SIF Round 3 Project Registration

Date of Submission

May 2024

Project Reference Number

10105122

Initial Project Details

Project Title

Nature4Networks (R3 Discovery)

Project Contact

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Challenge Area

Whole system network planning and utilisation to facilitate faster and cheaper network transformation and asset rollout

Strategy Theme

Net zero and the energy system transition

Lead Sector

Electricity Distribution

Project Start Date

01/03/2024

Project Duration (Months)

3

Lead Funding Licensee

SSEN-D - Scottish and Southern Electricity Networks Distribution

Funding Licensee(s)

SSEN-D - Scottish and Southern Electricity Networks Distribution

Funding Mechanism

SIF Discovery - Round 3

Collaborating Networks

Scottish and Southern Electricity Networks Distribution

Technology Areas

Carbon Emission Reduction Technologies

Environmental

Project Summary

Our electricity network is exposed to the increasingly unpredictable and severe impacts brought about by climate change, like flooding and extreme heat. Typically, hard engineering solutions have been used to protect assets from problems such as flood risk. Whilst these are undeniably effective for their primary purpose, they offer no additional benefits and the materials used in their construction is extremely carbon intensive.
However, nature provides us with other options and approaches which are effective, and provide climate, biodiversity, social, and well-being benefits. Nature4Networks with GHG, Frontier Economic and SSEN will explore using nature-based solutions to safeguard our electricity networks.

Project Budget

£164,719.00

SIF Funding

£148,247.00

Project Approaches and Desired Outcomes

Problem statement

Electricity network assets are critical to accelerating progress towards Net Zero. However, they are subject to climate change impacts, including flooding and extreme heating, which can lead to equipment damage and loss of supply. Traditional engineering methods (concrete flood defences or forced cooling systems) address these issues, but add to the cost, embodied carbon and associated climate change impact, lead times, and complexity of installing new network infrastructure.

Nature4Networks proposes to identify and assess nature-based solutions (NbS) that could deliver wider benefits if applied to electricity networks, including flood resilience, carbon sequestration, biodiversity enhancement, social benefits, and asset regulation (e.g., temperature control) while maintaining the required asset performance in light of climate change. Being able to confidently utilise alternative options such as NbS, offers the potential to reduce costs, accelerate delivery times and provide more flexible and adaptive long-term whole system options.

With the use of advanced modelling techniques and digital simulations, our project aims to identify asset risks and map them against a NbS portfolio, assessing applicability and net benefits (taking into account opportunities and barriers that could prevent NbS from being adopted) when compared to traditional solutions. As such, these types of data sets have not been used in this manner before and will deliver a novel and unique portfolio of investment intervention options.

Our project will compare costs and benefits, improve network coordination through identifying where NbS may benefit a combination of assets, both reducing costs and leading to more sustainable solutions helping to de-risk and accelerate delivery of network infrastructure, with greater acceptability from key stakeholders. Therefore, The Project is well placed to address the Whole System Network Planning Challenge, Scope 1 Digital simulation, and advanced modelling techniques to facilitate whole system network planning and development.

The project will initially focus on a small set of specific distribution assets and use cases such as flood protection for existing primary substations or new substation construction, This will be used to develop the methodology which van then be expanded to other equipment types and use cases.

While the solutions developed within this project will be tailored to electricity network assets, the broader projectoutcomes may have wider whole system applicability with users including gas, telecoms, water, and transport.

Video Description

https://www.youtube.com/watch?v=ftHpSIbiijE

Innovation justification

How does your Project demonstrate novel and ambitious innovation in the energy networks?

Currently DNOs rarely consider approaches other than engineered options when designing network assets. There is growing recognition of the potential of innovative NbS and their importance in tackling the combined climate and biodiversity crises. This has seen some sectors (e.g., water) begin to embrace NbS to address common challenges, including water management, flood risk reduction, whilst potentially increasing acceptability by key stakeholders.

Readiness Levels:

We judge the current TRL for some options to be mature (7/8) but we envisage needing to identify additional options specifically for electricity sector challenges. Using the lessons learned from other sectors, our project seeks to raise the current low IRL (2) and CRL (3) for application of NbS to common challenges associated with electricity network assets (e.g., substations and transformers) by 1 or 2 levels. See Appendix 1 below for more detail.

Engineering solutions are effective and well understood, and can be designed for almost any conceivable problem, within fine and well-defined margins of tolerance. However, materials like concrete and steel are extremely energy intensive, they are also generally single purpose, delivering one technical function (and limited additional benefits).

By comparison, an NbS approach, like the re-wetting of a peatland as part of flood mitigation strategy, represents a flexible and expandable solution to meet technical requirements and safeguard organic rich soils, enhance biodiversity value, increase the water table and regulate flow rates and support recreation. The project will look at options for the assessment of these benefits within the investment process.

Lack of evidence is the biggest barrier to uptake of NbS approaches in place of traditional engineered options. Concerns arise over the efficacy and cost of NbS, including how they compare with well-understood engineering approaches and how the delivery risk (including financial) can be managed when dealing with uncertainties related to nature.

Our project sets out to identify issues related to different network asset types that may be addressed by NbS approaches; operational parameters that solutions must adhere to; any regulatory changes needed; and define (at a high level) the nature of the NbS and counterfactual approaches.

We are looking to provide a greater evidence base to overcome concerns highlighted above, which will provide a foundation for subsequent design of schemes suitable for specific locations, preparation of investment cases and measuring their effectiveness once deployed.

Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Financial - cost savings per annum for users of network services

Environmental - carbon reduction – direct CO2 savings per annum

Environmental - carbon reduction – indirect CO2 savings per annum

Revenues - creation of new revenue streams

Others that are not SIF specific

Impacts and benefits description

Impacts and benefits description
The project will assess the feasibility, costs and benefits of using Nature-based Solutions (NbS) tailored to electricity network assets relative to existing conventional solutions deployed to address issues such as flooding, noise and over-heating. Should NbS approaches provide effective alternatives for these challenges, the project will provide not only financial savings through lower network costs but also wider environmental and social benefits (carbon emission reduction, carbon sequestration, biodiversity enhancement, physical and mental well-being support) and increased social acceptance.

The benefits to consumers will be assessed using a number of key metrics:

Financial -- reduced operating cost and impact on customer bill: Investing in NbS could represent the most value-for-money option to mitigate issues faced by network operators as part of their day-to-day operations. These savings could then be passed on to end users and result in lower electricity bills. Savings will be measured by calculating the long-term cost (including capex, opex, and repex) of NbS and traditional solutions.

Environmental - both direct and indirect CO2 savings per annum: The construction of "grey" infrastructure is often carbon intensive, (e.g. concrete flood barriers). By contrast some NbS approaches may produce negative emissions through sequestration into biomass. Scope 1, 2 and 3 emissions will be qualified for both NbS and traditional solutions. The project will also quantify other environmental externalities -- e.g. relating to biodiversity or the amenity value of land.

Revenues : The project will explore and quantify revenue streams through which DNOs could attract additional returns in investing in NbS and share the upsides with customers (e.g. payments for ecosystem services such as carbon or biodiversity credits, or payments from neighbouring landowners).

Other benefits which may directly impact consumers (such as noise reduction and increased acceptability relative to

conventional solutions) and de-risk asset roll-out will be identified and assessed.

Discovery stage will provide a shortlist of appropriate NbS for DNO assets; identify key benefits and costs when compared to a traditional counterfactual and illustrate where (if anywhere) there is likely to be sufficient value.

Should sufficient value be demonstrated, Alpha stage would build on this by identifying barriers to the adoption of NbS and how they can be overcome and carrying out a quantified Cost-Benefit Analysis (CBA) potentially using a SROI methodology. This CBA will include metrics described above and will assess the benefits of adopting NbS from the perspective of a DNO as well as society as a whole.

Teams and resources

The project team was formed following the Innovation Basecamp in mid-2023, and includes

SSEN Distribution (SSEN-D), Project Lead -- SSEN-D have demonstrated leadership on sustainability by becoming the first DNO to be accredited on a 1.5°C science-based target pathway, now recognised as essential in response to the climate crisis. With a dedicated Sustainability team bringing a range of specialist expertise (nature, carbon, circular economy, sustainable procurement) SSEN-D are well-placed to explore alternative, sustainable nature-based-solutions to the traditional 'hard engineering' techniques which are prevalent withing the energy industry nowadays. SSEN-D will ensure that the proposed solutions meet the technical requirements, as well as contribute to SSEN-Ds objectives captured within the ED2 Environmental Action Plan, as well as the Net Zero Transition.

Frontier Economics is a leading economics consultancy with deep experience advising utilities on climate policy. The Economics team have strong quantitative skills and develop models which can be easily used by a wide range of stakeholders. The Frontier team will lead on the development of the cost-benefit analysis.

Sarah Deasley and Alex Whittaker have extensive experience in the energy sector and have led a variety of innovation projects. They will provide the strategic steer and attend key meetings. Matthew Bell (Director in our public policy practice and former Chief Executive of the CCC) and Phil Wickens (Associate Director in our water practice) will provide expertise on nature-based asset valuation and policy.

Hélène Roth will be Project Manager and responsible for the quality of the work delivered. She has wide-ranging experience advising clients on networks regulation.

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings and transportation. Our Energy Solutions team has a strong track record of completing projects for electricity network operators, sector regulators and other stakeholders in energy sectors around the world. This includes delivery of innovation projects for GB DNOs and support for implementation of new systems as part of work under data and digitalisation strategies. In addition, our Sustainability and Resilience team within our Environment business group provides expertise in Nature-based Solutions.

Our NbS lead, Matthew Ling, will be responsible for scoping and reviewing possible NbS options for application to SSEN's network. Matthew will be supported by Ghalia Albarazi, Senior Advisor with Asset Management expertise in the water sector. David Thorn, a Principal Consultant, will provide electrical engineering insights for the project.

Project Plans and Milestones

Project management and delivery

SSEN-D will lead on all Project Management activities. We will use the 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 Workpack collaborations, as well as face-to-face sessions (if/when required) to stimulate thinking and provide effective performance while developing outputs.

Weekly sessions and use of PM tools 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 workpacks have their own distinct targets, but at the same time, they are supporting other workpacks' deliverables -- e.g., a broad range of asset types and their typical issues will be identified in workpack 2 and subsequently, its direct and indirect benefits will be analysed in workpack 3.

A number of risks and barriers have been identified. The top scoring items can be seen below. A full list of risks and barriers, including mitigating actions, identified are available in the PM Book.

Risk 3 - NbS can enhance biodiversity and habitat restoration, there is a risk that it may inadvertently cause unintended consequences like disrupt existing ecosystems or lead to the introduction of invasive species to existing network infrastructure. The mitigation is to develop clear coordination and integration plans between NbS and existing network infrastructure and environment by conducting impact assessments to identify potential conflicts and solutions.

Risk 5 - Some NbS may be suitable for specific local conditions but not easily scalable to cover large electrical networks. Finding cost-effective and scalable solutions can be a challenge. The mitigations are to identify potential NbS that can be adapted or replicated in different conditions and operations and to prioritise scalable solutions that can cover large electrical networks to get effective results.

This Project is not expected to require any regulatory changes throughout the Discovery or Alpha stage. The project will, however, as an output of Alpha, deliver a recommendation of any regulatory change needed to make this approach a success.

The Project is not expected to impact on customers reliability of supply during the Discovery or Alpha Phase.

This project will not have any direct or adverse impact on existing or future energy consumers and their premises.

Key outputs and dissemination

By the end of the Discovery phase, our project will achieve an assessment of SSEN's network assets, identifying opportunities for Nature-based Solutions application. We will also perform a high-level CBA including narrative and counterfactual analysis, as well as potential benefits area together with how benefits can be maximised and deployment mobilised.

Workpack 1 - Project Management
Lead: SSEN
Support: GHD, Frontier
Purpose: Co-Ordination of Discovery deliverables, project performance, project reporting and alpha application. UKRI engagement.

Key outputs/deliverables:

- PM Book
- Risk Register
- Meeting Outputs
- Alpha Application

Workpack 2 - Network Assessment and NbS Portfolio
Lead: GHD

Support: SSEN, Frontier
Purpose: Undertake an assessment of SSEN's network assets identifying opportunities for Nature-based Solutions (NbS) application.

Key outputs/deliverables:

- SSEN network asset opportunity assessment for NbS deployment (excel)
- Catalogue of NbS options for application in line with SSEN assets - detailing what they are, how they work, how they address the problem.

Workpack 3 - CBA and modelling
Lead: Frontier
Support: SSEN, GHD
Purpose: Develop a counterfactual analysis and a high-level CBA model outlining areas of benefit (cashable and non-cashable) (not quantified).

Key outputs/deliverables:

- A high-level CBA model including counterfactual and narrative.
- A report detailing key barriers/opportunities for Nature based Solutions.

The scope of WP3 will be to determine if and how regulation and policy would need to be updated to enable successful roll out of NbS approaches. 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
- Specific engagement with water, gas, telecoms providers to address whole system options.

The project and outputs facilitate the opening up of a new market opportunity. The project outcome will support the market for NbS by providing evidence of demand and of the benefits of NbS as a credible alternative to hard engineering. This will encourage market participants to commercialise NbS solutions in GB, supporting innovation and inward investment.

Commercials

Intellectual Property Rights (IPR) (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.

Value for money

The total project costs are £164,719.
The 10% compulsory contribution will be provided in its entirely by Lead Partner SSEN-D £ 16,472.

We are seeking funding through the Strategic Innovation Fund for the remaining costs £148,247.

The balance of costs and SIF funding across the consortium is:

SSEN-D - Costs are £24,898, and funding sought is £ £24,898 minus 10% compulsory contribution (£16,472) = £8,426

GHD - Costs are £ 69,856 and funding sought is £69,856

FE - Costs are £ £69,965 and funding sought is £69,965

There are no subcontractor costs associated with this application.

Where possible, we have benchmarked costs received against those used by equivalent suppliers who are already engaged on SSEN's frameworks.

The project delivers value for money through avoided operational costs of traditional hard engineering solutions which can be costly, carbon intensive and do not deliver wider social and environmental benefits. The project will identify Nature-based Solutions (NbS) which would deliver wider ecosystem service benefits, including flood resilience, carbon removal, biodiversity enhancement, social benefits, and asset regulation, such as noise abatement and temperature control.

Further value for money may be delivered by providing consumers with increased resilience to supply interruptions and gives consumers peace of mind that they may not face the significant disruption of an outage. Customers may face fewer and shorter interruptions as a result of NbS solutions.

BAU adoption
The most suitable route to market will be explored during the project as the project looks to develop the correct approach.
The project partners will work together and involve the relevant teams at SSEN to deliver the desired benefits and implement the solution into BAU without delay.
The proposed solution would be applicable to all other GB DNOs, as well as a wide range of sectors including other Transmission operators, developers, water, road and rail.

Supporting documents

File Upload

SIF Round 3 Project Registration 2024-05-22 9_16 - 62.3 KB
Nature4Networks_R3Discovery_Application_10105122.pdf - 245.9 KB
10105122 Nature4Networks (N4N) (2).pdf - 209.5 KB

Documents uploaded where applicable?

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