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

May 2024

Project Reference Number

NIA2_NGET0063

Project Registration

Project Title

intercompatible CAble REpair (iCARE)

Project Reference Number

NIA2_NGET0063

Project Licensee(s)

National Grid Electricity Transmission

Project Start

April 2024

Project Duration

2 years and 0 months

Nominated Project Contact(s)

Kerri Hayes

Project Budget

£1,500,000.00

Summary

Although substantial studies have been performed on overhead line and cable, there is far fewer studies on the potential risk posed to interfaces within cable joints for high voltage (HV) cable systems. There are significant cost and time associated with any cable repair, with the situation likely to worsen with an increasing number of cable installations and an ageing fleet of cable assets. The availability of a 'Universal Joint' would enable a package to be made available for a speedy cable repair solution that can promptly re-establish service in the event of a cable fault, this emergency return to service solution would greatly improve resilience of a fast-changing electricity infrastructure.

Third Party Collaborators

The University of Manchester

Pfisterer

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

The UK government is targeting 40 GW of offshore wind by 2030, introducing challenges to the resilience of electricity infrastructure. There is an increased risk of failure to existing HV cable assets. We know there is a significant cost and time associated with repair of a 400 kV underground cable system. The situation is likely to worsen with an ageing fleet of cable assets in the network. There is no product in the market for a 275 kV or 400 kV plug-and-play solution for emergency return to service (ERTS).

Method(s)

- An ERTS solution that can promptly re-establish service in the event of a cable fault and would greatly improve resilience of a fast-changing electricity infrastructure. Cable repair times will be reduced from weeks to days if this project is successful.
- The existing ERTS product of Pfisterer covers up to 170 kV. Design limitations on weight and size, handling issues for installation and behaviour of epoxy curing process restrict the ability to scale up to either 275kV or 400kV systems currently – this project will explore feasibility and prototype testing to remove these challenges and limitations.
- A modular lego approach where onsite jointers will prepare both cable ends with male connectors. A factory pre-tested back to back female joint will be shipped to site for assembly and energisation.
- The key goals of this project is to develop this solution for 400kV and to (1) identify technically viable materials and robust methods to connect two female components with inert materials, (2) ensuring optimised design with respect to weight and size of the joint while effectively manage the field stress in critical regions and (3) design and develop representative scaled prototype demonstrators for dielectric type testing to validate the proposed solution.
- A subsequent T3 project is being planned that will see this solution fully tested at both 400kV and 275kV and market ready within T3 if this initial project proves successful.

Scope

- Design analysis for a 400kV prototype joint
- Prototype demonstration stage
- Material development for connector technology
- Project management, recommendation and dissemination

Objective(s)

- Significantly reduce cable repair time leading to lower capital expenditures,
- Reduce management and associated costs of spare parts and perishable items,
- Improve availability of product– standardised universal joint components easily configurable to different cable designs
- The flexibility to disconnect/reconnect and test from the pluggable joint body in the event that the repair installation encountered unexpected technical issues, which is not possible with the conventional cable jointing approach.
- Testing of prototype to ensure that this solution can be scaled to 400kV.

Consumer Vulnerability Impact Assessment

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 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.

Success Criteria

A successful outcome would prove the viability of prototype and that this method of cable repair is suitable up to 400kV.

Project Partners and External Funding

University of Manchester and Pfisterer

Potential for New Learning

The project will deliver reports for each of the workstreams within the overall work package. The reports will describe the work carried out and the results that are achieved. The reports will focus on findings in the following areas:

Scale of Project

The project is planned to last 24 months

- Led by Pfisterer (M1-15) - Design analysis for a 400kV prototype joint
- Led by Univ. of Manchester (M12-24) - Prototype demonstration stage
- Led by Univ. of Manchester (M13-24) - Material development for connector technology
- Led by Univ. of Manchester (M1-24) - Project management, recommendation and dissemination

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The research work will be carried out between Manchester University and Pfisterer factory in Winterbach, Germany.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total NIA expenditure is: £1,350,000

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

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

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

As HV cable assets age there is increased outage risks and impacts to network resilience. It is predicted that 50% of our 275kV and 400kV cables will be subject to constraints in the future. Developing a universal repair approach that will reduce the cable repair time substantially will enable resilience for a net zero network and also reduce constraints. Currently less than 30 400kV jointers in the UK are certified and possess the skills to complete these type of cable repairs. A significant number of this workforce will disappear due to retirement. This universal approach will streamline the training process and further support network resilience.

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

N/A

Please provide a calculation and/or description of the expected benefits of the solution

n/a

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

The project will be applicable to both distribution and transmission assets

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

N/A

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

☐ 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

Results will be shared with all licensees, however, NGET will focus on transmission assets for this project., therefore outputs will be targetted towards other TOs in the UK.

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. Networks must explicitly mention similar projects that they have considered and how these differ.

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

NGET is unaware of similar projects being undertaken and as part of the NIA approval process no other networks have made us aware of projects that might result in 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

Currently this technology is only proven at lower voltages up to 170kV and not up to 275kV or 400kV and therefore is innovative. Design limitations on weight and size, handling issues for installation and behaviour of epoxy curing process restrict the current ability to scale up to either 275kV or 400kV systems.

Relevant Foreground IPR

Foreground IPR details are still to be determined during the contracting phase of this project.

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 a part of it's business and usual activities

As this technology is unproven at 275kV and 400kV it is appropriate to use innovation funding rather than BAU funding to de-risk the solution.

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

NIA funding is appropriate as it enables NGET to access learning about new technologies for cable repair more quickly than if the market were to explore this potential use case. Without the project it is unlikely that any of the innovation suppliers involved would explore it and the improvements would not become available. NIA funding will allow for dissemination and sharing of this solution on project completion. In addition, in RIIO-ET3 we plan to develop this solution to market readiness inline with required standards for UK transmission companies which means quick adoption for UK transmission companies of this solution.

This project has been approved by a senior member of staff

☑ Yes