Scottish and Southern Energy
Power Distribution

Date of Submission

March 2014

NIA Project Registration and PEA Document

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.

Project Registration

Project Title		Project Reference
HVDC Nanocomposite Insulation		NIA_SHET_0008
Project Licensee(s)	**Project Start Date**	**Project Duration**
National Grid Electricity Transmission, Scottish Hydro Electric Transmission, Scottish Power Energy Networks	Jun 2012	3 Years 6 Months
Nominated Project Contact(s)		**Project Budget**
Andrew Robertson (SHET)		£889,000

Problem(s)

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.

Success Criteria

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

Demonstration component demonstrates enhanced properties which make its use attractive.

Technology Readiness Level at Start	Technology Readiness Level at Completion
3	6

Project Partners and External Funding

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)

Alstom, TSB, Mekufa & Gnosys: £404,500

Potential for New Learning

Nanocomposites have been deployed in polymerics with demonstrable improvements in electrical characteristics in the past. However this has been on small samples and primarily for academic purposes. This project proposes to devise a method to disperse the filler in a controllable fashion and make the process reproducible.

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).

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 in 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

Specific Requirements 1

1a. A 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 systems and 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	☐

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

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.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

2b. Is the default IPR position being applied?

Yes	☐
No	☒

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

The learning from this project, in terms of licences relating to relevant Background IPR and Foreground IPR, is accessible to the Transmission Network Owners (NGET, SPT and SHE Transmission) and OFTOs.

ii) Describe any potential constraints or costs caused or resulting from, the imposed IPR arrangements

The IP from this project cannot be shared with DNOs, without consent, however given the early stage of this technology and the focus of the project on HVDC applications, there is limited interest from these network licensees and this is not considered a significant constraint.

iii) Justify why the proposed IPR arrangements provide value for money for customers

The learning from this project, in terms of licences relating to relevant Background IPR and Foreground IPR, is accessible to the Transmission Network Owners (NGET, SPT and SHE Transmission) and OFTOs. This technology has the potential to significantly reduce the size of HVDC converter stations, with a potentially significant cost saving (particularly for offshore converters).

2c. Has the Potential to Deliver Net Financial Benefits to Customers ☒

i) Please provide an estimate of the saving if the Problem is solved.

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.

ii) Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

Not required for Research Projects

iii) Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

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.

iv) 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.

2d. Does Not Lead to Unnecessary Duplication ☒

i) Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

All GB transmission network licensees, other than Off-shore Transmission Operators (OFTOs) are supporting this one project in this field. There are no OFTO-led projects in this area.

ii) If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a