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

Jan 2023

Project Reference Number

NIA2_NGET0032

Project Registration

Project Title

Swarfless Cut Isolation System for SF6 Outages and Repairs (SCISSORs)

Project Reference Number

NIA2_NGET0032

Project Licensee(s)

National Grid Electricity Transmission

Project Start

February 2023

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Gordon Wilson (Box.NG.ETInnovation@nationalgrid.com)

Project Budget

£280,000.00

Summary

This is a two-stage project to develop and test a system to cut into stainless steel pipework and introduce an isolation valve into small-bore pipework associated with Gas Insulated Systems (GIS) which require repairs. The current practice requires significant gas handling activity with a risk that it can cause new SF6 leaks.

Stage 1 will develop a suitable blade for cutting without generating swarf, which would risk the integrity of the insulating medium. Stage 2 will safely integrate the isolation system into the pipework. Different blades will be trialled in Stage 1 and will define which method will be used to introduce the isolation system.

Nominated Contact Email Address(es)

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Problem Being Solved

SF6 (sulphur hexafluoride) has the highest known global warming potential (GWP), 25,200 times that of CO2, with a long atmospheric lifetime. SF6 filled HV equipment has small-bore pipework associated to incorporate control and ancillary equipment such as pressure gauges and SF6 topping-up points. This is consciously designed without isolation valves between the monitoring equipment and the HV equipment to ensure it isn't inadvertently isolated from the equipment in which it is designed to monitor.

However, without the option to isolate gas in the main gas chamber, repairs to the small-bore pipework, such as the replacement of corroded valves which are needed to enable gas quality checks, require removal of all of the SF6 from the equipment under outage. Removing the SF6 will generally take between 1 day and 1 week depending on the volume of SF6 within the equipment which makes these repairs expensive and they have to be planned in advance to secure outages and appropriate resources. Ensuring all SF6 is removed from the equipment also requires a vacuum to be created inside the equipment which also imposes a significant risk of creating other leaks on the equipment by stressing the flanges and seals.

Method(s)

The project will be delivered in two stages:

Stage 1: Three different blade designs will be trialled to deliver a swarfless cut into stainless steel typically used for GIS small-bore pipework. The three blade types will compared and contrasted to show which of them is the most suitable for delivering a clean cut.

Stage 2: Based on the best performing blade from stage 1 (assuming that at least one delivers a successful swarfless cut), trials will be carried out to follow the cut with the introduction of an isolation (scissor) valve. On successful completion of a development of a complete system, trials will be carried out as part of this stage.

Data Quality Statement (DQS):

- The project will be delivered under the NIA framework in line with OFGEM, ENA and NGGT / NGET 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. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Measurement Quality Statement (MQS):

- The methodology used in this project will be subject to our 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.

Risk Assessment

TRL Steps = 2

Cost = 1

Suppliers = 1

Data Assumption = 1

Assessed risk score 5 - Low

Scope

Equipment that contains SF6 can develop leaks over time resulting in loss of SF6 to the atmosphere. SF6 emissions have an impact on global warming over a period of thousands of years because it is very stable as well as having the highest known GWP. The scope of this project is to develop a system that enables repairs on SF6-filled equipment, in some cases to repair SF6 leaks and reduce emissions, at reduced cost and reducing the risk of inadvertently creating new SF6 leaks, which may arise from applying reduced pressure on ageing seals.

The outputs of the project deliver benefit through reduced cost for defect repair activity, reduced impact on global warming from new SF6 emissions and reduced volumes of SF6 required for top ups and gas call outs for top-ups.

Objective(s)

The objective of the project is to deliver a cutting system for small-bore pipework on GIS that does not compromise the integrity of the insulation system while enabling the incorporation of a new isolation valve.

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 an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to reduce the costs for households over the long term as a result of reduced transmission operating costs for managing SF6 filled equipment and reducing emissions from new SF6 leaks. Other considerations including the projects impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Success Criteria

The project will be considered successful if a system is developed that enables an isolation valve to be introduced into small bore pipework of GIS without generating any swarf that could compromise the insulation system.

Project Partners and External Funding

Not applicable

Potential for New Learning

The cutting systems proposed are based on systems for other metal types used in other industries where swarf is of less concern. The learning will be gained from the experience of adapting the existing system for inserting isolation systems in a different application using a new cutting blade.

Learning will be disseminated through defined project progress and completion reports. In addition, opportunities to demonstrate the technology will be identified such as the Energy Innovation Summit and other industry conferences.

Scale of Project

In stage 1, three prospective blades have been identified which could produce a swarfless cut based on experience and knowledge of the supplier. It would be possible to trial blades one at time, starting from the least expensive, working up to a more advanced blade. This would result in the project taking longer and testing all three provides an opportunity to identify which system works best and whether there are benefits in cutting time or ease of use rather than simply finding one that will do the job.

Stage 2 of the project will learn from the first stage so that only one complete cutting system will be developed and demonstrated. Demonstration of the developed system will increase transition of the project into business as usual activity.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

Development work will be carried out at the innovation providers' facilities. Demonstration on a realistic equipment will take place at NGET facilities, likely a Refurbishment Centre and/or Deeside.

Revenue Allowed for the RIIO Settlement

Not Applicable

Indicative Total NIA Project Expenditure

£252,000

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:

This project supports the energy transition to a net zero network by reducing direct, Scope 1 emissions of SF6. Reducing SF6 losses has a direct impact on transitioning to a low carbon network.

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

The benefit of this project assumes successful delivery of a cutting system that incorporates an isolation valve into SF6-filled pipework. A review has been undertaken of the equipment where repairs are needed or likely to be needed over the next 10-15 years to enable ongoing gas testing or repairs to the equipment. Based on the expected cost of carrying out this work through removal of gas from the equipment and the potential risk of introducing new SF6 leaks compared with rolling out a successful project with the same level of work the project will deliver a net benefit of around £14m over 15 years.

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

NGET has determined the project to be suitable for equipment supplied by one manufacturer with significant numbers of assets on NGET sites. It would be directly applicable to others with the same equipment. The applicability to other assets on other networks has not been explored but may be of value.

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

For the purposes of calculating the net benefit above, a rollout cost of £1.8m was assumed over 15 years.

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 research is being conducted to understand potential for incorporating isolation valves into specific transmission assets filled with SF6. It is therefore learning that may be directly applied to other networks with similar assets. The disseminated results will be shared with all licensees so that the reasons for the conclusions may be understood. It will be the responsibility of others to determine to what extent it applies to other equipment types.

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.

This project does not duplicate any work that NGET is aware of, nothing was raised during the evaluation of the project scope template.

Any residual risk of duplication will be addressed through dissemination of progress with other licensees and being open to co-operate with licensees working in this space.

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

To the best of our knowledge no system exists so far to achieve the objective of this project. The system is building on knowledge gained in other industries with different requirements where the solutions were not directly applicable.

Relevant Foreground IPR

The foreground IPR will be the knowledge associated with the development and demonstrations of a swarfless cutting system for steel small-bore pipework associated with SF6-filled equipment. This will include the selection of an appropriate cutting blade and results of testing and demonstrations.

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 apart of it's business and usual activities

Although systems have been developed for other industries the particular requirement for not generating swarf in the cutting process is critical to the success of the project. Depending on the results there may be a need to try alternative blades and cutting systems and there is a risk that the project may not succeed technically, which would be unattractive to business-as-usual funding sources.

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

There are technical risks associated with any innovation project as the proposed solution may not work. If the initial work proves unsuccessful the project will need to be revised or further work will have to stop, this would be the case in either Stage 1 or Stage 2 of the project.

The project is anticipated to generate sufficient benefit to justify the expenditure over 15 years so the success of the project will only become apparent over a longer period of time.

This project has been approved by a senior member of staff

☑ Yes