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 2013

Project Reference Number

NIA_NGET0117

Project Registration

Project Title

Bulk Oil Circuit Breaker Bushing In Situ Refurbishment

Project Reference Number

NIA_NGET0117

Project Licensee(s)

National Grid Electricity Transmission

Project Start

December 2013

Project Duration

3 years and 0 months

Nominated Project Contact(s)

Jo Taylor & Keith Williams

Project Budget

£238,799.00

Summary

This project will develop a new methodology to refurbish the bushing oil in situ, and will demonstrate on site. None of this work is possible at the moment, and will enable the wider associated cost of bushing proceedures to be greatly reduced.

Nominated Contact Email Address(es)

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Problem Being Solved

In a power system, circuit breakers are used to clear faults when they occur. There are various different types of circuit breakers used by utilites to do this, depending on the requirements of the location. Common types of circuit breakers include Gas Insulated Switchgear (GIS), Air insulated Switchgear (AIS) and Oil Insulated switchgear, which this project focuses on. The Bulk Oil Circuit Breaker (BOCB) itself is statistically the most reliable circuit breaker on the National Grid system, bushing issues aside. Each of the BOCB's on the National Grid system has 6 bushings used within that system, where the bushing is used to electrically insulate the working parts of the circuit breaker and the transmission system from the earthed housing in which it is contained.

Each bushing refurbishment cost is almost half the price of a modern AIS complete circuit breaker (uninstalled). With aging assets, 3 historic disruptive failures since 2000 and up to 10 replacements per year (an average of 6 bushing refurbishment per year since 2009) at £45k per bushing (excluding site works), consideration has to be given to best value and for retaining BOCBs in the system. With over 100 BOCB over 50 years of age by the end of RIIO-T1 (2021), the current business plan has these assets planned for replacement. If the bushings can be refurbished in situ then the cost of BOCB refurbishment may be significantly reduced.

National Grid do not have the capability to deliver this service internally, hence the need to develop this capability with a supplier.

Method(s)

Development

The method proposed is to analyse the moisture content within the bushing using standard techniques. Then, National Grid will remove the bushings, and send them to NAREC who will perform laboratory testing and strip down the bushing to assess the physical condition. This will provide more evidence on the relationship between moisture content and condition to trial the redesign proposals to minimise any further moisture ingress.

When this piece of work has been completed, we will attempt an in-situ refurbishment of the bushings on the BOCB. This will enable us to keep the electrical insulation up to the standard required in IEC 60422 and will address the life limiting component that limits any life extension opportunities.

Scope

This project will develop a new methodology to refurbish the bushing oil in situ, and will demonstrate on site. None of this work is possible at the moment, and will enable the wider associated cost of bushing proceedures to be greatly reduced.

Objective(s)

To establish an alternative and cost effective refurbishment that creates life extension and remove the requirement to undertake any asset replacement. This will enable BOCBs to continue in service beyone their original design life.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

A trialled proceedure for in-situ bushing replacement.

A methodology for in-situ bushing refurbishment.

A business implementation proceedure.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Project is being trialled on one 275KV BOCB as a proof of concept work. This circuit breaker consists of 6 bushings, and is appropriately sized to deliver a technique that is replicable across the transmission network. It will be run in a laboratory.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

This project will deliver a solution that will be trialled in a laboratory environment, but is replicable across all sites where there are BOCBs present. The breaker being trialled will be taken from the Decommissioning work being undertaken at Thorpe Marsh (Doncaster).

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

£238,799

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)

Deferring the BOCB and associated bay / infrastructure replacement will estimate around a 95% saving /deferred spend.

Please provide a calculation of the expected benefits the Solution

Base = 6 x 45,000 = 270,000 (excluding site works) to replace a BOCB of bushings with refurbished travelers (uninstalled).

Method = 104,500 to develop the design, prove the methodology and supply 1 BOCB of strategic stock (uninstalled).

B-M = 165,500

National Grid have used this project as a model for the future method cost. We fully expect this cost to reduce after the work has been completed.

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

This project will inform the asset management/replacement strategy for this family and could be applied to breakers of similar family types on other licenses networks. We have 288 of these type of breakers on the system.

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

Costs are yet to be fully understood but it's estimated as approximately £100k to develop the first 275kV solution (275kV, 132kV and 66kV opportunity) and roll out the method across GB. It's estimated to be another £100k to cover the remaining 132kV and 66kV inclusively.

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

n/a

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

Optimising Asset Management

Safety

Circular Economy

☑ 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.

n/a

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

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

☑ Yes