Scottish & Southern Electricity Networks

SIF Round 4 Project Registration

Date of Submission

Jan 2025

Project Reference Number

10143133

Initial Project Details

Project Title

3DAR (Dynamic, Data Driven Asset Rating) Discovery R4

Project Contact

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Challenge Area

Faster network development

Strategy Theme

Data and digitalisation

Lead Sector

Electricity Distribution

Project Start Date

01/02/2025

Project Duration (Months)

3

Lead Funding Licensee

SSEN - Scottish Hydro Electric Power Distribution Plc

Funding Licensee(s)

SSEN - Scottish Hydro Electric Power Distribution Plc

Funding Mechanism

SIF Discovery - Round 4

Collaborating Networks

Scottish and Southern Electricity Networks Distribution

Technology Areas

Modelling

Demand Side Management

Project Summary

With increasing demand for both electrification and renewables connections, many areas of the distribution network are approaching their capacity and will need intervention. Traditionally, DNOs can reinforce the network or procure flexibility services to meet these peaks. These are costly solutions that can have long lead times. By leveraging dynamic asset ratings at scale for the first time at distribution level, this project enables the deployment of a data-driven solution that optimises capacity through real-time, localised weather data and asset modelling. 3DAR will enhance network investment planning, reducing costs and ensuring long-term resilience for faster, more efficient connections.

Add Third Party Collaborator(s)

SIA Partners UK

Project Budget

£120,391.00

SIF Funding

£108,352.00

Project Approaches and Desired Outcomes

Animal testing

- ○ Yes
- ◉ No

Problem statement

'Dynamic, Data Driven Asset Rating' (3DAR) addresses Challenge 1: Faster Network Development and focus area: Novel methods to increase electrical capacity from existing assets/ support more efficient connection methods.

The problem and our Project

Dynamic Rating (DR) allows the operator to use the maximum safe capacity of an asset (e.g. overhead lines, transformers etc), through use of physical high-cost sensors and is a well proven method of increasing network capacity. The approach has generally been restricted to Transmission and used on conductors as Dynamic Line Rating (DLR).

Deployment of DLR for a specific circuit requires a detailed field survey and assessment to identify the potential headroom. While this is applied to some high value Transmission assets, the number and geographic spread of assets at the Distribution level makes the cost of monitoring the DR of assets prohibitive.

To properly consider DR at scale in distribution, the available headroom needs to be readily available to planners at the start of the design process. In addition, implementing a 'sensor-less' Dynamic, Data Driven Asset Rating (3DAR) tool will lower cost and liberate benefits for application at scale on distribution networks without the need for expensive technology.

How our Project meets the primary Innovation Challenge

3DAR will allow the proven benefits of DR be to realised at scale, in a fast and efficient manner. By digitising the assessment process and leveraging new and existing data, a digital tool will be created allowing planners to make informed decisions on the application of DR. Data sets will include weather/climate, topographical and circuit routes and load profiles amongst others.

The end-to-end solution will shape DNO long-term investment strategies, optimise flexibility products, increase available capacity and support faster more efficient connections.

Potential users

The final output will provide accessible tools to all DNOs, for use by:

- Strategic Investment Planners - allowing at scale assessments of additional capacity.
- Network Planners - providing readily accessible circuit by circuit assessment on application of DR
- Designers - providing information to undertake detailed DR design and implementation.

3DAR will make the rapid and global deployment of DR an affordable and effective solution.

Other public or network innovation funded work

To date DLR has been restricted to Transmission. This Project draws on learnings from REVISE (updating line ratings using new environmental data), P4R (sophisticated weather modelling and forecast engine) and wider research including DLR, to create a whole new offering.

Video Description

https://vimeo.com/1021777287?share=copy

Innovation justification

Core innovative aspects

3DAR will develop a common framework for use within distribution networks, across a range of asset types (see appendix). By combining asset and demand forecast data with advanced weather forecasting we will develop a dynamic and flexible approach to asset rating and begin to identify areas of the network where DR may be beneficial. This automated approach can be used for both long term investment planning and for near real time optimisation of network flexibility requirements.

Innovation and state of the art

Asset ratings are usually based on an assumed ambient temperature and operating environment, with values remaining fixed for the season. Some transmission operators use in-situ monitoring systems to calculate the available circuit rating dynamically in real time. These are expensive and deployed only in specific circumstances. The challenge of this approach at distribution scale, is covering a higher volume of assets across a wider geographic area. A solution without sensors is required.

Key innovation areas:

- **Optimising locational weather data** collection by integrating operational research.
- **Downscaling weather data** to highly local forecasts, allowing for a more robust evaluation of assets suitable for DR
- **Quantifying risk** of applying DR at scale across distribution system
- **Bridging planning and operations** using aggregated data models to ensure well-informed and operationally aligned decisions.

Building on previous research

This Project will consolidate insights from academic research, SSEN Transmission's REVISE Discovery Phase, and SPEN's ongoing Beta Phase Project, P4R. These provide a firm foundation, but do not address the key challenge of cost-effective deployment at scale across the DNO network.

In addition, relating to the application of sensor-less DLR, there are several established vendors providing these services to Transmission Operators, the Project will seek input from them.

Splight: https://www.splight-ai.com/about
Heimdall Power: https://heimdallpower.com/

TRL

3DAR has a current TRL of 4, and CRL2. We aim to progress this to TRL 5 in Alpha and higher in Beta.

SIF funding

Given the Project risk and complexity, SIF provides the ideal funding mechanism. Additionally, the cross-industry collaboration required to integrate granular weather data into DR modelling supports the need for SIF, as no current market proposition exists to use this data effectively in distribution.

Counterfactual

Traditionally, DNOs have either reinforced networks or procured network flexibility services to provide additional capacity both requiring significant capital or operational costs.

Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Environmental - carbon reduction – direct CO2 savings per annum

New to market – processes

Impacts and benefits description

3DAR will enable operators to choose the most cost-effective solutions for network constraints, defer costly reinforcements, and optimise flexibility investments at both procurement (long-term) and dispatch (short-term) levels.

Financial: operating the network

Deferring network reinforcement: By having a holistic view of network load and capacity, 3DAR will provide insights into where additional headroom can be unlocked on the network, and where assets can be run for longer, at a higher capacity than current static operating levels. With tools currently available SSEN have already deferred over £44m in ED2, the use of 3DAR gives DNOs further options to defer investment.

Reduced expenditure in the procurement of flexibility services over ED2 as a result of increased capacities of network assets. 3DAR will reduce investment in flexibility services procurement by optimizing the use of existing network capacity through real-time data-driven decisions, such as leveraging DR. This optimisation allows DNOs to defer costly network reinforcements and right-size flexibility procurement. Rather than relying heavily on procuring flexibility services to manage grid congestion or imbalances, DNOs can use the additional capacity unlocked through DLR to handle short-term peaks. The estimated CAPEX for procuring flexibility services in RIIO ED2 under Consumer Transformation was: £5.1 - 6.5m. The estimated financial savings from reduced expenditure in procuring flexibility services could be 5%-15%.

Environmental: carbon reduction, direct CO2 savings per annum. 3DAR supports a more efficient and low-carbon grid operation by enabling better integration of renewables, reducing reliance on fossil fuels, and cutting overall emissions. By enabling a more efficient use of existing grid capacity, 3DAR will ensure that the renewable energy generated during periods of high output can be more readily accommodated on the grid. This displaces the need for fossil fuel generation that would otherwise be required to meet demand. By maximising the use of renewable energy sources, it directly contributes to reducing the electricity system's carbon footprint.

Creation of new market processes: The continuous evaluation provided by 3DAR ensures that the network is run at its most efficient level, minimising the need for expensive external interventions while maintaining reliability and supporting the integration of more renewable energy. This process leads to a more cost-effective and scalable approach to network management, reducing the reliance on flexibility services procurement.

Teams and resources

The Project team consists of:

SSEN: As lead and DNO, SSEN-D will provide an experienced Innovation Project Manager to oversee Project delivery and support all work packages.

In addition, SSEN-D will provide subject matter experts in:

- policy
- short- and long-term flexibility
- integrating platforms into BaU
- asset management
- finance

SSEN carries out an annual Distribution Network Options Assessment, calculating flexibility procurement and utilisation and network reinforcement needs. Innovation has contributed to this and 3DAR will add a further tool to this assessment and help to further embed our flexibility first approach. Within Distribution we have experts who work daily on short- and long-term flexibility procurement and utilisation.

Sia Partners: Sia Partners is a management consultancy firm with extensive expertise in the Energy & Utilities sectors, in addition to essential capabilities in developing open data partner ecosystems and data science solutions for utilities.

They understand the individual network differences and requirements and will be able to ensure interoperability of the envisaged solution. Sia Partners' team will combine Energy consultants, and Data Scientists to bring together sector together knowledge, open data expertise and technical capability with digital tools and techniques.

Sia Partners has successfully delivered several innovation projects involving advanced climate and weather data modelling solutions for DNOs in recent years. This includes SPEN's Predict4Resilience project and SSEN's Project TRANSITION, both of

which have brought innovative data science and software development capabilities into DNO network planning and control room operations. They are therefore very well placed to lead on the delivery of WP1 and WP2.

Sia Partners has recently supported Ofgem and Innovate UK to review their benefits assessment framework leading to a re-design of the previous cost benefit analysis approach to align with our best practice recommendations. They are well placed to deliver WP3.

Subcontracting: The University of Glasgow will be a subcontractor, to help validate outcomes, provide support on weather related risk management and help define future testing needs.

SSEN and Sia Partners work together in the Predict4Resilience project. It was on the strength of work carried out in P4R that SSEN-D and Sia Partners co-created this project. At Discovery, no wider external parties are necessary for successful delivery. We realise that further expertise will be necessary at Alpha and will engage with these during Discovery. The Project will have access to all necessary resources, equipment and facilities needed for discovery between the project partners.

Project Plans and Milestones

Project management and delivery

SSEN-D will lead on Project Management activities. We will use tools provided by UKRI (Risk Register, Project Plan), as well as tools developed internally (Gantt Chart, Project Costs, Finance Tracker) to regularly monitor project performance. The Project Team will meet weekly to review progress and collaborate. We will support the team sessions with focused Work Package collaborations, as well as face-to-face sessions (if/when required) to stimulate thinking and provide effective performance while developing outputs.

This approach will enable the project team to monitor across milestones and deliverables' dependencies, ensuring key outcomes complement each other.

As shown in the Gantt Chart, all Work Package have their own distinct targets, but at the same time, they are supporting other Work Package deliverables.

For example: D2.1 sets out the approach to modelling weather data which feeds directly to D2.2 and the approach 3DAR will take to testing the model in Alpha.

Several risks have been identified with examples shown below. A full list of risks and mitigations identified are available in the PM Book.

1. **Legal and commercial**: experience from previous projects show that data sharing agreements can be a challenge, these will be discussed in advance of project kick-off.
2. **Data modelling**: the short time frame for Discovery could hamper the ability to develop a highly advanced model. By leveraging academic partnerships models will be codeveloped and independently validated.
3. **Compliance**: conductor sag can be mitigated with a comprehensive impact assessment and prioritising ESQCR (Electricity Safety, Quality and Continuity Regulations).
No regulatory changes will be required for Discovery/Alpha phases. The project will, however, as an output of Alpha, deliver a recommendation of any regulatory change required to see the application of DR at scale on the distribution network.

The Project is not expected to impact on customers reliability of supply or have any direct or adverse impact on existing or future energy consumers and their premises during the Discovery or Alpha Phase.

https://apply-for-innovation-funding.service.gov.uk/application/10143133/form/question/44113/forminput/123489/file/767434/download

Key outputs and dissemination

he 3DAR Project has been designed around 4 main Workpackages. Each Workpackage has a set of clear Outcomes and Key Activities, which result in an agreed set of Deliverables.

A named owner has been allocated to lead each package, as well as delivery of individual Key Activity based on their skills, experience and strengths.

Full detail can be viewed in the attached PM book -- please see the Gantt Chart and the Project Plan tab, however, below summarises the Project Structure:

WP1 - Requirements Gathering/Asset Scoping

Lead: Sia Partner

Outcomes:

- O1.1 Compile a report which identifies the most suitable assets for 3DAR at the distribution-level.

Deliverables:

- D1.1 Report including literature review and engagement findings

WP2 - Determining Optimal Use Cases for 3DAR

Lead: Sia Partners

Support: University of Glasgow

Outcomes:

- O2.1 Assess current network loads and constraint across SSENs network and overlay them with weather data to identify the locations that would be most suitable for 3DAR.
- O2.2 Select representative sites for testing.

Deliverables:

- D2.1 Detailed approach to modelling weather data methodology
- D2.2 Approach to Alpha testing -- architecture, experimental design, risk management

W*P3* - Impact Assessment

Lead: Sia Partners

Outcomes:

- O3.1 Estimate benefits from implementing 3DAR.
- O3.2 Quantify the long-term impact of 3DAR on SSEN's network resilience and capacity.

Deliverables:

- D3.1 CBA
- D3.2 Impact Assessment report

WP4 - Project Management

Lead: SSEN -- Distribution

Outcomes:

- O4.1UKRI Engagement
- O4.2 Project delivery

Deliverables:

- D4.1 End of Phase slides
- D4.2 Show and Tell slides
- D4.3 Signed agreement

The outputs of these activities will inform our decision to progress into Alpha Phase and this knowledge and learning will be disseminated to the SIF community at the end of project Show and Tell.

We will promote the work using a multi-channel and multi-party approach, depending on the intended audience. Examples include:

- Amplification of UKRI, IUK and Ofgem official SIF communications
- Press releases, Energy Innovation Summit, websites and social media

3DAR will provide an important tool for network investment planning, faster connections and long-term resilience. It will bring a new product to an existing (albeit disjointed and nascent) market, and far from undermining the development of a competitive market, it will stimulate it by injecting fresh approaches and processes. Given there is not an existing comparable product on the market, the intention is for this to be rolled out across all GB DNOs to the benefit of all consumers.

Commercials

Intellectual Property Rights (IPR), procurement and contracting (not scored)

To ensure clarity is provided to the Project partners, UKRI and Ofgem regarding the intellectual property (IP) landscape, the Project is using an IP register to track the Background IP provided to the Project, the Foreground IP the Project generates, and the use and access rights to all this IP. The main contract governing the Project (the Collaboration Agreement) will include detailed, mutually agreed terms governing IP that are in line with the SIF Governance Document. For the Discovery Phase, all the IPR arrangements will follow the default recommendations of Chapter 9 SIF Governance Document.

Investment Needs

3DAR will draw on the below projects that have looked at weather forecasting, demand forecasting, use of weather data and line rating.

TRANSISTION NIC_SSEEN0 (Complete)

Funding: £14,500,000

The TRANSITION project aims to further develop DNO experience and capability with deploying local flexibility markets, enabling non-DSO services such as peerpeer capacity trading as well as enlightening ESO and DNO whole system coordination efforts.

Specifically, the workstream to develop the ability to forecast the net load expected at selected primary substations and feeders, over the short-term is led by Sia Partners along with toll development.

Predict4Resilience 10061710 (Live)

Funding: £5,020,674

P4R aims to "significantly improve network planning, modelling and forecasting capabilities" to "deliver the next generation of user driven digital products [...] across transmission and distribution". Through an advanced indication of where inclement weather will affect the network and a better prediction of expected fault numbers, P4R will enable resources (engineers, mobile generation, welfare provisions, customer liaison staff, mobile catering for consumers etc) to be proactively placed in those areas most likely to be impacted, something that is especially important in island locations where travel distances are significant. This creates a more resilient network, minimises disruption for customers and brings about financial, social and environmental benefits.

The end software solution will be fit for all GB and international DNOs, as well as any adjacent sectors who suffer weather-related interruptions. By providing Control Room operatives short-term predictions regarding the expected level of faults in each district across the licence area, DNOs can better prepare for a storm and restore power supply sooner than is currently possible and minimise disruption for customers.

REVISE UKRI10101698 (Live)

Funding: £171,300

The primary focus of REVISE is revisiting the current methodology for assigning overhead line ratings. The calculation process uses historical environmental data captured in the 1980s that is applied uniformly across the UK disregarding local/regional climate variations. The existing transmission network is increasingly constrained by system capacity limits exacerbated by rapidly increasing renewable integration. Improving understanding of line ratings, using latest
generation high resolution weather topographic data combined with the latest techniques for system modelling, will allow for improved targeted investment to ensure we meet demand for the connection of new renewables to the network, securing a safer and greener future.

Value for money

Total project cost has been set at £120,391 of which £12,039 will be met through compulsory contribution (10%). We are requesting £108,352 of SIF funding.

The balance of costs and SIF funding requested is as follows:

SSEN -- Distribution:

Full Cost: £35,411
Funding: £31,870
Contribution £3,541 (10%)

SSEN Full Costs include £7,200 allocated for the subcontracting costs for University of Glasgow.

Sia Partners:

Full Cost: £84,980
Funding: £76,482
Contribution £8,498 (10%)

Funding is expected to be allocated to deliverables and work packages in the following way:
WP1 -- Requirements Gathering/Asset Scoping: Funding: £20,077 (19% of total)
WP2 -- Determining Optimal Use Cases for 3DAR: Funding: £31,549 (29% of total)
WP3 -- Impact Assessment: Funding: £47,165 (44% of total)
WP4 -- Project Management: Funding: £9,561 (9% of total)

Value for money

The spread of costs across project participants is proportional to the work they will deliver. SSEN-D and Sia's rates are competitive and consistent with previous SIF projects.

Deliverables and work packages have been prepared using experience gained from previous successful SIF projects to ensure 3DAR delivers a high-quality output and value for money for the consumer. Through further development post discovery this project will:

- Enable more efficient connections
- Provide a cost-effective tool for investment network planning ensuring long-term resilience
- Bring together key stakeholders to avoid duplication

SSEN have carefully considered partner selection and have partnered with Sia Partners who are essential to the success of the project. Sia Partners are suppliers on SSEN's consultancy framework and were appointed following a competitive procurement exercise which included rates negotiations, a benchmark against comparative consultancies and an assessment of value for money. Additionally, Sia Partners have discounted their rates for this project and SSEN are satisfied that the rates provided are appropriate for the expertise they will be providing, and that these skills are not available within SSEN's resource pool.

Specifically:

- Deep sector expertise via Energy consultants, and Data Scientists who bring together sector together knowledge, open data expertise and technical capability with digital tools and techniques.
- Subject matter expertise of advanced climate and weather data modelling solutions for DNOs within innovation project
- Having recently supported Ofgem and Innovate UK (UKRI) with a review of their benefits assessment framework for the Strategic Innovation Fund (SIF), they also bring a strong understanding of the SIF CBA process and will ensure all outputs from WP3 from 3DAR are aligned to best practice guidance.

The finances of all project partners are included in the https://apply-for-innovation-funding.service.gov.uk/application/10143133/milestones-summary

Supporting documents

File Upload

SIF Round 4 Project Registration 2025-01-06 4_36 - 74.2 KB
10143133 Dynamic, Data Driven Asset Rating (3DAR).pdf - 201.7 KB
3DAR_Application_10143133.pdf - 371.5 KB

Documents uploaded where applicable?

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