Scottish & Southern Electricity Networks
TRANSMISSION

SIF Round 3 Project Registration

Date of Submission

Mar 2024

Project Reference Number

10101698

Initial Project Details

Project Title

REVISE - Revisiting and Evaluating Environmental Inputs on Line Ratings

Project Contact

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Challenge Area

Novel technical, process and market approaches to deliver an equitable and secure net zero power system

Strategy Theme

Net zero and the energy system transition

Lead Sector

Electricity Transmission

Other Related Sectors

Electricity Transmission

Project Start Date

01/03/2024

Project Duration (Months)

3

Lead Funding Licensee

SSEN - Scottish Hydro Electric Transmission

Funding Licensee(s)

SSEN-T - Scottish and Southern Electricity Networks Transmission

Funding Mechanism

SIF Discovery - Round 3

Collaborating Networks

National Grid Electricity System Operator

National Grid Electricity Transmission

Technology Areas

Overhead Lines

Electricity Transmission Networks

Resilience

Environmental

Project Summary

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 highresolution 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.

Add Third Party Collaborator(s)

University of Strathclyde

Met office

Gilytics

Energyline Ltd

Project Budget

£171,300.00

SIF Funding

£149,854.00

Project Approaches and Desired Outcomes

Problem statement

The existing transmission network is increasingly curtailed due to a limited amount of electrical energy that can be transferred by existing circuits. The cost of curtailment is expected to peak between 1-2.5 billion pounds a year by 2025. The majority of curtailed generation from renewable sources is due to positioning at network extremities combined with variable generation. This application proposes a novel technical approach to cost-effectively minimising curtailment.

Overhead line (OHL) circuits in the UK are rated using the methodology set out in TGN26 --a document detailing the current methodology for assigning ratings; based on static environmental parameters, developed in the 1980s and applied uniformly across the UK. An OHL located in southern England would have the same rating if it were instead located in the Scottish Highlands despite the variation in climate. Therefore, for many places within the UK, the environmental parameters used to calculate the OHL rating are divergent from those used to calculate the rating.

The project will address the challenges of revising line capacity in three key areas.

1. Examining the current methodology to identify the critical inputs and assumptions that have the most impact on the rating calculated.
2. For those critical inputs and assumptions, based on modern meteorological and data science principles, determine the regional/localised values that can be obtained.
3. In using the regional/localised values calculate the potential increase or subsequent decrease in rating that should be applied.

It is expected that Northern regions, which have high renewable penetration, would see an increase in circuit ratings and a reduction in curtailment due to a variation in the climate from that of which the ratings are currently based - lower temperatures and increased windspeed due to differences in terrain and altitude. Likewise, it is expected in southern regions, where climate change is likely to result in warmer conditions, a rating decrease could be required to maintain operational safety.

By updating the inputs in the circuit rating calculation and maintaining the OHL maximum operating temperature, this approach offers the potential to revise OHL ratings with no need to physically modify the system.

The intended users are Transmission Network Owners who would assess their current lines and determine, where appropriate, revised ratings. As the Electricity System Operator uses these ratings, they would also be an intended user and interested party. To our knowledge, no public or network innovation-funded work has recently been completed in this area.

Video Description

https://www.youtube.com/watch?v=Q-rbTlmP0TU

Innovation justification

The core innovation of REVISE is a pathway to implementation of an updated process and supporting tool to revise existing OHL ratings, which builds on previous and ongoing research. The University of Strathclyde has recently completed a literature review of the line-uprating approaches that various networks across the world have taken.

The TRL of revising line capacity ratings using environmental data accurate to a line's location/region is 9, as this is a mission-proven BaU. However, the innovative aspect of this project is harnessing this proven technology and pairing it with the latest generation high-resolution weather topographic data combined with the latest techniques for system modelling to implement the solution within the UK. By the end of Discovery, through the engagement with key customers work package an IRL of 2 will be also achieved. Further understanding of requirements, use case, and constraints will be gained, and a cost-benefit analysis will be established pushing the CRL to 4.

An agile approach will be taken over the 3 months to gain a deeper understanding of how current processes could be improved to support the management and operation of a net zero power system. By completion of Discovery, understanding will be sufficient to decide whether the project should be progressed to an Alpha phase application. Alpha will include identification and processing of region(s), proof of concept, and further exploration of required implementation activities.

As the project involves revisiting and potentially re-rating existing OHL infrastructure, requiring a high level of validation and confidence to avoid designing in significant risk. For greatest strength, the solution/process needs to be applicable to all of GB and be open to other networks. GB-wide co-ordination is therefore required and means that funding via BaU is not suitable. It is felt that the use of the SIF fund is wholly appropriate for this project as it brings together industry and academia, representing the entire network. Involvement from NGET and the ESO will lead to a common standard across the UK.

During project ideation, consideration was given to adopting 'post fault' ratings on lines not at risk of fault conditions or, for windfarms, attempting to correlate generation, line rating, and windspeed to produce a pseudo-dynamic rating. These were not progressed due to their inability to reduce constraints on the majority of the network and the high risk of regularly exceeding the line rating resulting in a risk to the network and public.

Appendix Q3 REVISE.pdf (opens in a new window) (/application/10101698/form/question/36580/forminput/99771/file/629653/download).

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

Others that are not SIF specific

Impacts and benefits description

REVISE will deliver the following benefits:

Financial - future reductions in the cost of operating the network

By 2025, total UK constraint costs are expected to peak at around £1 billion to £2.5 billion a year which is ultimately paid by consumers. The total cost of managing power flow constraints on the GB transmission system in 22/23 was £1.1bn (£740m on SSEN-T network). Even if potential savings from REVISE account for only a small portion of these costs, it will be sufficient to justify the project deployment costs, for example:

% Reduction in Constraint Est. Annual Saving [SSEN-S (North to South) boundary]

2.5 £ 8,234,400

5.0 £16,468,800

10.0 £32,937,600

REVISE could also reduce connection costs by allowing smaller, wood pole lines, 132kV circuits etc., and less costly overhead lines to be viable for a larger number of connection schemes.

Environmental - carbon reduction -- indirect CO2 savings per annum

Revise offers the following:

- Alleviating the constraint on renewable generation reduces the partial reliance on gas/diesel generation used to offset the difference.
- Circuit rating achieved with no physical works and the associated embedded carbon involved.
- May enable smaller renewable schemes to connect without the need to wait for further infrastructure works, helping to progress the connection queue.
- May remove the need to upgrade/replace circuits following a connection request.

New to market - processes

REVISE will be a new process/tool that will calculate overhead line ratings using high-resolution weather topographic data. This

will replace the existing process developed 1980s and applies uniformly across the UK. After a successful demonstration and pilot of the tool it will be available to other UK transmission network operators.

It is possible that a new commercial tool could be created, this will be determined in later phases of the project.

Others that are not SIF-specific

REVISE will offer the opportunity to improve the reliability, stability, and safety of the network. Firstly, by identifying circuits that, using the current rating methodology, are at risk of exceeding their safe operating temperature, and thus may put the public and network at risk. Secondly, increasing the post-fault rating of circuits enabling the network to recover demand more quickly in the event of a fault; compared to having to wait for a circuit under outage to be reinstated.

Overall, REVISE will lead to a more flexible and adaptable network.

A cost-benefit analysis will be undertaken as part of Discovery.

Teams and resources

SSEN-Transmission have established an exceptional team of 6 partners to deliver this coordinated innovation. We have successfully collaborated with all partners, building positive and productive working relationships from previous SIF and other large-scale projects. Partners are key players and leading experts within their field and are best placed to work on this project.

Lead

SSEN-T is best placed to lead this project because its network extends over some of the UK's most challenging terrain facing extreme weather and altitude. SSEN-T is focused on developing real-world solutions to support cost-efficient asset intervention planning and decision-making. SSEN-T will lead WP3 and WP5.

Project Partners

The **University of Strathclyde** is an internationally leading technological and research-intensive university with a substantial track record of successful collaborative research in areas of advanced electrical power systems, HV engineering, power electronics, energy conversion, engineering data analytics, and will lead WP1.

Gilytics are sector leaders in spatial modelling with extensive experience and expertise in collecting, processing, cleaning geographic data, and generating spatial models. The team includes specialists in creating spatial and optimization models at different spatial resolutions to predict events or model behaviors. Gilytics will contribute to WP1 and WP2.

Gilytics require access to metadata and characteristics of meteorological/weatherdata/parameters from the Met Office, who have agreed to share this metadata to aid analysis.

The **Met Office** is a world-leading meteorological organisation, responsible for UK weather observation data and forecasts and provides the global standard in climate change data. They have strong partnerships with other environmental data providers and a good understanding of its data users and their needs and will lead WP2.

Energyline is an established multidisciplinary engineering consultancy in transmission and distribution design. With 20+ years of knowledge and experience of OHLs and underground cable design schemes, they have the expertise and skills to make a significant contribution to the discovery phase and will lead WP4.

National Grid Electricity Transmission operate the transmission network in England and Wales with extensive experience in leading innovation projects within areas of digitalisation, asset management, and network condition monitoring and will contribute to WP's 3-4.

National Grid ESO is the system operator for the GB Transmission System and have a large pool of electrical power system engineers, with a wide range of experience in the planning, operation, and performance evaluation of the GB Transmission System and will contribute to WP's 3-4.

See **Appendix_Q7** for further description of the team and resources.

Project Plans and Milestones

Project management and delivery

Project Management Approach

SSEN-T will follow its well-established robust and proven project management processes successfully applied to all previous SIF projects as well as other Innovation projects. Discovery Phase projects will be run by applying an agile, flexible, and adaptable approach throughout the project. This process is audited and compliant with the SIF Governance document.

The project is divided into five work packages as detailed in the Project Management Book (Appendix for Q2 and Q7) uploaded to the application portal.

WP1: Review Existing Methodology (Lead -- University of Strathclyde)

(SIF funding request: £45,944.98)

WP2: Science and Data Availability and Region Review (Lead -- Met Office)

(SIF funding request: £49,544.69)

WP3: Engagement with Key Customers (Lead -- SSEN-T)

(SIF funding request: £19,640.63)

WP4: Implications and Interactions (Lead -- Energy Line)

(SIF funding request: £13,190.43)

WP5: Project Management (Lead - SSEN-T)

(SIF funding request: £21,530.53)

Links and Dependencies between WPs and Milestones are represented in the Project Plan and Project Management Book.

Risk Management Strategy-

A list of risks has been compiled by the project partners (see Project Management Book). Regular reviews will be held to track and update the risk register. The risks cover technical, management, and commercial aspects of the project. The main risks and associated mitigation are:

- Targeted data not being available or taking too long to access. To mitigate this risk we will identify the key internal or external contacts, make contact early and request for approval to access the data.

- Stakeholders not returning the questionnaire on time and therefore not gaining the required insight. To mitigate this risk we will design the questionnaire in a streamlined manner to minimise effort. Regular reminders will also be scheduled for stakeholders to prompt responses.

Planned or unplanned supply interruptions-

This project will not lead to any planned or unplanned supply interruptions for consumers and therefore will not have a detrimental effect on the consumer and will not require access to the electricity or gas network.

Energy Consumers Interactions-

Whilst there is no direct Consumer contact anticipated, the project will help to identify lines that can be uprated and therefore increase capacity over existing lines contributing towards the transition to net zero improving system efficiency and reducing connection delays. Conversely, it may highlight lines that require downrating which is equally important to promote a safer network and support longer-term system reliability by reducing future curtailment.

Appendix Q7 REVISE.pdf (opens in a new window) (/application/10101698/form/question/36584/forminput/99795/file/629656/download).

Appendix Q7 REVISE_Project Management Book.xlsx (opens in a new window) (/application/10101698/form/question/36584/forminput/99795/file/630434/download).

Key outputs and dissemination

Key Outputs-

The main outputs will be a better understanding of revising line ratings by:

- Identifying the limitations of the existing methodology **(University of Strathclyde)**.
- Investigating data availability and a proposed approach to defining regional areas **(Met Office)**.
- Determining requirements for creating a data modelling tool **(Gilytics)**.
- Gaining an understanding of the impact of applying new ratings and how the tool may be rolled out to existing assets **(SSEN-T)**.
- Determining the safety limits and features of OHLs that need to be accounted for **(Energyline)**.
- Development of an outline plan for Alpha and a Cost Benefit Analysis **(All Partners)**.

Dissemination Opportunities-

The methods for dissemination of the key outputs are:

- Each organisation has its own corporate website which is a platform for sharing the outputs of the project.
- Discovery 'Show and Tell' Webinar, expected to take place May 2024.
- Publication of key project documents on the ENA Smarter Networks Portal which is publicly available.
- Energy Innovation Summit Autumn 2024: All networks would plan to attend this unique UK event to potentially present a poster showcasing the findings of the REVISE Discovery phase.

Competitive markets-

There are no activities or outputs in the Discovery phase that will prevent other networks from procuring similar services from other parties.

Commercials

Intellectual Property Rights (IPR) (not scored)

To ensure transparency is provided to the Project Partners, UKRI, and Ofgem regarding the IP landscape, the Project will employ an IP register to capture the Project Background IP and any Foreground IP that is generated during the Discovery Phase of the Project, however, it is not anticipated that IP will be generated during this phase.

The default position for the governance of the project (Collaboration Agreement) in terms of IP will be that described in the latest SIF Governance Document (currently Version 2.1) as part of Chapter 9.

Value for money

There is an even spread of costs across the project partners appropriately calculated in line with the amount of work they are delivering. SSEN-T has competitive day rates, and the project partners rates are competitive and consistent with previous innovation projects. We are confident that consumers will gain significantly more benefit from the REVISE Discovery Phase than the SIF funding contribution.

The total project cost for the Discovery phase is £171,747. The project is requesting £149,851 of funding (87% of the total cost), with the remaining £21,895 (13%) being provided by internal contributions. This level of funding will lead to outcomes that provide value to the consumer.

SSEN-T costs are £27,265 to lead this project and manage the delivery of work. SSEN-T is requesting £21,812 of funding and will contribute £5,453.

The University of Strathclyde's costs are £42,342 and will be requested in full from SIF funding. The University of Strathclyde are unable to offer a contribution at this phase. Increased contributions from other partners compensate for this.

Energyline costs are £12,400, with a funding request of £11,160, and a contribution of £1,240.

Gilytics costs are £14,300, with a funding request of £12,740, and a contribution of £1,560.

National Grid costs are £11,429, with a funding request of £10,286, and a contribution of £1,143.

National Grid ESO costs are £10,261, with a funding request of £8,261, and a contribution of £2,000.

The Met Office costs are £53,750 with a funding request of £43,250, and a contribution of £10,500.

REVISE is an ambitious project and will bring together a consortium of leaders within their fields. The consortium has carefully prepared the Discovery phase project plan and work packages, using their expertise to define each deliverable and ensure project REVISE fulfils the scope and delivers quality output and value for money for the consumer, by:

1. Providing a cost-effective solution to network reinforcement, reliability and stability.
2. Maximise the potential to connect new energy projects more efficiently and effectively.
3. Avoid duplication of effort by bringing together key players.

There are currently no commercialisation plans for the project. In terms of rolling out to business as usual, there will be further consideration taken throughout the Discovery phase through engagement with key customers to investigate the means for rolling out into business in usual if the project is successful.

The Discovery phase will not require the use of any pre-existing assets or facilities.

The finances of all project partners are included in the milestones summary (/application/10101698/milestones-summary).

Return to your project finances (/application/10101698/form/section/14905/) to complete or make changes to your organisation's financial information

Supporting documents

File Upload

Stakeholder Engagement_Summary_Discovery2024.pptx - 5.9 MB
REVISE_WP1_Review_of_Existing_Line_Rating_Methodology 28.05.2024.pdf - 2.1 MB
REVISE_Show and Tell_Discovery_June2024.pptx - 4.4 MB
REVISE_Discovery_Phase_draft_v1 (1).pdf - 483.0 KB
REVISE_Discovery_End of Phase Meeting_21May24.pptx - 6.4 MB
MetOffice_discovery_phase_report.pdf - 960.7 KB
90SS1354-REP-001 - WP4 Interactions and Implications Report Issue 1.pdf - 745.3 KB
SIF Round 3 Project Registration 2024-03-08 2_55 - 64.5 KB
SIF Round 3 Project Registration 2024-02-28 4_23 - 64.4 KB

Documents uploaded where applicable?

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