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

Nov 2024

Project Reference Number

NIA_SHET_0049

Project Registration

Project Title

Pole Mounted Switchgear

Project Reference Number

NIA_SHET_0049

Project Licensee(s)

Scottish and Southern Electricity Networks Transmission

Project Start

December 2024

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Brant Wilson – Innovation Portfolio Manager

Project Budget

£61,000.00

Summary

The ability to disconnect a teed circuit is currently limited to a ground-mounted solution, e.g. Switching Station. For what is a limited functionality this becomes expensive and time-consuming, and it can be challenging to gain consent to construct a building in a remote position. The proposed solution is to explore the feasibility of an overhead line (OHL) switching solution that can be applied to teed circuits to support the ambitions of SSEN-T to provide quick, efficient connections to deliver earlier and better manage key resources and supply chain.

Nominated Contact Email Address(es)

transmissioninnovation@sse.com

Problem Being Solved

To facilitate the connection of new assets from an existing circuit rather than direct from a substation requires the use of a teed connection or switching station. In certain circumstances, there is a requirement to switch a teed circuit which is currently limited to a ground-mounted solution, e.g. a Switching Station. For a solution that has limited functionality, that is, it is there to protect against a fault, this becomes an expensive and time-consuming solution. It can be a challenge to gain consent to construct a building in a remote position and is carbon intensive.

The current policy is informed by the arrangements in line with the Standardisation of Substation single-line diagrams (SLDs) Technical Bulletin, TB-NET-SST-008. There are currently no OHL mounted switching design solutions at or above 132kV in the UK.

We need to consider solutions on the SSEN-T network, and wider UK, that offer value for new connections and make the best use of critical resources whilst protecting network operability.

Method(s)

To explore an OHL switching solution that can be applied to teed circuits to support the ambitions of SSEN-T to provide quick, efficient

connections to deliver earlier and better manage key resources and supply chain.

The Operational/Asset consideration to ensure that the safety aspects, functionality, reliability, and life span of the solution are understood, considered, and taken fully into consideration within this feasibility assessment.

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 ENIP document, the cumulative risk score is scored as 5 = **LOW** from the sum of the risk thresholds below:

TRL Steps – 2 TRL Step – Low (Score 1)
Cost – <£500,000 – Low (Score 1)
Number of suppliers – 1 – Low (Score 1)
Data – Assumptions known but will be defined within project – Medium (Score 2)

Scope

The scope of this initial NIA project will be limited to a feasibility assessment of an initial visualisation and definition of functional requirements to define a conceptual design to assess the uncertainties flagged. This will support the business in making an informed decision on whether to proceed with development activities or whether the risks associated with this project outweigh the potential benefits.

The scope of works has been split into two distinct phases:
1. Initial Visualisation and Definition of Functional Requirements
2. Conceptual Design

Financial benefits can be found in section 3.2.2.

Objective(s)

The objective of this project is to assess the feasibility of a 132kV pole mounted switchgear for Transmission networks within the UK.

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 achieved.

Project Partners and External Funding

SSEN Transmission will partner with Energyline Limited to assess the feasibility of delivering Pole Mounted Switchgear using NIA funding.

Potential for New Learning

Firstly, the outcome of the initial feasibility assessment will provide an initial visualisation and definition of functional requirements to

define a conceptual design to assess the uncertainties flagged. This will support the business in making an informed decision on whether to proceed with development activities or whether the risks associated with this project outweigh the potential benefits. Secondly, there is potential for other Transmission Owners (TO's) and Distribution Network Operators (DNO's) to make use of the outputs of the project.

Learnings from the project will be disseminated via internal and external stakeholder events which will be conducted during the project. The learnings will also be shared within the annual project report and at relevant dissemination events such as the Energy Networks Innovation Summit.

Scale of Project

The project time frame is designed to get maximum learning for minimal cost. It will be limited to a feasibility assessment of an initial visualisation and definition of functional requirements to define a conceptual design to assess the uncertainties flagged. This will support the business in making an informed decision on whether to proceed with development activities or whether the risks associated with this project outweigh the potential benefits.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

The project will take place in the Scottish Hydro Electric Transmission license 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 and the future adoption of the learnings.

Indicative Total NIA Project Expenditure

The total NIA Expenditure for the project is £61,000, 90% (£54,900) 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:

As generator connections continue to increase in volume and capacity within the 132kV network, as part of the energy system transition, increasingly more generator connection requests will include 'tee-connections'. The current approach is a full switching station with line circuit breakers, the pole mounted switchgear (PMS) is an alternative solution that is potentially cheaper and can be deployed quicker. We need to consider solutions on the SSEN-T network, and wider UK, that offer value for new connections and make the best use of critical resources whilst protecting network operability.

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)

Not applicable.

Please provide a calculation of the expected benefits the Solution

Successful development and rollout of PMS could lead to not only clear financial savings but also an estimated reduction in programme of roughly 2 years due to no buildings being required and a reduction in civil works in comparison to the current switching station solution. Note the overall connection programme will include the associated developer end and connection substation. There will also be a move from Substation and Protection and Control (PnC) resources to build the switching station to OHL and PnC for the PMS. It is anticipated that there will be a significant reduction in overall manhours.

The following benefits could also be realised as a result of this project:

Cost: A reduction in cost is largely attributed to the removal of the switching station with an overhead line-based solution including switchgear being installed on an overhead line structure, no building requirements, and fewer tower modifications. Currently, ahead of further feasibility work, these estimates are based on success in identifying a viable solution that overcomes the current flagged uncertainties.

Programme: A further benefit to PMS is the reduction in the construction programme. A full switching station could take 3 – 4 years to design, consent, and construct compared with approximately 1 – 2 years for the design, section 37 consent, and construction of a PMS solution.

Outages/Maintenance: At this moment in time, maintenance of the proposed switchgear will be reviewed as part of the feasibility study. However, it is anticipated that this would not be more than that required for ground mounted. There would be a need for the maintenance resource to be moved from ground-mounted substation teams to OHL teams and an element of training and tooling/ equipment considered.

Contractor Resource: The work involved in constructing the Pole Mounted Switch solution will be much less than the switching station.

The erection of the OHL structures is low-risk and current OHL Contractors will be competent to install. The innovation is around the design and installation of the 4-member structure and forms the main element of the innovation development. However, it is anticipated the design will be aligned with current construction practice. The design, installation, operation, and maintenance of the switchgear will be the main risk element of the innovation and form the central part of the feasibility study.

Network Operability: The teed option will be confirmed in a policy update in line with Security and Quality of Supply Standard (SQSS) requirements. This PMS will offer a solution that provides network operability to disconnect the spur in the event of a fault in the same manner as that provided by a switching station. To allow disconnection and earthing of equipment, this will be provided via OHL jumpers and portable earths rather than fixed equipment. This will be reviewed and covered under a Hazard Review as part of the Feasibility.

Carbon: The PMS solution will firstly consider SF6 free options, but to ensure a full review other switchgear options may be considered as part of the feasibility.

As this project stage is limited to a feasibility assessment, at this time there is no requirement for a cost-benefit analysis as the technology readiness level (TRL) is 3. Although this technology has previously been deployed in North America, there is work to be done to ensure it is suitable for our network and to determine whether any adaptations are required. As part of the activities within the feasibility assessment, a full cost-benefit analysis will be completed and presented as part of the decision gate at the end of the project and will support the decision of whether to progress the project to stage 2, to carry out further development and testing or not.

Key Project Risks:

• To date and to our knowledge, this technology hasn't been used in the UK – a key risk is that the technology has not currently been deployed outside of North America, although it has been used there for over forty years. The technology has been tested and proven in similar weather environments for decades however it has never been deployed by a UK Transmission Owner. To help mitigate this risk, the OEM has committed to providing continuous in-person support (if a contractual agreement is settled).

• Construction access – The project actively considers generator connections that are in remote areas. Getting the correct equipment to the site could be a risk for the project. As a mitigation, allowances for access roads will be factored into the cost estimate.

• Operational personnel not familiar with existing ground-mounted switches in an OHL arrangement or in using new OHL design plant and equipment. This will be mitigated by the activities carried out within this feasibility assessment.

• Ability to maintain protection and communications without the need to introduce ground-mounted infrastructure, batteries, and control panels. This will be mitigated by the activities carried out within this feasibility assessment.

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

The learnings are not limited to Scottish Hydro Electric Transmission, all transmission and distribution network operators across GB could benefit from this research work.

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

This research project is at low TRL level, consequently the costs for rolling out the method across GB network are not fully defined. If this project is proven, then there is the potential to use the outputs of the project to a future stage of development in using PMS across the Transmission network in GB. The costs would be dependent on the proven solution and on-site requirements.

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

If this project proves successful, then the next stage will feed in to prototyping the arrangement to validate its operability before moving to fully detailed design and drawings. There is potential for other TO's and our distribution colleagues to make use of the outputs of the project. Both NG-Distribution and SSEN-Distribution have indicated an interest in the outcome of this project.

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

Not applicable.

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 the best of our knowledge, there haven't been any registered projects that have trialled and tested pole-mounted switchgear as an alternative solution to a full switching station required for Teed generator connections.

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

Not applicable.

Additional Governance And Document Upload

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

Although traditional switchgear will be considered in a non-traditional application, other PMS technology that has been used in North America for decades will also be researched. Although new to the GB transmission network it has been proven to operate reliably and efficiently in similar environments within North America. The innovation will be around the implementation and feasibility of this technology within our network.

Relevant Foreground IPR

Any new intellectual property which are completed as part of the NIA project will be made available to other relevant networks licensees. No background IPR is required.

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

NIA has been deemed the best method of supporting the delivery of this project. Development projects funded by NIA give suitable financial support to investigate areas for potential development that could not be funded by BAU as no allowance was made in the RIIOT2 settlement.

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

As noted in the NIA guidance, certain projects are speculative in nature and yield uncertain commercial returns. This is the case with this project. Although PMS has previously been deployed in North America working under both similar voltage and environmental parameters, there is feasibility work to be done to ensure it is suitable for our network and to determine whether any adaptations are required. There is a risk that the study produced does not recommend further work into the next development stage of this project. If the project is successful, it will have resolved uncertainty around availability to the connection customer due to unknown impact on outage requirements for maintenance and fault restoration.

This project has been approved by a senior member of staff

☑ Yes