

NIA Project Registration and PEA Document

Date of Submission

Nov 2016

Project Reference Number

NIA_NGET0202

Project Registration

Project Title

Development of a Universal Bushing

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NIA_NGET0202

Project Licensee(s)

National Grid Electricity Transmission

Project Start

September 2017

Project Duration

2 years and 1 month

Nominated Project Contact(s)

National Grid TO Innovation Team

Project Budget

£173,000.00

Summary

The scope of work is outlined below. It can be split into four distinct areas; design, manufacturer, prepare & make safe and trial. This scope will enable the desired learning.

1. Design: Produce a conceptual design of the universal bushing for 33kV
2. Manufacture: Manufacturer a prototype bushing at 33kV
3. Prepare and Make Safe: Produce detailed RAMS for installing the bushing
4. Trial: Physically install the bushing on a transformer to trial in a working environment
5. Subject to success at 33kV a solution will be developed for higher voltages

Nominated Contact Email Address(es)

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Problem Being Solved

License Network Operators (LNOs) use hundreds of bushings across the GB electricity network.

There is no standard design for bushings across the different voltage levels, the variety of design and sourcing constraints of bushing introduces several issues. For example, the use of multiple types of bushings can pose a problem when carrying out maintenance, because it is not always apparent which design is in use until an engineer attends site to view the top of the transformer and take measurements. When sourcing replacements, the lead time for ordering bushings is 3 to 4 months. In the event bushings are not immediately available by the manufacturer there is a risk that a transformer will be out of service. Network Operators must then mitigate risk that a delay in receipt of a replacement bushing does not impact on security of supply or lengthen planned outages.

LNO's hold stocks of bushings of multiple designs to ensure replacement of bushings like for like is possible across their networks. This practice, while necessary, leads to increased costs for storage and for the bushings themselves. Even with the practice of stocking a variety of bushings, there still remains a risk that there is not a bushing that is fit for purpose upon failure.

Method(s)

The project aims to design and complete a trial installation of a universal bushing suitable for installation on British Electricity Boards Specification for Transformers and Reactors (BEBS T2) specified transformers initially at 33kV. The development of a universal bushing suitable for higher voltages will be considered for follow on phases is successful at 33kV. There is currently no universal bushing available that can be installed on multiple transformers at 33kV or above. The design will therefore be unique, because the development of a universal bushing would be first of its kind in GB, and there has never been a trail of fitting a 33kV universal bushing onto a transformer that it is not specifically designed for.

Scope

The scope of work is outlined below. It can be split into four distinct areas; design, manufacturer, prepare & make safe and trial. This scope will enable the desired learning.

1. Design: Produce a conceptual design of the universal bushing for 33kV
2. Manufacture: Manufacturer a prototype bushing at 33kV
3. Prepare and Make Safe: Produce detailed RAMS for installing the bushing
4. Trial: Physically install the bushing on a transformer to trial in a working environment
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Objective(s)

The aim of this project is to design and trial a prototype universal bushing that is suitable for installation on British Electricity Boards Specification for Transformers and Reactors (BEBS T2) specified transformers.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The successful delivery of this project includes the development of a novel universal bushing. The new design prototype will be trialed on a live network and the findings will be shared with all LNOs in the final project report.

Project Partners and External Funding

External Funding – (nil)

Potential for New Learning

The learning from this project can be directly applied to other Network Licensees. All LNO's in GB own infrastructure that will include transformers with the requirement to replace bushings. The new bushing design will be shared with all Network Licensees.

Scale of Project

The project scope includes a design to show that the bushing / bushing kit will work across the full range of BEBS T2 transformers. This standard was adopted by the entire UK Transmission and distribution industry up to the 1990s so are therefore applicable to all LNOs. The trial element is anticipated to prove this concept in a real life, working environment.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The design element of the project will be desk based research. The trial element will be conducted on a suitable substation located on the UK transmission network. The research will be applicable for all 33 kV (not limited by geographical area).

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£173,000

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:

n/a

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)

A universal bushing would provide significant cost savings by

1. Reducing the requirements to hold multiple bushings as strategic spares with in date test certificates
2. Reducing the duration the duration of outages on equipment because of bushing failures. The cost of delays to other works due to bushing failures can cost upwards of £350,000 for an individual failure due to the system access constraints it causes in the local area.

Please provide a calculation of the expected benefits the Solution

The total annual saving from this project could be up to £350,000. This estimate is based on an bushing failure in 2016 which lead to significant delays to a construction project resulting from outage cancellations following a bushing failure. The cost impact of each bushing failure will vary dependant on its location and the failures impact on wider works.

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

The outputs of this project are replicable to the same or greater extent across all LNO's.

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

There would be a small cost for dissemination. Costs for implementation would be internal costs only. Upon successful development of the universal bushing, the relevant policies and procedures will be updated, along with operator training.

Assuming the technology is proven, a number of the new bushing kits will be purchased by National Grid and the technology will be shared with all other LNO's.

It is anticipated that the use of the Universal bushing would replace the use of the traditional bushings. The unit cost is estimated to be like for like, solution versus traditional bushings. Therefore the requirement for having traditional bushings of multiple varieties will be eliminated. Thus the requirement for purchasing bushings will be significantly reduced.

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

The learning from this project can be directly applied to other Network Licensees because all LNO's in GB own infrastructures which will include transformers with the requirement to replace bushings.

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

This project fits within the Efficient Build and Service Delivery value area of the Electricity Transmission Owner Innovation Strategy:

- ☒ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

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.

The design and information about the bushing will be made available to all LNO's to ensure that it is not necessary for this work to be replicated.

Upon review of the ENA Smarter Networks portal no other research is being undertaking on the development of universal bushings.

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 project is innovative because it requires a new design of bushing to cover multiple designs. Although this was considered as desirable in the past it was not considered a practicable solution until discussions were held with the identified supplier was willing to take on the project.

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

There is a financial benefit to this work because it reduces capital investment in spares and reduces outage time when a bushing is required and the bushing can be matched to the design more quickly. However the risk involved in investing in this is that it may not deliver. It might be expected that an OEM could develop a solution without NG investment but the scope would be large and may target only the most common designs in the OEM supplier range. By investing NIA we have been able to take the risk of development and target the solution to our own assets.

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

The technology is the first of its kind, as far as we aware, at high voltages. There are technical challenges to be overcome and there is clear risk that it will not succeed when starting at such a low TRL (3) with the expectation that a working prototype will be the end result.

This project has been approved by a senior member of staff

☒ Yes