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

Sep 2013

Project Reference Number

NIA_SPT_1306

Project Registration

Project Title

HVDC Cable Condition Monitoring System

Project Reference Number

NIA_SPT_1306

Project Licensee(s)

SP Energy Networks Transmission

Project Start

October 2013

Project Duration

1 year and 7 months

Nominated Project Contact(s)

James Yu (Future Networks Manager)

Project Budget

£150,000.00

Summary

The scope of the work is to increase the quantity and quality of available information on the condition and maintenance requirements of the critical HVDC assets.

Third Party Collaborators

HVPD

The University of Manchester

University of Strathclyde

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

High Voltage Direct Current (HVDC) subsea export cables and interconnectors are critical to the development of a European electricity transmission 'supergrid'. The proposed 'Round 3' large UK offshore wind farm installations (including the four largest at Dogger Bank - 9.0GW, Norfolk - 7.2GW, Irish Sea -4.2GW and Hornsea - 4.0GW) will add up to 25GW to the 8GW of offshore wind power that the Rounds 1 and 2 will provide. The big difference with the larger Round 3 wind farms is that due to the cost of high AC transmission losses to their more remote locations, they will all look to use offshore HVAC/DC substations and HVDC export cables back to land over the longer distances involved (of 100km+).

The UK Government (DECC) have stated that they require the (presently high) operational and maintenance costs to fall by 25% by 2020 to make this offshore renewable electricity more affordable to the UK consumer. At present the service reliability and the accuracy and detail of the state, condition and performance of the HV networks is not satisfactory. As a result the operating and maintenance costs are too high to allow this source of renewable energy to meet the DECC targets.

Method(s)

To address the 'market need' for improved maintenance information HPVD and our partners are developing an integrated high voltage network management system (OLPD-HVDC) that will address the emerging industry demand for the 'holistic' condition monitoring of these critical subsea HVDC cable networks. The system will provide early warning of faults and therefore allow direct preventative maintenance to help improve operating efficiency through the use of 'holistic' condition monitoring (CM) technology solutions and a corresponding, robust condition based management (CBM) approach to managing these assets. The monitoring technology will be able to indicate insulation defects along with cable faults ahead of failure to allow for preventative maintenance interventions. This will prevent the need for unplanned outages and downtime which as a result improves the security of supply and reduces operation and maintenance costs.

Scope

The scope of the work is to increase the quantity and quality of available information on the condition and maintenance requirements of the critical HVDC assets.

Objective(s)

The objectives of the work is as follows:

- Improve accuracy and detail of information available on the condition of the HVDC networks
- Increase ability to carry out preventative maintenance
- Reduce the number of cable and insulation failures and as a result the outages and downtime
- Allow more accurate determination of where the faults in the cables have occurred and thus reduce costs of repairs.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be deemed successful if the maintenance costs can be reduced and the reliability of the supply of electricity increased so as to reduce the cost and for UK consumers and the quantity of maintenance trips required.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is designed to get maximum output from minimal cost as it will make full use of the existing testing facilities in England (Alstom) and Scotland. Any smaller scale project would reduce the learning potential as it would not fully simulate real time network operation.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

Offshore: Dogger Bank, Norfolk, Irish Sea and Hornsea.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

The total NIA expenditure is expected to be £150,000.

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)

This project aims to enhance the understanding of subsea cable condition monitoring and has potential to achieve significant financial benefits in maintenances and repairing. This will deliver financial benefits by the following means:

- Reduced engineering through re-usable designs
- Reduced time and cost for outage planning, condition maintenance and repairing
- Reduced site waiting time (comes about £0.5m per day for special ships)
- Increased visibility and early warning for the potential fault location of the subsea cable.

Please provide a calculation of the expected benefits the Solution

N/A

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

N/A, due to be studies as part of the project

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

N/A, due to be studies as part of the project

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 project will develop existing knowledge on HVAC cable and GIS monitoring, from HVPD and UoS, and combine these to develop similar, state-of-the-art OLPD monitoring technology for HVDC cables. The project will involve the combination of the core on-line partial discharge (OLPD) condition monitoring platform with a number of additional state and condition monitoring modules to produce a ‘holistic’ HDVC cable condition monitoring system. This will be developed to the proof of concept stage including field trials on in-service HVDC cables at the end of the18-month development project.

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