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_NGESO085

Project Registration

Project Title

Assessment of the MITS planning backgrounds

Project Reference Number

NIA2_NGESO085

Project Licensee(s)

National Energy System Operator

Project Start

October 2024

Project Duration

2 years and 1 month

Nominated Project Contact(s)

innovation@nationalgrideso.com

Project Budget

£520,000.00

Summary

This project will develop new approaches to assess the requirement for network reinforcement by assessing the effectiveness of flexibility options and incorporating these into the calculation of base power flow and margins. The existing boundary calculation tool will be updated to compute available security constrained thermal flow margins with usable flexibilities to give indications of potential voltage and stability concerns. This will ensure the electricity system is designed in a secure and economic manner.

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

As the user mix for transmission and the processes of managing the uncertainty around which user connections are going to materialise continues to evolve, it is necessary to ensure that the design criteria applicable to the main interconnected transmission system are kept up to date. Currently there are:

- Limited scenarios used for planning
- Inadequate methodology used for deriving legacy scaling factors
- Lack of consideration of inherent flexibility available from modern day ‘active’ grids

Method(s)

This project will take place through a series of work packages:
WP1 Stakeholder engagement: to understand key stakeholders' needs, concerns and offerings throughout the project duration, testing technological/operational assumptions, using the open tools to generate evidence and analyses for subjectively feedback, and enhance user interface for classes of user
WP2: Characterisation of temporal/spatial statistical representation of network users (i.e. off-peak demand levels and inside/outside boundary diversities, variances)
WP3: Refine base planning tool: Accounting for probabilistic representation of network users and network itself.
WP4: Security analyses: Applying the boundary calculator to develop boundary flows arising from defined inflexible factors (e.g. price insensitive demands and non-marginal renewables), assess availability and quality of required data, and recommend scaling factors for different technologies, locations, times and renewable production conditions
WP5: Describe availability of flexibility actions (including effect of storage energy limits, duration of demand side actions, etc) and factors of safety appropriate in planning studies
WP6: Develop tool to select effective flexibility/control actions to meet user needs under contingencies (filtered for relevance to boundaries) & screen voltage/stability issues
WP7: Operability analyses: apply enhanced boundary capability calculator to develop the envelope of boundary flows that can be achieved by adjusting available flexibility options, determine methodology options for determining scaling factors for generation, interconnection, storage and other flexibility sources
WP8 Interfacing with Network Options Assessment (NOA): develop description of feasible envelope and effectiveness of controls for use by NOA market model (interfacing to NOA)

Scope

The scope of this project is to review to Section 4 of the NETS SQSS and the corresponding appendices to cover both the security and economy background assumptions. This should include relevant combinations of demand levels, renewable outputs and market positions.
The minimum design criteria for the system will be revised to include explicit evaluation of peak and off-peak scenarios which pose reliability challenges. The new design criteria should consider operational measures and commercial services as an alternative to circuit capacity, consider growing new technologies, such as solar generation, low MWh capacity storage, when defining scaling factors for a range of technologies. This leads to huge number of possible combinations to be assessed to establish boundary capability, which will be addressed by leveraging combinatorial reduction and screening techniques.
The project will use flow superposition techniques to reduce the computational burden for exploring the feasibility of securing pinch-point boundaries. This is achieved by superposing:
Flow arising from defined inflexible factors (e.g. price insensitive demands and non-marginal renewables); with
The envelope of flows that can be achieved by adjusting available flexibility options.
The evaluation offers further benefits in increased transparency in flexibility options in releasing pinch points, enabling scaling factors to be devised under differing system conditions and flexibility options.
Open data and analysis tools from micro-services architecture approach (modular and expandable, increases computing efficiency)
Combinatorial reduction and screening techniques (new application of such technology in GB energy sector)
(Currently existing and open source) boundary calculation tool to be extended to integrate flexibility options as well as to enable probabilistic analyses
•Key Project scope include:
(1) Identification of critical system conditions (beyond the security and economy conditions in the current SQSS Chapter 4),
(2) Scaling factors for diverse technologies (corresponding to different system conditions) and
(3) Ranking the economics of flexibility options
As per this scope, the following implementation plans will be:
•Recommendations made post-completion of this project will be used to identify the need for raising a modification request for SQSS Chapter 4
•If (modification request is) approved, and following completion of required/additional studies, relevant sections of SQSS Chapter 4 will be modified and new recommendations added
•Following appropriate review of the modifications, the revised Chapter 4 is expected to be featured in the next release of SQSS which will in turn provide guidelines for new connections and future network planning
•Many of the key deliverables to be extracted from findings of the (open sourced) boundary capability tool. We are aware that this will raise questions in the future in relation to integrating and/or ownership of tool within NGESO BaU activities. Post-completion of this Innovation project, therefore, we intend to engage with IT and Security teams to discuss potential issues and to ensure that any application of the tool to post-project activities adheres to broader Company policies.
•Learnings from the project would be disseminated amongst relevant stakeholders through seminars, conference presentations, technical reports and academic publications

Objective(s)

The main objectives for this projects are:
•Develop new approaches to address the complexity in interactions between identifying the need for boundary capabilities and effectiveness of flexibility options
•Identify methodology options for determining scaling factors for generation, interconnection, storage and other flexibility sources (combining resource availability, maintenance requirements, breakdown rates, operational limitations and confidence limits), assess availability and quality of required data, recommend scaling factors for different technologies, locations, times and renewable production conditions
•Identify methodology options for determining whole system peak and off-peak base flow conditions (selection of production sources and interconnector schedules to meet demand), recommend approach for off-peak conditions (merit order or additional scaling)
•Identify methodology options for determining required boundary flow margins above base flow conditions (the equivalent of peak security condition circle diagram) and the options for perturbing base flow patterns to test such margins
•Update boundary calculation open tool to compute available security constrained thermal flow margins with usable flexibilities
•Identify off-peak conditions when network capacity and/or flexibility availability may give security concerns and recommend basic security survey set
•Update boundary capability tool to give indications of potential voltage and stability concerns (for separate detailed analysis)

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A

Success Criteria

Following outputs to be delivered for project to be deemed successful:

- Identification of critical system conditions (beyond the security and economy conditions in current SQSS Chapter 4)
- Scaling factors for diverse technologies (corresponding to different system conditions)
- Ranking the economics of flexibility options

Project Partners and External Funding

University of Bath and Halo Software, no external funding

Potential for New Learning

Following are the learnings to be achieved from this project:
Identification of critical system conditions (beyond the security and economy conditions in current SQSS Chapter 4)
Scaling factors for diverse technologies (corresponding to different system conditions)
Ranking the economics of flexibility options
Learnings from the project would be disseminated amongst relevant stakeholders through seminars, conference presentations, technical reports and academic publications.

Scale of Project

The project spans 24 months with two project partners. The project consists of desk-based research using an open-source boundary flow calculation tool.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

Project will focus on the GB transmission system.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£520,000

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:

This project will involve developing new approaches to address the complexity in interactions between identifying the need for boundary capabilities and effectiveness of flexibility options. The boundary calculation tool will be updated to compute available security constrained thermal flow margins with usable flexibilities and to give indications of potential voltage and stability concerns. Methodology options for the following will be identified:
Determining scaling factors for generation, interconnection, storage, other flexibility sources (combining resource availability, maintenance requirements, breakdown rates, operational limitations and confidence limits), assess availability and quality of required data, recommend scaling factors for different technologies, locations, times and renewable production conditions will be identified.
Determining whole system peak and off-peak base flow conditions (selection of production sources and interconnector schedules to meet demand), recommend approach for off-peak conditions (merit order or additional scaling) will also be identified.
Determining required boundary flow margins above base flow conditions (the equivalent of peak security condition circle diagram) and the options for perturbing base flow patterns to test such margins

The proposed activities with the open, extendable and interoperable boundary calculator tool will:
Ensure the electricity system is designed in a secure and economic manner
Enable open knowledge sharing with key stakeholders with accessible tools
Take into account as many off-peak demand conditions and renewable patterns as necessary to explore the adequacy of accessible flexibility to inform a manageable number of conditions for securing the system.
Ensure consistency between the parallel ESO and DSO journeys in security standards.

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

Not applicable

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

The expected benefits of this project are:
Cost Savings: The project could delay or substitute reinforcement costs by optimising the utilisation of flexibility
Improved Economics of Flexibility Contracting: The project could improve the economics of flexibility contracting and call-off, potentially leading to more efficient use of resources and further cost savings
Enhanced Competition in Flexibility Markets: By increasing the transparency of need and encouraging participation, the project could enhance competition in flexibility markets. This could lead to more competitive pricing and improved market efficiency
Reduced Power System Analysis Burden: The project could reduce the burden of power system analysis through automation, leading to efficiency gains and potential performance improvements
Improved Security Assessment: The project could improve security assessment by explicitly covering potential off-peak pinch points

from solar peaks and interconnector flows. This could enhance system reliability and security
Enhanced stakeholder engagement through transparency and objectively based discussions

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

Study is to be conducted on the GB transmission system using an open-source boundary flow calculation tool, and as such, the results are expected to be replicable and accessible by relevant stakeholders

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

It is not anticipated that there would be a cost of rolling out the method across GB.

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

Recommendations of this project, e.g., identification of critical system conditions, scaling factors for diverse technologies and ranking the economics of flexibility options, would inform the process of raising a modification request for SQSS Chapter 4. This will in turn significantly influence the criteria used for planning the MITS.

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.

Discussions have already been held with relevant stakeholders to ensure that no duplication in project scope occurs, and this is to be further ensured through constant stakeholder engagement throughout the duration of the project.

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

Open data and analysis tools from micro services architecture approach
Combinatorial reduction and screening techniques (new application of such tech in GB energy sector)
Propose revised scaling and availability factors for diverse generation technologies considering different system conditions, flexibility options and uncertainties
Current methodology used for specifying minimum design criteria for NETS has several limitations that need addressing to prepare GB system for zero carbon operations by 2035

Relevant Foreground IPR

A final report verifying the work of the 8 work packages.

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’. NESO 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.nationalgrideso.com/future-energy/innovation
Via our managed mailbox innovation@nationalenergyso.com
Details on the terms on which such data will be made available by NESO can be found in our publicly available “Data sharing policy relating to NIC/NIA projects” at https://www.nationalgrideso.com/document/168191/download.

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

Operational risk: considering that this is new application of technology to GB energy sector, helpful to try this out first through an Innovation project before integrating this with BaU

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

Operational risk: considering that this is new application of technology to GB energy sector, helpful to try this out first through an Innovation project before integrating this with BaU
Operational risk in relation to lack of in-house resources to carry out review/conduct project while also focussing on other important areas of business
Technology risk in relation to lack of in-house expertise in incorporating mathematical tools in analyses, e.g., combinatorial reduction, screening techniques, probabilistic analyses, etc

This project has been approved by a senior member of staff

☑ Yes