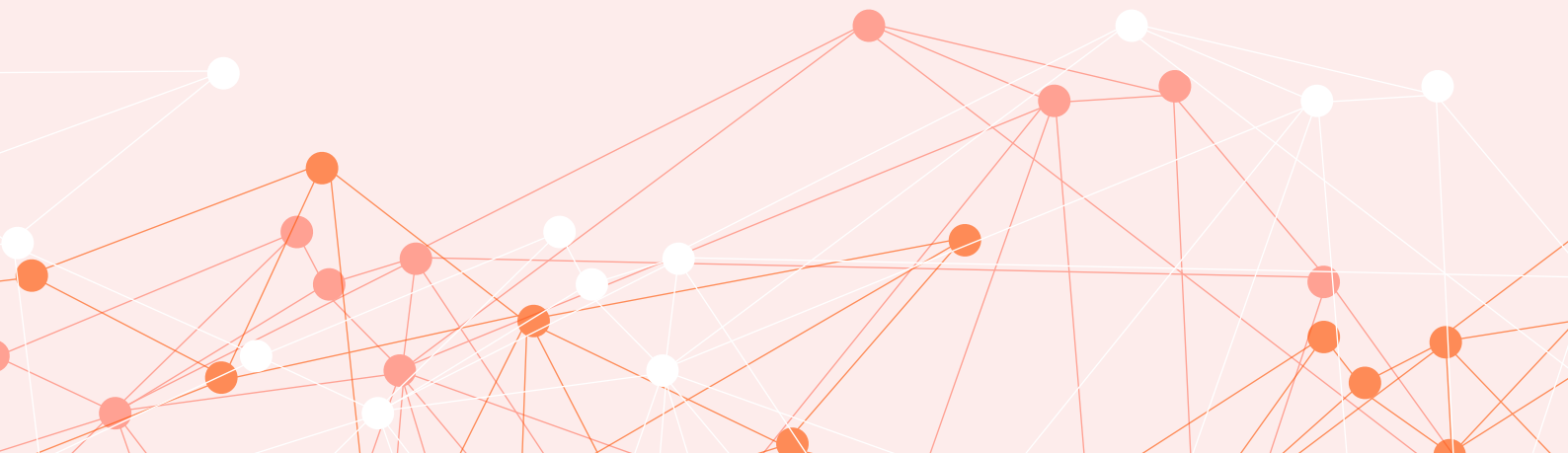
The Interactive Reporting Suite

.....

The project will integrate with SP Energy Networks IT systems and will be operational on a SP Energy Networks server.

The project has the potential for new learning in the following areas:

- New understanding of network behaviour – for example, through analysis of harmonic heat mapping;
- Improved understanding of asset degradation forecasting; and
- Understanding of the requirements of the implementation of a general data analytics platform in a networks business.



4.2 | Project Learning: NIA SPEN 0044 400kV Dynamic Cable Rating Retrofit Project Utilising RPMA Communications Technology

Despite the sensor cables (with their ends capped and bagged) having been laid in the ground many months previously all the cable contacts were found to be clean which facilitated the swift connections into the canary circuit boards within the telemetry units. Sufficient spare sensor unit cable was pushed back into each of the telemetry posts just in case a telemetry unit needs to be rotated or elevated slightly to improve signal strength.

During the commissioning of the telemetry units, cable jacket temperatures were measured successfully at six of the seven locations as measurements are within the expected range and each pair of sensors at the different locations show values close to each other. At one location both sensors are, however, showing unreasonable values which will require further investigation.

Two spare telemetry units have been configured identically to the other seven devices and have been registered in the Mercury telecoms server, as a precautionary measure in case any of the seven canaries need to be replaced.

4.3 | Project Learning: NIA SPEN 0051 All Terrain Low Ground Pressure Access Vehicle with 34m Boom

Once we have access to the new vehicle there will be project learning arising from its operational deployment.

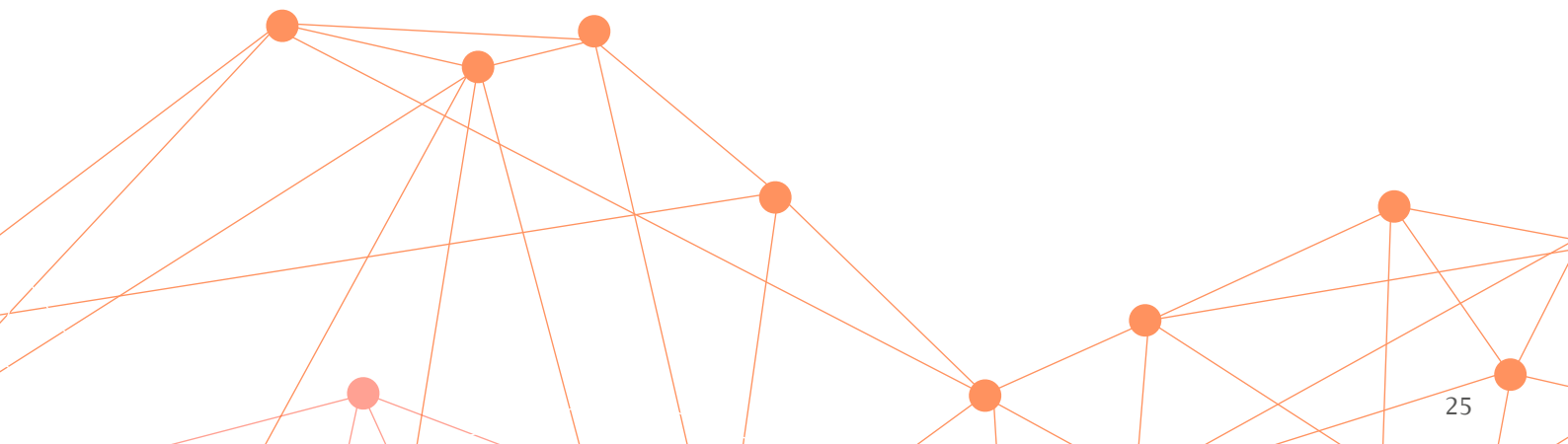
This will be the first vehicle in the UK electricity industry with these unique capabilities. Going forward it could be something that is developed for this industry by a mainstream manufacturer.

4.4 | Project Learning: NIA SPEN 0053 Project Synthesis – Effective Regional Inertia Monitoring and Automatic Control with a Whole System Approach

Due to factors out with our control the start date of this project has been delayed to the Summer 2021, when we'll expect to start work on the development and staged trials of the enabling technology components.

The project will provide new learning about: Regional Inertia Monitoring, Whole Energy System Deployment, Vector Shift Technological Readiness, Green Hydrogen. The learning from this project will be disseminated through the online learning portal and also through a workshop.

This project will look to develop the technical specifications for a regional monitoring and response platform, as well as the viability of response technologies within the SP Energy Networks region. If successful, the learning can be disseminated and a future project can use the information to develop future trials of a regionalized frequency response service.



4.5 | Project Learning: NIA 0054 Transmission OHL Crossing Protection Stage 1

The system being developed will be able to be used initially where 132kV lines cross lower distribution lines. If the system can prove cost effective, it will then be manufactured and trialled.

4.6 | Project Learning: NIA SPEN Project Conan

It is envisaged that the learnings and results from developmental work within Project Conan will provide an understanding of the capabilities and limitations of electromagnetic based sensing techniques on detecting corrosion in both ACSR and aluminium based conductors.

The project will also deliver learnings through the development of a new traceable, evidence-based methodology/ information upon which conductor condition replacement decisions are to be made.

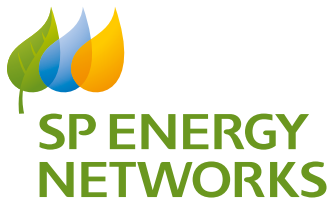
As part of this project, the supplier will utilise the learnings from disassembling, renewing and servicing existing Cormon equipment to further accelerate the development of the new device, Conan.

4.7 | Project Learning: NIA SPEN 0059 Landslide Protection Asset

There is no learning to report as the project has only just started during this reporting period. The Landslide protection project will enhance our knowledge of areas of the Transmission network vulnerable to landslides and prove that mitigation measures can be deployed safely through a trial on a selected pylon.







Contact us

.....



www.SPEnergyNetworks.co.uk



facebook.com/SPEnergyNetworks



twitter.com/SPEnergyNetwork



linkedin.com/company/spenergynetworks/



Innovate@SPEnergyNetworks.co.uk