SP Distribution and SP Manweb

Network Innovation Allowance Annual Summary 2023-24

SP Energy Networks

Contents

At SP Energy Networks, innovation is embedded across our operations. It serves as the engine for accelerating our Net Zero transformation to deliver a better future, quicker for our customers in our two electricity distribution licence areas: SP Distribution Plc (Central and Southern Scotland) and SP Manweb Plc (Merseyside, Cheshire and North Wales).

Graham Campbell
Director, Processes and Technology

If you have an idea you would like to discuss with my innovation team or, if you'd like more information on a particular project, please get in touch via: spinnovation@spenergynetworks.co.uk

Recognising the importance of innovation in delivering against the UK's 2050 decarbonisation targets, we are prioritising innovative solutions over traditional reinforcement to keep costs low for our customers. Not only are we delivering value-for-money, we are committed to addressing consumer vulnerability as part of a Just Transition.

Our Network Innovation Allowance (NIA) portfolio is the cornerstone of our innovation efforts – allowing us to grow ideas from our staff, our stakeholders and external partners – supporting Open Innovation and collaborative projects. This Annual Summary Report provides an overview of our Network Innovation Allowance (NIA) projects that were initiated, ongoing or completed during 2023-24.

Our portfolio of NIA projects is focussed on advancing the technology readiness of solutions across six key enabling themes:

- Power Electronics
- Network Resilience
- Whole Energy System
- Data & Digitalisation
- Sustainability
- Consumer Vulnerability

We're focussed on creating tangible benefits and being the trusted partner for our customers, stakeholders and communities. In RIIO-ED2, we have already realised benefits worth more than £5.6m across our distribution areas in SPD and SPM. Building on this strong start, and factoring in wider industry benefits, we expect our portfolio will yield more than £200m in benefits across the 5-year ED2 period.

£200m
estimated benefits in RIIO-ED2

Our NIA funding helps us target early opportunities in an agile manner; supporting technology development and enabling our Distribution System Operator (DSO) model. Our NIA portfolio continues to support our DSO capabilities across Planning & Network Development, Network Operations and Market Development. For example:

- NCEWS2 brought together data and information from across our low voltage network to deliver new insights for detecting emerging network issues and support our design engineers with Planning and Network Development.
- Real Time Fault Level Monitoring Phase 2 and LV De-Mesh are developing solutions for managing Network Operations in real-time using innovative monitoring and power electronics.
- Re-Heat and Level Up have generated new learnings on the use of heat flexibility to accelerate Low Carbon Technology rollout – insights that benefit our Market Development role.

At the same time, Security of Supply for Vulnerable Consumers (SSVC) and PSR Resilience System are helping us to better target the support we provide to vulnerable consumers.

I am excited by the innovation initiatives we have advanced this past year, establishing a solid foundation on which we will continue to deliver benefits for all GB customers and support the energy system transition whilst maintaining world-leading levels of safety, reliability and resilience of supply.

Network Innovation Allowance Portfolio Summary

SPEN Projects

28
Active SPEN Projects 2023/24

11
Ongoing Projects

17
Completed Projects

14
New Registrations
(including 7 RIIO-ED1 projects re-registered)

Partner-led Projects

9
Active Collaboration Projects 2023/24

5
Ongoing Collaborative Projects

4
Completed Collaboration Projects

3
New Collaborative Projects

Our commitment to innovation

We continue to evolve the innovation strategy that we set out as part of our RIIO-ED2 Business Plan. Having successfully delivered £3.4m in benefits to our SPD area and £2.2m in our SPM area, our strategy is ensuring we develop a balanced portfolio that addresses the fundamental requirements of accelerating the energy system transition and supporting consumers in vulnerable situations.

Our six themes provide the strategic direction for our portfolio of flagship (SIF, NIC) and the Network Innovation Allowance (NIA) projects showcased in this report.

Reduction in RIIO-ED2 expenditure through innovation

£87m

Network Resilience

Focussed on readying our network for the rapid uptake of Low Carbon Technologies (LCTs) and distributed generation, our Network Resilience theme seeks to develop novel solutions that modernise our network operations and optimise our assets and practices.

This year we've registered the **SMARTer Selection of Automatic Sectionaliser Links** and **Interconnected HV secondary substation battery monitor** projects which are both targeting reductions in customer interruptions. At the same time, we are continuing to make advancements in our existing projects, including our industry-leading work on **Active Fault Level Management and Real Time Fault Monitoring**.

Find out how **Real Time Fault Monitoring Stage 2** is facilitating new connections to our network in the Project Highlights.

Power Electronics

Power electronic technologies are a game-changer for addressing the new challenges faced by DNOs – namely, the challenge of balancing the requirement for a secure, reliable network with an increasingly diverse generation mix and changing consumer behaviour.

Power electronic technologies, like the solutions we are developing in our **LV De-Mesh** project, are enabling us to make more effective use of our existing network capacity, reduce the number of LV interventions required and ultimately reduce disruptions and costs for our customers.

In ED2, we've already realised benefits worth £5.6m:

£3.4m SPD

£2.2m SPM

Data and Digitalisation

The digitalisation of our power networks underpins our transition to a Distribution System Operator model and is fundamental to the Energy System Transition.

This year we completed our **NCEWS2 – Network Constraint Early Warning System** which has significantly advanced our field operations through the development of our LView tool – giving our operatives access to real-time LV network information directly in the field. Providing them with the knowledge they need to respond proactively to emerging issues on the network.

We also share the learnings from our **X-FacTOR** initiative, our Virtual Reality workforce training feasibility study, as well as our **iDentify** and **Data Historian** Replacement projects.

Whole Energy System

An integrated approach to network planning and operations that connects energy vectors and involves our customers is key to unlocking efficiencies in the Energy System Transition.

That's why our NIA projects **Re-Heat** and **Level-Up** have been exploring opportunities to support the decarbonisation of heat through technologies that seek to mitigate the effects of increased demand on the electricity network.

Sustainability

Net Zero is founded on the need to protect our environment and the pathway to get there is no different. Innovation plays a vital role in ensuring our journey to Net Zero is sustainable and helping to minimise our impact on the environment.

In many cases, this means adapting our practices as we modernise our network and **Project APPEAL** is a great example. We are trialling environmentally friendly alternatives to creosote for treating the vast network of wood poles on our distribution network. This way, we continue to make sure our poles have a long service life, so we provide great value to our customers, whilst reducing harm to the environment.

Consumer Vulnerability

Innovating to ensure no customer is left behind as part of delivering a Just Transition. We understand that consumer vulnerability encompasses a broad range of people in a variety of circumstances. It's important therefore that we can tailor our response to the unique needs of our customers.

To do that, our **Vulnerability in the Energy System Transition** project developed an interactive map that visualises vulnerability-related information and our **PSR Resilience System** project is enhancing the insights we can obtain from Priority Services Register data so we can better anticipate our customers' needs.

As an example of the targeted support we are developing, our **Security of Supply for Vulnerable Customers (SSVC)** project has successfully developed battery backup devices for customers who rely on medical devices and a decision support tool for our staff so we can better support those customers during system outages.

Project Highlights

Our projects across our network range in scale and scope to deliver the most impact and benefit to our customers and stakeholders. For this summary report we have highlighted case study examples with significant learning to demonstrate our strategy in action. You can find the full list of our projects towards the end of this report and online at the Smarter Networks Portal.

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Consumer Vulnerability

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PSR Resilience System
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Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0087	£400,000	April 2023	March 2025	Complete under ED1 and continuing in ED2	https://smarter.energynetworks.org/projects/NIA_SPEN_0087

Power Electronics

LV De-Mesh

Power Electronics is central to our innovation strategy and with LV De-Mesh we are pioneering these technologies on the Low Voltage network to bolster reliability.

Overview

Through LV De-Mesh we are designing and proving a system that reliably and autonomously disconnects LV backfeeds between “healthy” and faulty HV cable networks during HV fault restoration works – but doesn’t otherwise detract from reliable network operation.

The goal is to develop a technically and commercially viable solution that can be used alongside other established technologies. For example, remotely controllable HV switching points and directional fault passage indicators.

The solution will facilitate the meshing of networks with standard substation equipment and protection by reducing the risks associated with the use of rapid restoration methods following HV faults to an acceptable level.

Up to
£500k/year
estimated savings

Benefits

By facilitating quicker restoration during typical HV faults on Y-type networks, estimations show that Customer Minutes Lost (CML) figures can be reduced by approximately 40%. Given the number of Y-type circuits on the SPM network and average number of faults the total saving could be up to £500k per annum.

Progress

We’ve produced a report exploring the limitations of existing solutions and identifying the desired functional attributes of the proposed solution. This report explored:

- Required physical and electrical characteristics of the system,
- The logic and requirements for autonomous and high integrity operation,
- Enhanced protection characteristics that offer discrimination between upstream and downstream devices whilst also offering cable overload protection.

The report also included logical use cases to outline scenarios that the device would be required to operate under.

Next steps

We are further developing the functional specification before commencing laboratory tests for the device and completing a period of live network trials.

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0050	£1,980,000	May 2020	March 2024	Complete under ED1 and continuing in ED2	https://smarter.energynetworks.org/projects/nia_spen_0050-rtflm-stage-2

Network Resilience

Real Time Fault Level Monitoring Stage 2

Deploying innovative fault-level measurement devices on our network to monitor and predict network fault level in real-time.

Overview

Fault Level is already one of the greatest network challenges. The network has a safe fault level design limit which cannot be exceeded without splitting up the network, reducing the fault in-feeds or adding new equipment. Generation growth is expected to continue and accelerate as UK generation decentralises to meet Net Zero 2050 targets. Innovation is needed to avoid fault level becoming a barrier to the low carbon transition.

The Real Time Fault Level Monitoring (RTFLM) Stage 1 project demonstrated a proof-of-concept design to measure fault level in real time. This has been successful, with changes in network fault level registering within a number of seconds. Two prototype devices were built with measurements taken at both 11kV and 33kV in SPEN's SPM network. As SPM operates an interconnected network, this also demonstrated success with this network type.

RTFLM Stage 2 extends the trials across multiple networks and network locations. Trials will be extended to include 132kV, split board configurations and different substation design scenarios. SPEN also intend to undertake a combined trial with a separately NIA funded project looking at Active Network Management based on Fault Level.

Benefits

Potential to identify available capacity on the network by providing more accurate fault level assessments in real time. Helping to avoid reinforcement costs while facilitating new connections to the network, particularly for Distributed Generation and other Low Carbon Technologies. We expect to deliver benefits of up to £21.6m across the ED2 period.

Progress

Since our last update, we have been progressing further RTFLM deployment and analysing the data obtained. We have now commissioned three devices across SP Energy Networks with a further three already designed and in the planning stages. Also in this period, our partners at UK Power Networks (UKPN) have launched operational trials of their first device.

Building on our previous work, we have significantly improved the design of the device to meet the standards required for widespread deployment across UK DNOs. We've been refining the fault level algorithm, with a specific focus on refining the process of differentiating between network noise and real fault level fluctuations.

In our analysis, day and night fluctuations in fault level were visible, as were the differences between weekdays and weekends. A network switch event resulting in a step change in fault level was also recorded as expected. This is the first time continuous fault level monitoring data has been obtained and it demonstrates network fault level as a dynamic value, with daily, weekly or even hourly fluctuations evident in the data. This opens possibilities for new ways of planning and operating networks to maximise network utilisation, accommodating the influx of distributed renewable generation and to facilitate the Net Zero transition.

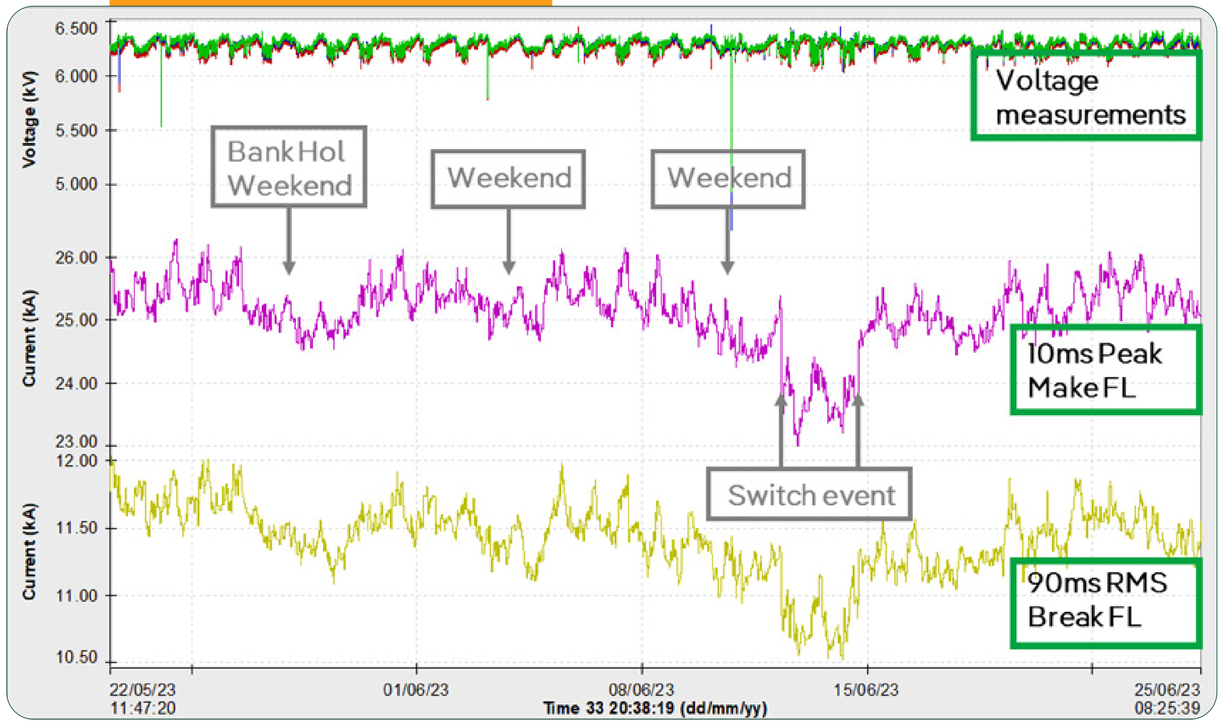
£21.6m

Estimated benefits in RIIO-ED2

Next steps

SP Energy Networks will deploy a fourth device in Q3 2024, the first deployment in our SPD area (Scotland).

We're readying the project for business-as-usual adoption with the development of policy, technical specifications and procurement framework all in progress.



The plot shown shows waveforms captured over a five-week period in May/June 2023 in Liverpool, UK (city centre location).

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0085	£150,000	May 2023	December 2023	Complete	https://smarter.energynetworks.org/projects/NIA_SPEN_0085

Data and Digitalisation

XR Facilitating Training and Operations (X-FacTOR)

Leveraging Virtual and Extended Reality technology to train and upskill our staff safely and effectively.

Overview

We're using Data & Digitalisation to address an industry-wide challenge: the loss of expert knowledge and skilled staff through retirement and attrition due to increased demand of those skills. Technology has advanced exponentially, creating an increasing need to add high-tech, dynamic equipment and systems to our grid so we can accelerate the journey to Net Zero. To achieve that, the energy industry must utilise both new and existing current technology in innovative ways, to support effective infrastructure delivery.

X-FacTOR seeks to leverage Extended Reality (XR) Technology – applying it within the energy industry – to design an immersive training program for, and with the expertise of, field staff. This will make knowledge transfer a more effective, efficient, and safer process which translates into a more robust and resilient grid operation – improving reliability for our customers.

Progress

Phase 1 of the X-FacTOR project identified two Proof-of-Concepts (PoC) to deliver across two use cases identified during collaborative workshops between SP Energy Networks and Digital Catapult:

- Overhead Line Inspection – Vegetation Management
  As a highly procedural task, inspection of overhead lines has been identified as a high impact and high feasibility use case for immersive learning. Inspection allows for translation of standardised and methodical material into VR and addresses concerns around fear of working at height in a safe and controlled environment.

- Damage Assessor Training
  In the UK on average, 20 people are killed and 400 people are injured as a result of coming into contact (or close proximity) with electricity overhead. Even if the lines are 'dead', they can become live again with no notice. This may happen automatically after a few seconds, or they can be re-energised up to several hours later if the operator is unaware of damage on the line.

This PoC will help trainees develop understanding of weather effects and availability of resources as well as increase their understanding of the physicality of the training and showcase outcomes of poor practices during training.

Next steps

With use cases identified, we will develop the virtual reality training packages in the next phase of this project to digitalise our training operations.

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0034	£1,050,000	October 2018	May 2023	Complete	https://smarter.energynetworks.org/projects/nia_spen_034

Data and Digitalisation

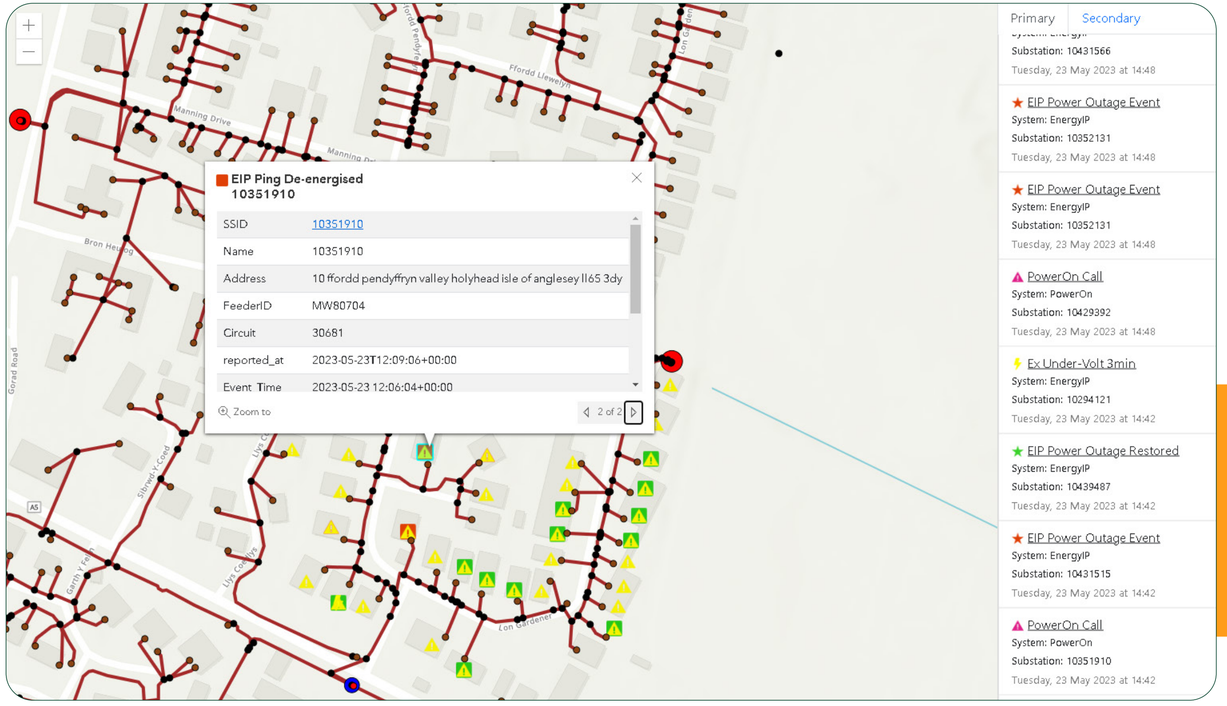
NCEWS2 – Network Constraint Early Warning Systems (Phase 2)

Developing a platform to provide visibility of our network – unifying multiple data sources and adding new capabilities.

Overview

As Smart Meters (SMs) are rolled out across the UK, it is expected that this greater visibility of the LV network will provide sufficient intelligence to trigger Smart Grid dynamic network control, which in turn will release more capacity on the network for increased levels of LCTs.

As part of the NIA funded innovation project NCEWS (Network Constraint Early Warning System), we developed an LV Connectivity Model which will allow us to annotate Smart Meter, EV, and other internal/external data sets in order to allow users to better understand the operation of SPEN's LV Network via the NAVI (Network Analyse and View) Platform and associated data exports. Our ambition is for this to become our central data management tool.



Benefits

- Enhanced visibility of network data for improved decision making
- Faster fault identification and resolution
- Reducing Customer interruptions (CI) and Customer Minutes Lost (CML)
- Identifying network issues and targeting planned maintenance before they develop into faults

Progress

Our NAVI platform has been released to all district design engineers and we have fully rationalised our network model. We've built the capability to integrate the platform with our power systems analysis tools to automate building network models and we're using the LV network data we have collected across our innovation portfolio – our LV Engine project, for example. NAVI also houses our EV-UP and Heat-UP tools, previously developed through innovation, for analysing the network impacts of LCT uptake.

The LView platform has consolidated all potential Low Voltage data into a single view: giving our teams access to smart meter, SCADA, incident reports and LV substation monitors in real-time. This has enabled us to be masters of our own data and bring our data management in-house.

£4.3m
benefits realised since project start

NCEWS2 has developed a unified interface for accessing LV network data from a variety of systems and monitors

For our field staff, LView means they can now access all this data in the field, even on slower data connections. Enabling us to respond to faults more efficiently and improve the service we provide to our customers.

Significant learning

The solution developed as part of the project has proved very useful within the business and it was subsequently extended to cover SPEN's full high voltage (HV) and extra-high voltage (EHV) network. Since transitioning into BaU, the solution has formed a key part of many projects including LV connection and scenario analyses, HV tracing to assist earthing studies, and acted as the main feed of pre-analysed GIS data to several other internal projects.

With more Smart Meters and substation monitors now installed within the SPEN licence areas we have begun to analyse voltage profiles to help with phase identification more accurately. By correlating the Smart Meter data, monitor data and the various datasets annotated to the NAVI network model (including Customer Numbers, MDI and ADMD data) we have developed a methodology to highlight and prioritise potentially 'at risk' areas of the network and present the results in a manner easily consumed by the business.

Also, by developing exports of the network to multiple PSSE tools, at both LV and now HV level, we have been able to provide our design engineers with an automated snapshot of circuits, annotated with all asset information, to improve the accuracy of designing new points of connection and managing the network.

Adopting an agile approach to development has been core to ensuring a timely delivery and maintained focus on business requirements. At the same time, it allowed us to adapt to ever changing priorities. Involving key users in the testing of functionality enabled a smooth transition from project to BaU as the wider business has been part of the journey.

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0080	£200,000	May 2022	March 2024	Complete	https://smarter.energynetworks.org/projects/nia_spen_0080

Data and Digitalisation

Data Historian

Like many businesses, DNOs on the journey to DSO are collecting far more data now than ever before. We need solutions that are cost-effective and efficient to enable us to make the data-driven decisions that ensure value-for-money for our customers.

Overview

The current data historian solutions, used to record and store our operational data, are long established (20+ years) and costly. In recent years, data storage has become cheaper and many more options are available now than there were before. Recognising this, SP Energy Networks undertook a proof of concept in 2021 to established if a generic time series database could fulfil DNO requirements as a data historian replacement.

This project digs deeper to test if the generic solution can integrate with SPEN operational systems. The project looks to trial the generic solution in parallel with the existing system for hosting real-time data from Low Voltage (LV) Power Quality Monitors to demonstrate the effectiveness and suitability for use by DNOs.

Benefits

- Enhanced reduction in operating costs in relation to current data historian solutions
- Integration of digital and analogue data onto a single platform promoting more efficient data collation, management of the power network and conforming with regulatory requirements
- Migration to a contemporary cloud-based data historian platform, provides the ability to take advantage of modern interface techniques in line with our architecture strategy, along with a significant drop in cost of ownership over traditional on-site solutions.

Outcomes

The project has successfully shown that a generic, cloud-based time series database (such as InfluxDB, trialled here) can be used as a Data Historian satisfying SPEN requirements, including cyber security.

Functionally, InfluxDB is different from our existing data historian which makes a like-for-like comparison more challenging. However, each of the individual use cases we evaluated within this project show that it would be possible for DNOs to adopt this kind of solution going forward.

We've concluded a trial using the data from our LV monitor programme and adopted the solution as part of our Business-as-Usual setup until a formal tendering process for replacing our larger data historian systems takes place in the coming years.

Significant learning

We've identified some key differences when using a generic solution, compared to traditional data historian technology. For example, the solution trialled uses down-sampling to better store the data – this reduces the granularity of the data over time which could result in reduced temporal resolution of the data collected.

We also identified that the solution can be more complex than the existing solution when it comes to making modifications to the data. In addition, the InfluxDB solution we trialled does not have an asset management framework like those built into our existing data historian – though this is not a feature we currently use.

We estimate up to 33% cost savings could be achieved from deploying the solution we trialled versus our existing data historians over the RIIO-ED2 period.

Up to
33%
cost saving across ED2

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0008	£771,020	March 2016	May 2025	Complete under ED1 and continuing in ED2	https://smarter.energynetworks.org/projects/NIA_SPEN0008

Sustainability

APPEAL – Environmentally Acceptable Wood Pole Pre-Treatment Alternatives to Creosote

Assessing the performance of environmentally-friendly alternatives to creosote for preserving wooden overhead line poles.

Overview

Project APPEAL, launched in 2016 and being delivered through the Energy Innovation Centre, is a collaborative project between SP Energy Networks, Northern Powergrid and Scottish & Southern Electricity Networks.

This project aims to assess the performance of environmentally friendly alternatives to creosote for wood pole preservation. It is expected that the outcome of this project will influence UK DNO policies for the replacement of wooden poles.

To understand how these preservatives perform, we're using an accelerated decay test chamber with treated poles (timber stakes and round timbers) to test the different preservatives within a shorter timescale than if we trialled them directly in the field. Where a field trial would run several decades into the useful life of the asset, with the accelerated test chamber we are able to provide a useful evaluation within a condensed (5-8 year) timeframe.

Through this testing we aim to identify a possible replacement for creosote in the treatment of overhead line wood poles.

Progress

We've widened the scope of the project to extend the duration of the original timber stake trial and begin a new trial with round timber samples as well as testing of a new alternative preservative. We are now looking at RVP, Tanasote and Koppers as potential alternatives.

The timber stake trial is now complete and the final report published. The round timber trial is progressing and the third update report has been published.

Next steps

The treated stakes will remain in the test bed for a further 12 months. In addition, round timbers have been added to the trial and they will shortly be reported on.

Significant learning

Creosote preservative treated stakes did not outperform either RVP or Tanasote treated stakes.

Each preservative demonstrated similar patterns of success and failure after 72 months of exposure in the accelerated decay chamber. Creosote and RVP treated poles exhibited significant decay.

RVP and Tanasote are fulfilling the treatment longevity claims of their respective manufacturers (30 and 40 years) which aligns with industry expectations for pole lifetimes. As such, both are recommended as creosote replacements for pole treatment.

Barrier sleeves have also been demonstrated as an effective approach to extend the life of wood poles further by preventing or slowing the decay process.

Results from the first 18 months of the round timber trial are similarly positive. No external decay was found in any of the preservative treated timbers after exposure to the high decay potential soil bed. Very significant external decay was found in the untreated control timbers after 18 months soil bed exposure. This decay was more widespread than that found after 12 months soil bed exposure, demonstrating the effectiveness of the accelerated decay process and the decay chamber.

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0057	£1,985,213	June 2021	May 2024	Complete under ED1 and continuing in ED2	https://smarter.energynetworks.org/projects/NIA-SPEN-0057

Whole Energy System

Re-Heat: Enabling Renewable Heat

The first DNO-led, large-scale trial of electrified heat, developing solutions to make heat demand flexible – reducing peak demand on the electricity network.

Overview

Re-Heat is the first of its kind to investigate the impact of full electrification using technology such as Air Source Heat Pumps (ASHPs) and thermal storage to maximise the usage of existing assets by deferring and optimising the conventional network reinforcement needs.

Re-Heat will demonstrate tools to enable an accelerated deployment of low carbon electrified heating at an efficient cost to customers and release the whole-system benefits of flexible heat, providing timely evidence to inform national policy and electricity networks' investment strategy.

Benefits

- Customers could benefit through lower socialised costs resulting from savings due to avoided network reinforcement.
- Carbon reduction across SPD.

Progress

We've successfully developed network planning tools for assessing the network impact of heat load and evaluating alternative network solutions.

Direct Load Control (DLC) in home controllers were successfully installed into the domestic properties participating in the trial to control the Air Source Heat Pump and PCM thermal storage devices.

An interface has been developed to allow the DNO to schedule and dispatch load control requirements.

The project team were able to demonstrate, through a trial comprising 32 participating residential properties, the successful operation of the DLC and thermal storage solution in conjunction with heat pumps.

Next steps

The analysis and evaluation of trial results is currently under way, the findings of which are due to be published in 2024, and will include:

- Consideration of the benefits of the Re-Heat approach compared to conventional reinforcement.
- Recommendations to enable the trialled Re-Heat method to be adopted at scale.

The reports which are due to be produced in 2024 will also provide objective insights into whether the use of PCM heat battery alongside a smart controller can be a cost effective and reliable alternative to conventional network reinforcement.

Significant learning

We look forward to sharing the learnings from this project in the dissemination reports we have planned for 2024.

Registered id:	Budget:	Start date:	End date:	Status:	Link
SPEN_0066	£297,000	December 2021	March 2024	Complete	https://smarter.energynetworks.org/projects/SPEN-0066

Whole Energy System

Level Up

A Digital Energy Balancing Platform for Low Carbon Technologies.

Overview

Level Up will develop and trial the ZUoS energy balancing digital platform. It will leverage low carbon assets (Solar PV, Batteries, Heat Pumps) installed by the participants of the OneCarluke Community Energy Club (CEC). The ZUoS platform will utilise live energy data-feeds from the energy club's LCT assets and network monitoring. It will integrate the data collected with SP Energy Network's NAVI platform (developed through our NCEWS project) and simulations will be run on the model. This will benefit the network by:

- Developing optimisation strategies to reduce peak demand on the LV network;
- Enhancing energy system modelling in combination with data from LCTs, to build improved LV forecasting capability.

The solution will enhance forecasting accuracy; local energy balancing; and help with resilience planning to inform capacity thresholds more accurately for LCT deployment and LV infrastructure upgrades.

Progress

The effectiveness of various control mechanisms has been evaluated with regard to their ability to reduce evening demand peaks.

We found that demand response and Collective Demand Side Management (CDSM), using overnight battery charging were the most effective of the solutions we assessed. However, the broad peak results in battery depletion before the end of the peak when using a simplistic demand response. The CDSM scenario strategically deploys battery energy to optimally reduce the peak.

The collective control of small-scale assets has been shown as a viable method for reducing peak demand on local network infrastructure. The project has developed a method statement for the operation of CDSM that benefits CECs, local communities and DNOs.

Significant learning

We've also highlighted barriers to adoption and methods by which DNOs can mitigate these barriers and support the technological and economic case for CDSM of CECs, namely:

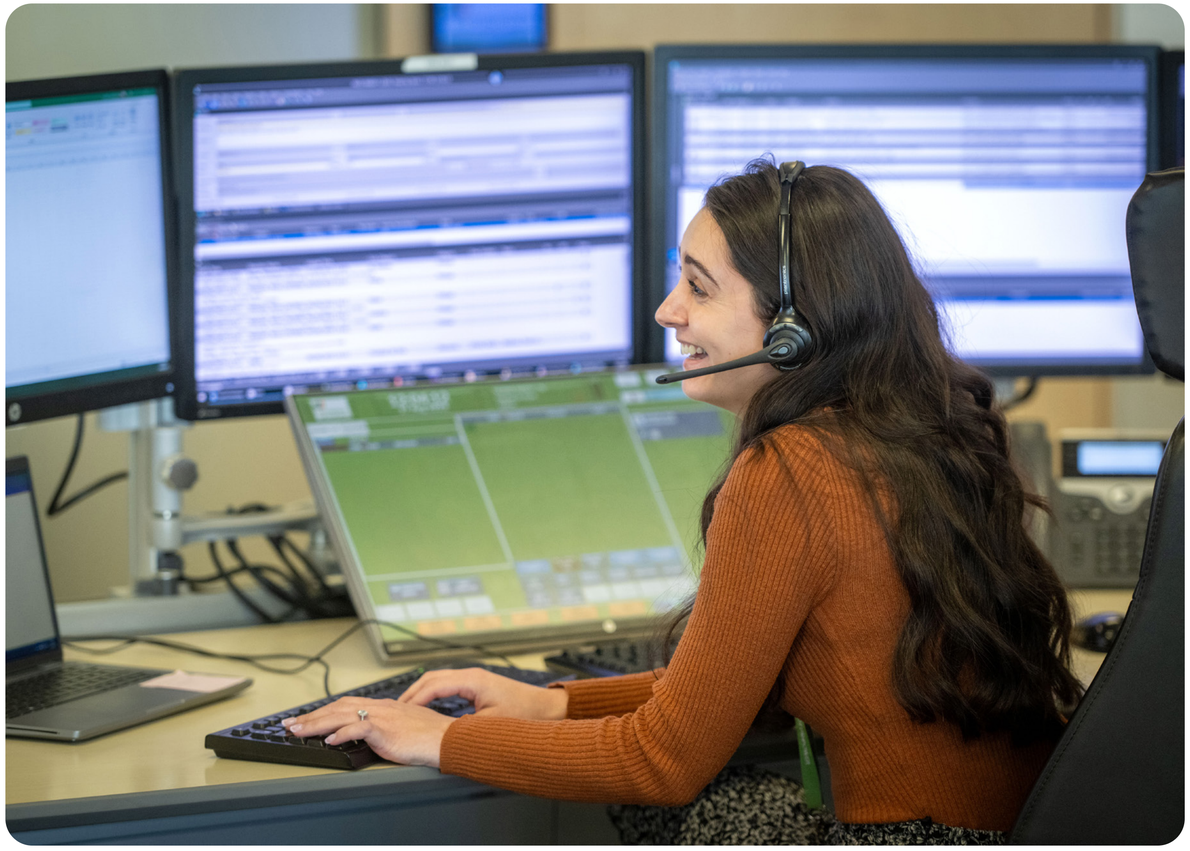
- Data sharing – open data standards should support the ability to share data to optimise energy flows.
- Interoperability across low-carbon technologies, including the widespread adoption of standards and standardisation across manufacturers and interoperability between DNOs and the CEC's virtual network manager.
- Enhanced approach to assessing diversity of low carbon assets and the standardisation of methods for assessing their peak loading conditions.
- Support for dynamic locational price signals to incentivise CECs to control their assets to benefit the local network.
- Support the deployment of smart meters to allow half hourly settlement, allowing the control of assets in response to predicted network loading.

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0078	£375,000	August 2022	March 2024	Complete	https://smarter.energynetworks.org/projects/NIA_SPEN_0078

Consumer Vulnerability

Security of Supply for Vulnerable Consumers (SSVC)

Through our Consumer Vulnerability strategy theme, we identified an opportunity to better support vulnerable customers during system outages through battery-backups and decision support tools.



Overview

Security of Supply for Vulnerable Consumers (SSVC) aimed to identify and test applicable technologies for restoring power and communications to vulnerable consumers and develop a technology/scenario support tool to enable effective decision-making during loss of supply incidents.

Planning to respond and protect the most vulnerable consumers following either planned (e.g. for maintenance) or unplanned (e.g. due to storm damage) system outages is a challenging process that relies heavily on staff expertise, local knowledge and manual data processing. This means that, despite best efforts, some consumers may be left without energy supplies and communications for periods of time that can lead to emergency situations.

Outcomes

Over 50 individual hardware solutions were reviewed across three categories (power reinstatement, communications, and vulnerability specific) to assess technical viability and to map technologies to vulnerability needs. Two of the shortlisted battery backup devices were sent to three of our customer impact panel members for testing and feedback..

Our customer impact panel highlighted the urgent need for backup power for critical medical equipment. In turn, we tested various medical devices (including nebuliser, sleep apnoea and medical bed) for compatibility and to enable simulated load testing.

Scenario response plans outlined the deployment strategies for different outage scenarios, ensuring efficient distribution of high capacity and lower capacity batteries to support vulnerable customers during power disruptions.

Significant learning

Building bespoke battery with integrated monitoring: To enhance the effectiveness of battery deployment during power outages, there is potential value in developing a bespoke battery system with built-in monitoring capabilities. This would allow real-time tracking of battery status, including charge levels and health, enabling proactive maintenance and replacement planning.

Community partnership: Strengthen partnerships with local emergency services and community organisations to enhance coordination and information dissemination during power outages. Collaborative efforts could lead to more effective identification and prioritisation of vulnerable customers, ensuring that battery systems are deployed to those in most urgent need.

Registered id:	Budget:	Start date:	End date:	Status:	Link
NIA_SPEN_0086	£300,000	April 2023	April 2024	Complete	https://smarter.energynetworks.org/projects/nia_spen_0086/

Consumer Vulnerability

PSR Resilience System

Understanding our customers is critical to an effective support strategy. That's why we've been developing a resilience system for our Priority Services Register as part of our Consumer Vulnerability strategy theme.

Overview

The project aims to create a method to improve the support offered to consumers in vulnerable situations by developing an efficient vulnerability system. The system will look to upgrade the Priority Services Register (PSR) to be more accurate in the quality and content of the data held to enable better support planning for consumers in vulnerable situations and extend the details of characteristics and needs of consumers beyond the current PSR codes.

Benefits

- Improved accuracy of existing PSR data and therefore improved support for consumers in vulnerable situations
- Improved understanding of consumers in vulnerable situations, enabling the collection of data beyond PSR codes
- Better understanding of consumer needs, leading to improved outcomes and improved customer satisfaction
- Ability to share and incorporate new data, increasing the PSR coverage and improving accuracy.

Progress

We have created an environment for data sharing between SPEN and our delivery partners, MorganAsh, as well as our PSR database solution, enabling secure collection and analysis of consumer data. We have selected 20,000 consumers in areas of greater vulnerability to conduct the trial the solution.

Next Steps

Adapting the MorganAsh Resilience System (MARS) to effectively handle DNO customer data, in preparation for testing with the full PSR dataset. This involves establishing necessary customer characteristics, integrating them into the Resilience Rating, and ensuring compliance with SP Energy Networks requirements.

Health	4
Wealth	10
Life Events	8
Financial Capability	10
Engagement Capability	10
Support Network	10
Permanency	8

Our NIA 2023-24 Portfolio

These tables summarise our full NIA activities for the 2023-24 year. Learn more and stay updated about an individual project by clicking the link to the ENA Smarter Networks Portal.

Completed Projects	ENA Reference	Started
Environmentally Acceptable Wood Pole Pre-treatment Alternatives to Creosote (APPEAL)	NIA_SPEN0008	Mar-16
Active Fault Level Management (AFLM)	NIA_SPEN0014	Feb-17
NCEWS2 – Network Constraint Early Warning System (Phase 2)	NIA_SPEN_034	Oct-18
Bethesda Home Hub	NIA_SPEN_0043	Oct-19
iDentify	NIA_SPEN_0049	Feb-20
Real Time Fault Level Monitoring Stage 2	NIA_SPEN_0050 RTFLM Stage 2	May-20
Re-Heat: Enabling Renewable Heat	NIA SPEN 0057	Jun-21
Innovative Replacement for Underground Substations	NIA_SPEN_0061	Sep-21
Level-Up	SPEN 0066	Dec-21
Data Historian Replacement	NIA_SPEN_0080	May-22
Security of Supply for Vulnerable Consumers (SSVC)	NIA_SPEN_0078	Aug-22
Switchgear Requirements for Future Networks	NIA_SPEN_0082	Mar-23
Resilient and Flexible Multi-Energy Hub Networks for Integrated Green Mobility	NIA_SPEN_0089	Feb-23
Open Innovation Phase 2	NIA_SPEN_0083	Apr-23
LV De Mesh	NIA_SPEN_0087	Apr-23
PSR Resilience System	NIA_SPEN_0086	Apr-23
XR Facilitating Training and Operations (X-FacTOR)	NIA_SPEN_0085	May-23

Live Projects	ENA Reference	Started
Secondary Telecommunications Phase 3 – Trial of Hybrid Telecoms	NIA_SPEN_0029	Nov-17
SMARTer selection of Automatic Sectionaliser links	NIA_SPEN_0093	Dec-23
Battery to Bypass Contraints for Smart Local Energy (BBC)	NIA_SPEN_0092	Feb-24
Active Fault Level Management (AFLM) ED-2	NIA_SPEN_0096	Mar-24
Real Time Fault Level Monitoring Stage 2 (ED-2)	NIA_SPEN_0097	Mar-24
Interconnected HV secondary substation battery monitor	NIA_SPEN_0091	Mar-24
Environmentally Acceptable Wood Pole Pre-treatment Alternatives to Creosote (APPEAL) (ED-2)	NIA_SPEN_0098	Apr-24
Switchgear Requirements for Future Networks (ED-2)	NIA_SPEN_0101	Apr-24
LV De Mesh	NIA_SPEN_0100	Apr-24
PSR Resilience System (ED-2)	NIA_SPEN_102	Apr-24
Re-Heat: Enabling Renewable Heat (ED-2)	NIA_SPEN_0102	May-24

Collaboration projects

Collaboration is a core aspect of our innovation process and, as well as collaborating with partners on our own projects, we actively support other DNO-led projects that address key industry challenges. Below we have summarised our involvement in NIA projects led by other networks. To learn more about these collaborative projects led by our partners, please refer to the lead DNO Annual Report or visit the Smarter Networks Portal using project links listed below.

Collaboration – Completed	ENA Reference	Started
Net Zero Service Termination Project	NIA_SSEN_0055	Aug-21
Consumer Vulnerability Impact Assessment Tool	NIA_WWU_2_06	Sep-21
Approach for Long-term Planning accounting for Carbon Assessment (ALPACA)	WPD_NIA_062	Jan-22
Decarbonising Utility Transport using Whole System Thinking	NIA_SSEN_0057	Feb-22

Collaboration – Live	ENA Reference	Started
CageCapture™ SF6 Paint Detection	NIA_SSEN_0059	Sep-22
Step Up Transformer	NPG_NIA_043	Mar-23
Impedance Scan Methods	NIA2_NGET0001	Jun-23
OHL Collision Avoidance	NPG_NIA_045	Aug-23
Equal LCTs	NIA_SSEN_0076	Feb-24

SP Distribution and SP Manweb

Network Innovation Allowance Annual Summary

2023-24

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