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 2014

Project Reference Number

NIA_NGET0074

Project Registration

Project Title

SF6 Capture & Leakage Repair

Project Reference Number

NIA_NGET0074

Project Licensee(s)

National Grid Electricity Transmission

Project Start

May 2012

Project Duration

2 years and 11 months

Nominated Project Contact(s)

Simon Atkin & Damien Culley

Project Budget

£130,000.00

Summary

The scope of this work covers the effective gas capture, re-use and sealing techniques of SF6 gas in a HV GIS circuit breaker. National Grid loses in the region of 12,000kg of SF6 every year, due to the sheer amount of SF6 switchgear there is installed on the Transmission system. This equates to nearly 30% of National Grids UK carbon emmissions. There are a few installations that classfiy as the worst leakers for National Grid. These are often where it is incredibly difficult to obtain an outage, or where leak sealing techniques have proven ineffective.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

National Grid use an electrically insulating gas called SF6 (Sulphur Hexafluoride) as a key element of certain types of High Voltage Switchgear known as GIS (Gas Insulated Switchgear). SF6 has the task of stopping the arc created by two pistons moving apart in order to clear a fault or open a circuit. It does this by being forced, at pressure, between the interrupters and stopping electricity jumping from one interrupter to the other. It is able to do this as it has high electrical insulating properties.

The problem that National Grid faces, is that SF6 gas is a potent greenhouse gas, with a global warming potential of 23,900 times that of CO2. The current, and international standards for new switchgear allow for a small percentage of leakage, however much of the older equipment does not meet these standards. National Grid is therefore developing a methodology for the effective capture of SF6 gas, and then subsequent leak repair. There is currently no methodology that does this, available to National Grid.

Method(s)

Research & Development

National Grid are undertaking a programme of work that has tasks in the following areas:

- SF6 Gas Capture
- GIS Leakage Repair
- SF6 Cleansing & Re-use
- SF6 Data Collection & Interpretation

The Gas Capture task will identify a methodology that is rapidly deployed and retro-fitted to an existing GIS Circuit Breaker around a leaking area. This will then capture and contain any SF6 that is leaked and prevent the gas being vented to atmosphere.

The GIS Leakage Repair task will try to identify a methodology that enables the Circuit Breaker to be effectively repaired while there is still pressurised SF6 contained within the Circuit Breaker. If unsuccessful, National Grid will find a methodology of sealing the SF6 leak when the tank has been de-pressurised and the Gas is stored in a safe container.

The SF6 Cleansing & Re-use task will identify a methodology that enables SF6 to be seperated from the particulates generated in circuit opening, and also a methodology for seperating the SF6 gas from the gaseous by-products, such as S2F10 (Disulphur Decafluoride), and then identify how National Grid can re-use the SF6 in the Circuit Breaker as opposed to sending it to be destroyed.

The SF6 Data Collection and Interpretation task involves a cross over with the above task - Cleansing & Re-use. In this workstream, National Grid will use the current condition monitoring platform available in National Grid to visualise the gas contaminate data, and assist in building a picture of the helath of the asset, based on the composition of the gas being analysed and recycled.

Scope

The scope of this work covers the effective gas capture, re-use and sealing techniques of SF6 gas in a HV GIS circuit breaker. National Grid loses in the region of 12,000kg of SF6 every year, due to the sheer amount of SF6 switchgear there is installed on the Transmission system. This equates to nearly 30% of National Grids UK carbon emmissions. There are a few installations that classfiy as the worst leakers for National Grid. These are often where it is incredibly difficult to obtain an outage, or where leak sealing techniques have proven ineffective.

Objective(s)

The projects objectives are in line with the tasks:

- Produce a retrofit solution for SF6 Capture on HV switchgear
- Identify a methodology for sealing SF6 leaks on HV switchgear
- Identify a methodology for Gas cleansing
- Identify a methodology and develop a quality standard for SF6 re-use
- Identify a methodology for interpretation of contaminates of SF6 gas
- Develop a solution that seals SF6 leaks on HV switchgear
- Develop a solution for Gas Cleansing
- Develop a solution for SF6 gas re-use
- Develop a solution for interpretation of contaminates in SF6 gas

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be successful if National Grid:

- Produce a retrofit solution for SF6 Capture on HV switchgear
- Identify a methodology for sealing SF6 leaks on HV switchgear
- Identify a methodology for Gas cleansing
- Identify a methodology and develop a quality standard for SF6 re-use
- Identify a methodology for interpretation of contaminates of SF6 gas
- Develop a solution that seals SF6 leaks on HV switchgear
- Develop a solution for Gas Cleansing
- Develop a solution for SF6 gas re-use
- Develop a solution for interpretation of contaminates in SF6 gas

- Develop business implementation documents for all developed solutions

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is focussed on a substation scale, however it will provide tools and techniques that are applicable to the whole of the UK transmission system.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

This project is focussed at Littlebrook 400kV GIS substation in Dartford, however, it will develop tools and techniques that will be applicable to the whole of the UK transmission system.

Revenue Allowed for the RIIO Settlement

Specifically for this work - zero. There is an SF6 incentive that is built into the RIIO settlement.

Indicative Total NIA Project Expenditure

£130,000

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)

SF6 is a gas that is not beneficial for the environment, in terms of climate change. National Grid are looking to minimise the impact its assets have on the environment, and this work will be key to minimising the impact of Gas Insulated Switchgear.

Please provide a calculation of the expected benefits the Solution

Base - Littlebrook X805 leaked 300kg/yr = c.£500,000

Method - £190,000 per leak repair.

B-M= £310,000

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

This project can be applied to every location where SF6 is used on the Transmission system.

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

This is unknown. The techniques proposed have no guarantee that they will fix the problem, and will be eligible for roll out. However, National Grid estimate that the cost per fix will be around £190,000.

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)

This project addresses the theme of environmental impact, as detailed in the National Grid Electricity Transmission 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.

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