Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Dec 2024

Project Reference Number

NIA2_NGET0075

Project Registration

Project Title

Framework for Risk Analysis and Modelling of Events (FRAME I)

Project Reference Number

NIA2_NGET0075

Project Licensee(s)

National Grid Electricity Transmission

Project Start

January 2025

Project Duration

0 years and 6 months

Nominated Project Contact(s)

Aisha Ali

Project Budget

£592,009.00

Summary

The expanding and interconnected electricity network poses challenges for National Grid Electricity Transmission (NGET) in monitoring and assessing network resilience. Currently, tracking resilience involves multiple metrics on separate Power BI pages, making it difficult to view overall resilience and hindering timely decision-making during storms or major events. This fragmented approach can lead to suboptimal maintenance and repair decisions. To address these challenges, the proposed project aims to incorporates probabilistic risk analysis to further improve resilience assessments, enhance decision-making accuracy using risk scores, and identify weak areas in the network. Additionally, simplify monitoring through a holistic map view. Ultimately, the project seeks to improve network resilience by streamlining risk identification and establishing minimum resilience levels for substations. FRAME II will be the full product release following the Minimum Viable Project phase in FRAME I.

Third Party Collaborators

baringa

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

The expanding electricity network is becoming increasingly integrated. It is crucial to understand the spread of network resilience risk and the overall network health score in different locations.

The network resilience team at NGET currently monitors network performance using multiple metrics presented on separate Microsoft Power BI pages. However, the existing data collection process, which involves regular updates from various sources and changing priorities, highlights the need for an additional analytical and visualisation platform beyond Power BI. The challenges to be addressed include:

- Lack of a holistic view making it challenging to assess network resilience status or obtain comprehensive information quickly.
- Difficulty in obtaining an overall view of the resilience of substations or zones.
- Limited ability to prioritise and make timely decisions during storms, network events, or major events like Eurovision.
- No comprehensive and streamlined approach to network resilience assessment and decision-making to enhance overall resilience and response capabilities during critical events.
- Increased likelihood of incorrect maintenance or repair decisions that do not optimise network resilience.
- Time-consuming process to understand site, zonal, and national risks.

Method(s)

FRAME Phase 1 (FRAME I) will deliver an interactive minimal viable product (MVP) web application displaying key metrics for the NGET Network Resilience Risk Tool. By incorporating the metrics into the resilience assessment framework, FRAME (the network resilience dashboard) will provide a more comprehensive view of network resilience, enabling more informed decision-making and proactive measures to enhance the overall reliability and performance of the network.

The project aims to jointly develop the MVP by leveraging NGET's data and hosting it within Baringa's infrastructure (Baringa. Cloud). The goal is to create end user views or reports by combining various metrics and individual views, tailored to user profiles, providing site and national perspectives. The tool will allow users to weight issues based on impact, apply filters, and integrate multiple data sources to generate a risk score model.

Machine learning models will be developed to calibrate fragility curves at the substation level using relevant data, with evaluation against business cases and a roadmap for continuous improvement. Following the MVP there is potential for transitioning the NGET Network Resilience Risk Tool into National Grid infrastructure under a separate contract for the FRAME phase two (FRAME II).

Data Quality Statement (DQS): The project will be delivered under the NIA framework in line with OFGEM, ENA and NGET internal policy. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal SharePoint platform ensuring backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Measurement Quality Statement (MQS): The methodology used in this project will be subject to our supplier's own quality assurance regime. Quality assurance processes and the source of data, measurement processes and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and will be made available for review.

Medium Risk
In line with the ENA's ENIP document, the risk rating is scored medium.

TRL Steps = 3 (7-8 TRL, 2 steps)
Cost = 2 (£556k)
Suppliers = 1 (1 supplier)
Data Assumption = 1 (data supplied by suppliers and NGET for analysis)

Scope

FRAME I will deliver an interactive MVP web application displaying key metrics for the Network Resilience Risk Tool. It will comprise of the following 5 work packages (WP).

Work Package 1: Identifying target User Interface (UI) wireframes, establishing the solution architecture design, and accessing relevant data sources for risk modelling in the FRAME platform.
Work Package 2: The first iteration of the risk score model for web application, the initial iteration of the large language model (LLM) for incident data summarisation, finalisation of UI wireframes, and the development of the initial UI.
Work Package 3: Deploy, test, and compare the risk score model, incident LLM models, and platform performance, while initiating penetration testing to ensure security measures are strong and resilient.
WP 4: Refine the network tool, complete User Acceptance Testing, address findings, and make final feature refinements before going live with the MVP.
WP 5: MVP go live, and a final comprehensive report will be created for the tooling and platform to specify its capabilities.

Objective(s)

The key objective of the FRAME project is to have a central view with resilience risk score to highlight network risk areas for decision-making. FRAME will enhance the visualisation of network resilience by combining multiple data sources and developing a risk scoring framework along with a holistic map view. This will facilitate prompt issue identification and enable quicker decision making during live events and extreme weather conditions.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to (please select/delete as appropriate) reduce the costs for households, improve the exchange of information between networks and customers while reducing the number of disruptions to them in the home. Other considerations including the project's impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Success Criteria

The project will be successful if it achieves the objectives set out in this document. In particular, the following outputs are expected:

- Holistic map view combining all metrics and individual views.
- Change asset level/detail view depending on user.
- Add weighted criteria for each topic to create the resilience score.
- Identify the ‘highest risk’ substations / zones within 1 minute of looking at the screen.
- Visualise complex data by transforming the data into accessible and understandable formats.

Project Partners and External Funding

Project Partner: Baringa - Energy Consultancy will deliver all the milestones of the project.
NGET is providing all the funding for the project and is the lead project partner.

Potential for New Learning

The project aims to deliver the following new learning:

- Resilience score for every substation which is not currently possible.
- Improved trending on events and asset limitations– location, frequency, time of the year with the ‘hot spots’ where resilience is weak.
- The learning will be disseminated through the reporting via the ENA portal. Effectively in-house, but lessons learnt, and innovation tool may be transferable to other TOs/DNOs with similar business-as-usual (BAU) environments.

Scale of Project

The total duration of the Network Resilience tool is limited to 6 months total (4 months build and integrate 2 months hosting) and will be an enabler for further stages if this stage is successful.
The Project is to enhance network detection and response capabilities, minimising downtime and optimising the allocation and management of network resources by analysing traffic patterns and predicting future needs. By automating the detection and historical data of resolution of similar network issues, the tool will reduce the need for manual oversight, lowering operational costs. Furthermore, the tool and its benefits can be applicable to BAU.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be conducted within the licensing area of NGET, which encompasses England and Wales.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£556,000

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

The project will support energy system transition by addressing network challenges like grid stability and reliability. Here's how the 'network resilience tool' will facilitate this transition.

- Maintain the health of ageing assets by developing a scoring method, thereby improving overall network resilience. For instance, identifying weak substations to be improved before/during customer connection works.
- Increased resilience against extreme weather events providing early warning systems and optimising infrastructure performance, improving network performance during storms or extreme weather.
- Proactive and preventative maintenance avoiding expensive unplanned repairs and optimising resource use by scheduling repairs during non-peak times, minimizing downtime and operational disruptions.
- Data-driven insights and cutting-edge algorithms within the model would empower NGET to improve climate resilience by identifying trends and their resolutions.
- Reduced likelihood of an unplanned outage which could impact demand and generators.
- Improved network resilience and reliability will reduce load, potentially increasing asset lifespan.

In summary, the Network resilience tool will enable to manage the complexities of the energy system transition. It will support the security of energy supply and facilitate investment in infrastructure. By making the electricity transmission network more robust and adaptive, the resilience tool will facilitate to a cleaner, more sustainable energy future.

How the Project has potential to benefit consumer in vulnerable situations:

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to minimise the exposure of vulnerable customers to the risks associated with power outages and disruptions while improving their access to reliable and stable electricity. It will enhance the ability of the network to respond to issues quickly, safeguarding those who are most at risk. Other considerations including the projects impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

N/A

Please provide a calculation of the expected benefits the Solution

FRAME is expected to deliver ~£5.78m with 4.45:1 benefit ratio directly to NGET over 10 years, by improving the network resilience and operational efficiency of multiple teams. These impacts are achieved by consolidating and visualising network resilience data and insights reports which help identify high-risk areas across geographic scale and enable faster and more accurate decision-making during network and weather events. Further benefits can be realised through alignment with the regulatory performance.

Additional qualitative benefits include enabling better coordination between teams for operational efficiency (e.g., proactive

maintenance), reputation with external stakeholders, reduced stress for teams operating during critical events or extreme weather and better understanding of complex relations between environment and network assets.

Please provide an estimate of how replicable the Method is across GB

The problem addressed in this project is experienced by all electricity transmission networks and has the potential to create positive benefits for all UK TOs. At the point of registration, we have identified no barriers to replication across Great Britain. The lessons learnt and the innovation tool may be transferable to other TOs/DNOs with similar Bau environments.

Please provide an outline of the costs of rolling out the Method across GB.

If the MVP stage is successful, it will pave the way for FRAME II, the full product release. This tool has the potential to be replicated in other Transmission and Distribution Network Operators (TOs/DNOs) with similar business-as-usual (BAU) environments, provided they have the same level of data and IT maturity.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☐ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☐ A specific novel operational practice directly related to the operation of the Network Licensees system

☐ A specific novel commercial arrangement

RIIO-2 Projects

☑ A specific piece of new equipment (including monitoring, control and communications systems and software)

☑ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☑ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

In the current system, it is not possible to assign a resilience score to each substation, which hinders the ability to comprehensively assess and compare their resilience levels. This limitation makes it challenging to identify areas that may require additional attention and improvements to enhance overall network resilience.

Furthermore, there is a need for improved trending analysis on events and asset limitations. This would involve tracking the location, frequency, and timing of events throughout the year to better understand their impact on the network and identify patterns or recurring issues. By gaining insights into these trends, it becomes possible to proactively address vulnerabilities and implement targeted measures to strengthen the network's resilience.

Another crucial aspect is the ability to identify "hot spots" where resilience is weak. This involves pinpointing specific areas or zones within the network that are more susceptible to disruptions or have a higher likelihood of experiencing resilience challenges. By identifying these hot spots, network operators can prioritize resources and interventions to improve resilience in these critical areas, thereby enhancing the overall performance and reliability of the network.

Addressing these challenges and implementing measures to assign resilience scores, improve trending analysis, and identify hot

spots will contribute to a more resilient network infrastructure, enabling efficient response and mitigation strategies during events and enhancing the overall reliability of the system.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

N/A

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

There are no other NIA projects looking at Network resilience tool to view Network resilience information holistically.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

N/A

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

This project is innovative for the following reasons:

- The application of mathematical models and systems engineering techniques to an electrical network. NGET, nor other TO's have not applied complex systems engineering approaches to a transmission network before. We believe this would be one of the most mathematically rigorous analysis of the transmission network undertaken.
- The aggregation of asset-based risk into network and substation level risk forecasting, (Risk score) using supervised machine learning methods is novel.
- This project will identify and test a range of tools and techniques which can be used to implement new quantitative methods across network operations and incident response. NGET does not currently apply any such tools or techniques within Resilience Planning.
- The LLM (Large language Model), a mathematic model to interpret data and summarise incident reporting.
- This tool is designed to justify the need for asset repairs and enhance decision-making regarding defect repairs by highlighting combinations of issues that indicate when a particular asset requires urgent replacement—capabilities that are currently beyond human analysis. The project integrates data from various sources to assess the condition of sites and the network effectively.
- Application of normative analysis methods which can be subsequently transferred to other network assets and processes to further reduce risk cost and exposure. (E.G Climate Resilience; Wildfire Threat Assessment). Our current analysis methods across Resilience are heuristics based.

Relevant Foreground IPR

All IPR is governed by the "National Grid Standard RIIO-2 Contracting Position – JOINT IP OWNERSHIP" that sets out National Grid's standard approach to Network Innovation Allowance (NIA) funded projects under the RIIO-2 framework. The Foreground IPR shall be owned jointly between the Parties in equal shares.
All Baringa.cloud pre-existing capability and all underlying infrastructure constitute Baringa's Background IPR and Baringa's Commercial Product.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

- A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. National Grid already publishes much of the data arising from our innovation projects here so you may wish to

check this website before making an application.

- Via our Innovation website at https://www.nationalgrid.com/uk/electricity-transmission/innovation
- Via our managed mailbox box.NG.ETInnovation@nationalgrid.com

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The project can be used as a Business as Usual (BAU) initiative, as it involves upgrading the existing Power BI dashboard or network resilience reporting. This upgrade aims to enhance visualization capabilities and introduce a risk scoring system. By incorporating the risk score, the project enables the team to promptly identify and assess risks, facilitating timely and proactive risk management.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

The work has not been undertaken elsewhere before and the results could have significant impact on business planning. The results will benefit other business units such as AO (planning performance managers, lead aces, operational managers), Network Resilience (Resilience and Policy Team) and TNCC (Control Room), NOI and AO management making NIA the most appropriate route.

This project has been approved by a senior member of staff

☑ Yes