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

Mar 2023

Project Reference Number

NPG_NIA_043

Project Registration

Project Title

Step Up Transformer

Project Reference Number

NPG_NIA_043

Project Licensee(s)

Northern Powergrid

Project Start

March 2023

Project Duration

0 years and 10 months

Nominated Project Contact(s)

Michael Crowe

Project Budget

£330,000.00

Summary

An alternative operational approch to connecting generators to OHLs under emergency outage coinditions.

Third Party Collaborators

Threepwood Consulting Ltd

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Problem Being Solved

To ensure that consumer supply is restored as soon as possible during major unplanned outages, network sections are often temporarily re-energised from an alternative power source while fault repairs are undertaken.

This is done by the installation of many generators. However, this method is inefficient and difficult to deploy, as each pole-mounted transformer must be connected to a separate generator at lower voltage (LV), and deployment can take multiple days to complete. This means that there are unnecessary delays in providing temporary restoration to customers and increasing the impact of the outage.

Method(s)

Using an impedance earthing inversion trailer unit, the following are proposed:

* an assessment of 'impedance' earthing and a comparison with solid earthing (in the form of a written report)

* the discussion of protection implications (modelling determining reliability, stability, and safety)
* recommendations for other safety measures (insulated or conductive matting, building on some recent experiences with SPEN and others in this regard).
* Trial of an inversion trailer unit and tests will be conducted at a facility where a variety of faults (or line energisations) can be applied to the system. The resulting EPR (earth potential rise), protection operation times, and safety voltages can be measured to ensure practice aligns with theoretical/modelled values and to give confidence in the reliable operation of the system.

Scope

The project includes theoretical modelling, which will be undertaken to explore the viability of the proposed approach.

Equipment development will utuilise UKPN's inversion trailer for prototype development and testing at PNDC.

Comparison of the equipment testing results against theoretical models will be undertaken leading to the production of a high-level specification and report detailing list of recommendations with a view to post-project field implementation.

Objective(s)

Key objectives are as follows:

*Complete desktop research on worldwide operations of 'unearthed' or 'ASC/Petersen coil' earthed systems
*Create model 11kV system to represent typical overhead line networks and complete system studies.
*Determine parameters for testing and test plan.
*Testing of Inverter/Transformer and Protection Configuration
*Analysis of Results & Comparison against Theoretical models
*Develop technical specification for the inversion transformer unit
*Produce report consisting of the earthing methodology, focusing on practicalities of impedance earthing, and a comparison with 'solid' (low impedance) earthing.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A

Success Criteria

Key success criteria are the delivery of the objectives outlined in the section above.

Where these cannot be delivered, an analysis and assessment as to the reasons why they cannot be achieved, that learning being published and shared, would also constitute a successful although not positive outcome.

Project Partners and External Funding

UKPN

SPEN

Potential for New Learning

This project will explore the impedance earthing method and draw comparisons with other methods that can be employed to effectively earth the HV system. It will build on earlier studies completed for UKPN to assess their 'inversion trailer' units and build a high-level specification. This will allow customers to be connected during large events, without the need of connecting multiple LV generators, which is costly and time consuming.

There is currently no tested, understood and safe method for achieving this. This is a key issue for DNOs and this is reflected in the consortium of three DNOs collaborating on this project.

Scale of Project

The project will undertake desktop research into impedance earthing method and draw comparison with other methods which could be used to effectively earth the HV system. Validations of the proposed system will be undertaken via theoretical modelling and tests in a laboratory environment. The project does not include field trials but a high-level specification will be made available to the networks for an inversion transformer unit. In the event of a successful and positive project outcome implementation of the fiundings are likely to be undertaken through ED2 TOTEX funding.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

Field implementation will not be undertaken.

Revenue Allowed for the RIIO Settlement

None.

Indicative Total NIA Project Expenditure

Project value is apporximately £330, 000. This includes disbursements, a small contingency and an allowance against DNO internal costs, which are below 10% of the total.

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:

Key benefits come from an improved customer experience, particulalrly in an increasingly net-zero world with increased reliance on electricity. This means that disruption to people's lives and the economy as a whole is reduced where there are unforeseen problems with the electricty system. This improves peoples confidence in the electricty system as a whole and helpos to encorage the take up of low carbon technologies, such as electric vehicles, as part of the net zero transition.

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

Customers are alkways vulnerable in unplanned outage situations. Any change in approach and/or technology that allows faster, more efficient restoration mitigates the impact of such outages on the customer. Again this is certainly more of an issue in an increasingly electrified world and has the potential to be a more frequent occurence in the face of climate change delivering more violent storms.

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 required for low TRL projects.

Please provide a calculation of the expected benefits the Solution

The technology and approach is insufficiently mature to allow the quantitative assessment of benefits.

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

The method is entirely replicable across the whole of the GB network, including the networks operated by those DNOs not participating directly in project delivery.

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

Roll-out costs are not entirely clear at this early stage. It is anticipated that the method will repalce the current use of multiple generators connected at multipole locations. As such it is likely that additional costs associated with adopting the solution will be low and that this alternative technolgy wopuld replace the old technology as restoration generation assets are replaced or re-let.

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

All distributiuon networks have issues with temporaray restoration and use the current inefficient approach. As such they will all have a direct interest in the project learning. Where this alternative solution is adopted post-project the learning generated is likely to be embedded in new generation assets and be

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

The ED1 innovation strategy recognises the need to improve the experience of customers, particulalrly under unplanned outage conditions. Thsi project contributes to that need.

Further, the project also looks forward to a world where the net-zero transition leads to much greater use of electricty and where fossil fuels for transport and heating are increasingly replaced. Under these circumstances issues around customer vulnerability are likely to be magnified under sustained outage conditions and this project helps to mitigate the impact and duration of such outages - this is a key element of our ED2 innovation strategy.

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.

As far as the participating DNOs, representing more than half of the GB network, are aware this approach has not been investigated or trialled on the GB network. No similar works appeared to have been undertaken worldwide that could be identified during the design phase of this 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

The need for the project outcome has been recognised as a result of the issues around storms and their network impact in 2021/2022. This, alongside the trajectory of increasing electrification and low carbon technologies, means that the need and this possible solution have only recently been identified.

Relevant Foreground IPR

Foreground IP will be in the form of high level specifications and assessment of potential equipment performance and operational approches required. This wiill be made generally available as a specification for purchase against for further development and delivery of field ready equipment.

Data Access Details

No datasets will be generated in this project.

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

The project has coinsiderable technical and economic risks associated with it. This is reflected by the low TRL at commencement.

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

Siginificant technical risk remains in the project. No full-scale testing of this approach using this method has been undertaken. Commercial issues are still to be resolved. Therefore the full cost and cost benefit cannot yet be calculated. This si further compounded by the low TRL involved and thre additional risks that implies.

This project has been approved by a senior member of staff

☑ Yes