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

Dec 2013

Project Reference Number

NIA_NGET0051

Project Registration

Project Title

33kV Superconducting Fault Current Limiter

Project Reference Number

NIA_NGET0051

Project Licensee(s)

National Grid Electricity Transmission

Project Start

October 2011

Project Duration

4 years and 1 month

Nominated Project Contact(s)

Barry Reeves

Project Budget

£3,260,000.00

Summary

The Government's targets for reducing carbon emissions means the UK needs to reduce its dependence on fossil fuels and adopt cleaner energy sources. Generators using renewable energy are sited near their energy sources (on hills for wind, by the sea for tidal and wave power, near landfill sites or digesters for gas, etc). Combined heat and power schemes, which recover waste heat from the process of generating electricity, need to be installed in locations where there is a need for heat. These sites are rarely connected to the National Grid system and in any case connecting to this voltage level would be unfeasible for generators of moderate capacity (typically under 50MW) which are likely to be connected in Sheffield.

The project is largely funded by the Low Carbon Network Fund, which has been made available by Ofgem.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

Generator connections are being made to local distribution networks but these have limited capacities to handle short circuit fault currents

To facilitate the connection of generation from renewable sources at the distribution voltage level, the network needs to be capable of withstanding these consequential increases in fault level. Traditional approaches to managing increasing fault levels lead to time consuming, costly infrastructure upgrades which may cause the proposed generation development not to proceed.

Key learning to be delivered by the project is the understanding of the circumstances under which the superconducting fault current limiter (SFCL) can be used to mitigate fault level issues which are a barrier to distributed generation (DG) connection and how the SFCL can then be designed into and operated within distribution networks.

Method(s)

The methods that have been proposed for this project is for National Grid to assist Northern Power Grid to enable the installation of the 33kv super conducting fault current limiter (LCNF project).

Scope

This project trials a specific piece of new equipment that has a direct impact on the operation and management of the distribution system.

The first phase is to identify suitable locations for the installation and undertake a feasibility and systems readiness study to analyse the network, outlining the optimum application and specification, and confirm the business and carbon cases.

The second phase is to design, build, install and commission a three-phase 33kV superconducting fault current limiter on the CE distribution network. It is proposed, subject to site surveys and agreement with partner organisations, that the unit is installed at a 275/33kV substation in South Yorkshire to limit the fault current to within the rating of the 33kV switchgear. This is currently managed through an operational management switching procedure which in some circumstances may increase the risk of loss of supplies to customers.

The project is largely funded by the Low Carbon Network Fund, which has been made available by Ofgem.

Objective(s)

Specifically the following learning outcomes would be expected for this project;

• Identification of network and physical circumstances where use of the SFCL could be used to mitigate fault level issues and address potential future DG connection issues.

• Identification of design, construction, commissioning, protection, control and operational issues associated with use of such equipment.

• Assessment of actual carbon benefits/confirmation of initial carbon case.

• Assessment of impact of equipment on policies, codes of practice, section level procedures, financial authorisation processes (including the financial justification) and identification of required revisions.

• Dissemination will be through the production of a "how to" manual that details the new knowledge outlined above.

Demonstration Objectives:

This project trials a specific piece of new equipment that has a direct impact on the operation and management of the distribution system and potentially the transmission system.

Phase 1: to identify suitable locations for the SFCL installation and undertake a feasibility and systems readiness study to analyse the network, outline the optimum application and specification, and confirm the business and carbon cases. This has been completed.

Phase 2: is to design, build, install and commission a three-phase 33kV SFCL on the CE distribution network. It is proposed, subject to site surveys and agreement with National Grid and other partner organisations, that the unit is installed at a 275/33kV substation in South Yorkshire to limit the fault current to within the rating of the 33kV switchgear. This is currently managed through an operational management switching procedure which in some circumstances may increase the risk of loss of supplies to customers.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be judged successful on completion of the following deliverables:-
- Robust carbon impact cases developed for different network scenarios
- Indicative business case developed
- Successful power system modelling of the unit
- Successful type testing of SFCL components
- Successful operation of SFCL, cryocooler and auxiliary components
- Operational experience relating to the SFCL, cryocooler and auxiliary components documented

- Network events and SFCL response captured electronically
- Running costs documented
- Maintenance requirements documented
- Identification of required changes to policy and operational documentation
- Successful dissemination of information and learning to DNO peer group.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project is of a limited scale and involves the installation of a single 33kV SFCL unit at an appropriate substation. Smaller units have been installed at 11kV but empirical deployment is now required at higher voltage to gain the specific learning required for successful installation and operation.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

Several sites are under investigation in South Yorkshire. The final location will be selected at the end of the first project phase once issues of system readiness have been assessed and appropriate risk assessments are complete.

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

IFI=£110k

NIA=£270k

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 fault current could cause a transformer to fail. The cost of the replacement is £5m.

This project is primarily focused on distribution and would require scaling to transmission with significant development costs.

Please provide a calculation of the expected benefits the Solution

Base = 5m
Method = 380k (plus development to Transmission, currently unknown)

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

Sites where there are distribution transformers at risk of returning fault currents (most sites in GB) once developed will apply to transmission.

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

Unknown, it is unknown whether this will work yet and if so, in what type of circumstances it can be applied. If proven, commercial aspects will be considered.

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

- [ ] 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

Fault Current Limiters are needed by all levels of the energy industry to ensure that returning DC currents caused by faults on the network do not cause a failure of an asset. This knowledge can be applied as the other network operators see appropriate.

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

n/a

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

Is the default IPR position being applied?

- [x] 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