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 2015

Project Reference Number

NIA_SPT_1501

Project Registration

Project Title

Medium Voltage DC (MVDC)

Project Reference Number

NIA_SPT_1501

Project Licensee(s)

SP Energy Networks Transmission

Project Start

December 2014

Project Duration

1 year and 1 month

Nominated Project Contact(s)

James Yu (Future Networks Manager)

Project Budget

£175,000.00

Summary

Undertake cost benefit analysis and stakeholder engagement to investigate and develop the needs case for an MVDC demonstration facility. Perform network studies to de-risk the implementation opportunities for MVDC technology solutions on Scottish Power's Network.

Identify key risks, projection constraints and mitigation measures to ensure a robust and realistic proposal.

Effectively present the proposal to external stakeholders in due course to maximise the knowledge dissemination in line with the NIA governance.

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

ScottishPower is investigating the feasibility of transforming an existing 33kV circuit into a Medium Voltage Direct Current (MVDC) operation, as an option for 132kV reinforcement and/or down graded transmission study. There have been various studies already which have indicated clear potential benefits of MVDC as an alternative reinforcement at Distribution and Transmission voltages.

Across the UK, increased levels of distributed renewable generation have contributed to a growing need for radical reinforcement solutions in areas of the network which are stretched to capacity. MVDC offers an innovative and powerful solution to increase thermal capacity and control flow at a critical point in the network.

The distribution network is facing both thermal and voltage limits and significant reinforcement is required to accommodate the demand and generation growth anticipated over ED1. It would be expected, from the initial desktop studies, that converting an existing 33kV circuit to DC operation can increase the thermal capacity, as well as resolving voltage issues and limiting fault level.

ScottishPower is requesting specialised support to develop these early studies further, and provide more in-depth analysis of its network to collect evidence from both transmission and distribution perspectives which will help to build up the business case for investment in an MVDC demonstrator.

Method(s)

This project will gather the evidence required to support a strong business case, which may in turn lead to the first ever DC operation of an existing AC distribution network circuit in the UK, with all the benefits of improved thermal transfer capacity, voltage support and control of flows. There are significant learning benefits to be gained from such an innovative solution that will help develop MVDC technology as a smart tool for future network reinforcement.

The project will help to demonstrate the implementation of MVDC circuits on a distribution network, the impact on network losses, availability and the utilisation of existing cable assets for DC.

Scope

Undertake cost benefit analysis and stakeholder engagement to investigate and develop the needs case for an MVDC demonstration facility. Perform network studies to de-risk the implementation opportunities for MVDC technology solutions on Scottish Power's Network.

Identify key risks, projection constraints and mitigation measures to ensure a robust and realistic proposal.

Effectively present the proposal to external stakeholders in due course to maximise the knowledge dissemination in line with the NIA governance.

Objective(s)

1. To progress detailed network studies to determine the suitability of MVDC as a reinforcement solution in specific cases.
2. To effectively engage the MVDC supply chain and carry out wider stakeholder engagement to determine the wider benefits of MVDC across UK distribution and transmission networks.

The key output of both 1) and 2) is to build confidence in the concept of MVDC solutions and ensure that the technical and cost input into the MVDC demonstration needs case is robust.

1. To validate the use of existing AC circuit for DC operation

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. Identification of Distribution/Transmission areas which will benefit from this technology;
2. Detailed business case (including technical and commercial analysis) studies for one particular case to capture the tangible benefits; and
3. The development of a fit-for-purpose provisional functional specification for an MVDC scheme.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project will be limited to detailed feasibility studies.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

SP Manweb/SP Distribution, as part of SP Energy Networks.

Revenue Allowed for the RIIO Settlement

None.

Indicative Total NIA Project Expenditure

Total expenditure for the full proposal is £175,000.

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)

Potential 30% Cost saving compared with conventional reinforcement.

Please provide a calculation of the expected benefits the Solution

Not applicable.

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

The preparation study will produce a technical network criteria checklist and methodology to identify other network areas with MVDC opportunities. This will then be used to determine the total number of potential applications of MVDC across the whole UK.

Indicators would include a combination of:

- Power flow issues,
- Reduced voltage headroom
- Network stability problems
- Fault level approaching switchgear ratings

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

Over £20m totex if the trial is successful.

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

Opportunities for DC reinforcement exist in any Distribution or Transmission network where there are any combinations of:

- Power flow issues,
- Reduced voltage headroom
- Network stability problems
- Fault level approaching switchgear ratings

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

Ageing assets and acceleration of renewable connections.

☑ 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

- [x] Yes