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

Sep 2025

Project Reference Number

NIA_SHET_0058

Project Registration

Project Title

GSP Modelling

Project Reference Number

NIA_SHET_0058

Project Licensee(s)

Scottish and Southern Electricity Networks Transmission

Project Start

January 2026

Project Duration

1 year and 9 months

Nominated Project Contact(s)

Brant Wilson – Innovation Portfolio Manager

Project Budget

£380,000.00

Summary

Distribution networks are becoming more complex and their representation in transmission level studies needs to be improved. The project aims to create new Grid Supply Point (GSP) models to enhance the representation of distribution networks in the transmission network models. Outdated and inaccurate distribution models may lead to operability issues at transmission level and impact investment decisions.

Third Party Collaborators

Imperial College London

Nominated Contact Email Address(es)

transmissioninnovation@sse.com

Problem Being Solved

The impacts of distribution networks on power system behaviours are increasing due to the rapid reduction of system strength caused by the increase of Distributed Energy Resources (DER). The GB system has been using static load models to represent distribution networks at the Grid Supply Point (GSP), which may no longer be satisfactory for stability and fault studies. It is known that distribution networks may influence the damping of oscillations and induce delayed voltage recovery due to the transient overcurrent of induction motors. With the current limitation of the inverter-based resources, there is a risk that delayed voltage recovery may propagate wider into the system and evolve into a fault-induced voltage collapse. Distribution networks may also supply fault current back into the GSP and therefore affect the protection schemes at the transmission level.

Method(s)

The use of composite load models for power system modelling offers several advantages such as providing a detailed representation

of both static and dynamic load behaviour. They also provide improved accuracy and greater stability analysis by incorporating different load types and being able to predict system stability under different operating conditions, respectively. One such model is the wellknown WECC (Western Electricity Coordinating Council) composite load model developed during the noughties. There is also ongoing research to identify the need for extra categories or new parameterisation within composite load models to address emerging active loads and distributed resources including EV chargers, distributed solar/storage, and variable speed drives. This project sets out to establish the GB version of composite load models as seen at GSPs and develop methodologies to verify such models in the field.

Data Quality Statement (DQS):
The project will be delivered under the NIA framework in line with OFGEM, ENA and SSEN Transmission 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 access control, backup, and version management. Deliverables will be shared with other network licensees through the closedown reports on the Smarter Networks Portal.

Measurement Quality Statement (MQS):
The methodology used in this project will be subject to 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.

In line with ENA's Energy Networks Innovation Process (ENIP) document, the cumulative risk score is scored as 5 = LOW from the sum of the risk thresholds below:

TRL Steps – 2 TRL Steps – Low (Score 1)
Cost – <£1m – Low (Score 1)
Number of suppliers – 1 – Low (Score 1)
Data – Assumptions known but will be defined within project – Medium (Score 2

Scope

The project scope is as follows –
• Undertake a comprehensive literature review of composite load models including the methodologies used to determine the composition of the models.
• Establish a GB version of a composite load model.
• Build detailed EMT models in PSCAD and run simulations based on SSEN-T use cases.
• Determination of the verification methodology for the GB composite model and associated calibration algorithms.
• Recommendations on test location / event selection and specifications of instrumentation
The potential net benefits are detailed in the cost benefit analysis section

Objective(s)

The objective of the project is to develop a proof-of-concept GB composite load model and enhance our network modelling capability

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 a neutral impact, meaning that it does not have any effect on customers in vulnerable situations. This is because it is a Transmission project.

Success Criteria

The project will be deemed as successful if all items in the scope, objectives and learnings are met which can be used to increase the understanding of network behaviours.

Project Partners and External Funding

The project will be undertaken using NIA funding by Scottish Hydro Electric Transmission supported by the following partner - Imperial

College London: Department of Electrical and Electronic Engineering. Expertise in Power Systems and Power System Stability and System Stability Analytics.

Potential for New Learning

This project will generate new knowledge in how Transmission Operators can utilise composite load modelling at the GSP to predict the influence of the distribution network on transmission.

Scale of Project

This project is designed to get maximum learning for minimal cost. This scale of project expects to provide sufficient learning to further understand network behaviours and inform our modelling capability

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

The project will be undertaken in the Scottish Hydro Electric Transmission licence area in Scotland.

Revenue Allowed for the RIIO Settlement

No allowance has been made for this type of development within the RIIO-T2 settlement. No savings are expected during project implementation; future savings may be possible depending on the outcomes of the project.

Indicative Total NIA Project Expenditure

The total expenditure expected from the project is £380,000. 90% of which £342,000 is allowable NIA expenditure

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 dominance of inertia Based Resources (IBRs) and DERs on the electricity network is exposing it to a growing number of oscillation events. This project will support the energy system transition by significantly reducing the impact of system oscillations on a current and future network built around the Power Electronic Devices prevalent in renewable generation

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

n/a

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 CBA is based upon improved system stability particularly at the GSP. It is assumed that the model could be utilised by networks in following a series of field tests and commissioning post-NIA project. The following figures are best estimates based on the current information available.

The lifetime net financial benefit is estimated to be £28.6 million comprising savings to:

Balancing mechanism:
- 0.01% saving resulting
- Estimated saving (20 years): £0.5 million

Localised blackout:
- One event every 5 years
- Potential loss per event: £20m
- Risk reduction of 50%
- Estimated saving (20 years): £22.5 million

Small system disturbances:
- Five events per year
- Potential loss per event: £0.2m
- Risk reduction of 50%

▪ Estimated saving (20 years): £5.6 million

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

All GB Transmission owners can utilise the project outputs to develop their own localised model and enhance their existing network models.

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

Costs are dependent on each TO and cannot be confirmed as part of this NIA project.

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

This project will generate new knowledge in how SSEN-T can utilise composite load modelling at the GSP to predict the influence of the distribution network on transmission. Other network licensees could follow the same methodology to create enhanced models of their own network area.

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.

To date, no other projects have been undertaken to address the problem statement. The literature search being conducted during the project will further ensure that the project builds on existing knowledge and avoids any unnecessary duplication.

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

There is currently no GB composite load model that interrogates GSPs from a transmission perspective, therefore this work is considered innovative.

Relevant Foreground IPR

Any foreground IP created, and any background IP used will remain property of the creating party. IP arrangements are as required of the NIA Governance.

Data Access Details

For information on how to request data gathered in the course of this project, see Strategic Innovation Fund (SIF) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://www.ssen-transmission.co.uk/about-us/innovation/.

Additionally, data from this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the Strategic Innovation Fund (SIF) can be found or requested in the ways listed below:

• Via the Smarter Networks Portal at: https://smarter.energynetworks.org. To contact select a project and click 'Contact Lead Network'. SSEN Transmission 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: Innovation - SSEN Transmission (ssen-transmission.co.uk)
• Via our managed mailbox: transmissioninnovation@sse.com

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

Due to the low TRL and risks associated with this project; NIA funding is the correct mechanism rather than 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

This project can only be undertaken with the support of NIA due to the overall costs and timescales required. There is also commercial risk that the project may not deliver the expected benefits. NIA is the best mechanism to fund development projects such as this.

This project has been approved by a senior member of staff

☑ Yes