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

Mar 2014

Project Reference Number

NIA_SHET_0008

Project Registration

Project Title

HVDC Nanocomposite Insulation

Project Reference Number

NIA_SHET_0008

Project Licensee(s)

Scottish and Southern Electricity Networks Transmission

Project Start

June 2012

Project Duration

3 years and 7 months

Nominated Project Contact(s)

SSEN Future Networks Team

Project Budget

£889,000.00

Summary

A new method will be created that will allow reproducible results for the distribution of nano scale fillers into polymeric insulation material. Scalability of the techniques will be demonstrated through the creation and testing of prototype full size bushings. To do this a new manufacturing method will be developed.

Third Party Collaborators

Alstom

TSB

Mekufa

Gnosys

Nominated Contact Email Address(es)

transmissioninnovation@sse.com

Problem Being Solved

Transmission network operators are currently planning development of the next generation of high efficiency and reliable HVDC transmission systems. These developments will include point to point and multi-terminal HVDC links. Establishment of higher performance and more reliable insulation material solutions, which are still affordable, is one of the major challenges that the electricity transmission industry faces.

Successful insulation technology demonstration and its subsequent implementation is seen as vital to supporting timely expansion of renewable generation and its integration in the UK power grid, i.e. allowing 2020 UK CO2 emission targets to be met, whilst reducing

energy costs and increasing security of supply; and has the potential to significantly reduce the size of HVDC converter stations, with a potentially significant cost saving (particularly for offshore converters).

In laboratory R&D, nanocomposite electrical insulation materials have been shown to significantly out-perform conventional micro composite insulating materials but results have been inconsistent and scaling to manufacturing processes has been problematic.

Method(s)

The planned work includes mastering the different facets of nanophase processing of cost effective materials for repeatable and scale independent manufacturing of preproduction materials for optioneering and optimisation as well as for demonstrator HVDC components that test scalability.

The development will use state of the art processing and measurement methods to establish design and processing rules and to support the design of components with highly optimised electrical and physical properties that can withstand the multi-stress environments found in HVDC systems.

The design and processing will then be trialled by manufacturing a demonstration component and undertaking suitable electrical and mechanical testing of the component.

Scope

A new method will be created that will allow reproducible results for the distribution of nano scale fillers into polymeric insulation material. Scalability of the techniques will be demonstrated through the creation and testing of prototype full size bushings. To do this a new manufacturing method will be developed.

Objective(s)

Assess whether nanocomposites can be dispersed in polymeric insulation material in a reproducible fashion.

Assess whether a new improved insulation material can be created and used to construct full size products such as bushings.

Evaluate the potential of the new material to allow the reduction in size of insulators in HVDC systems.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Demonstration of a manufactured component which passes electrical and mechanical testing.

Demonstration component demonstrates enhanced properties which make its use attractive.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The scale of the Project is considered appropriate to the scale of the potential benefits. An HVDC converter station costs in the order of £100 million. A highly conservative estimate would see costs reduce by 1% following successful implementation of nanocomposite insulation material (due to the reduction in the required size of the converter station).

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL6 Large Scale

Geographical Area

Demonstration component to be manufactured by Mekufa in Gloucester and tested by Alstom in Stafford. Application if successful will

be to GB transmission networks.

Revenue Allowed for the RIIO Settlement

At this stage no saving on expenditure can be assumed.

Indicative Total NIA Project Expenditure

The project plans to be funded through SHE Transmission's, SPT's and NGET's NIA allowance.

SHE Transmission	£174,500 (£44,500 under IFI and £130,000 under NIA)
NGET	£140,000 (£35,000 under IFI and £105,000 under NIA)
SPT	£170,000 (£40,000 under IFI and £130,000 under NIA)

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)

An HVDC converter station costs around £100 million. This project is targeted at reducing the size and improving the reliability of the insulation associated with such converter stations. This should result in a reduction in cost which has been conservatively assumed as 1%. SHE Transmission expects to require approximately eight such converter stations in the next ten years. Many more are likely to be constructed by other parties within the SHE Transmission area alone.

Please provide a calculation of the expected benefits the Solution

Not required for Research Projects

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

The methods being developed could be used on any insulation system. At present the focus is on HVDC products. An improved insulation material could equally be used on AC systems, which would make the technology suitable for use across the entire network. However, it is likely that the costs of nanocomposite insulation will be higher than existing cast resin based insulation systems. It is not therefore expected to make serious inroads into the AC distribution system. However, if successful, it could find a niche market in improving certain products and may allow low-cost cast resin products to be used at higher voltages.

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

Roll out of this method would be through purchase as part of manufacturers' HV system offerings, if an economic case can be made. Hence there would be no additional specific costs associated with roll out for network licensees, since system procurement is a business as usual activity.

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 work will be carried out by a consortium of developers and manufacturers. Knowledge and skill will be passed through to SHE Transmission, SPT and NGET via the issuing of reports and attending meetings with the consortium but the main benefit will be the ability to purchase advanced insulating products, since design and development of insulation components is not within the scope of transmission network licensees' business.

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

☑ 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