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NIA Project Registration and PEA Document

Date of Submission

Mar 2013

Project Reference Number

Project Registration

Project Title

Simulation of Multi-Terminal VSC HVDC System by Means of Real Time Digital Simulator (RTDS)

Project Reference Number

Project Licensee(s)

National Grid Electricity Transmission

Project Start

March 2009

Project Duration

2 years and 1 month

Nominated Project Contact(s)

National Grid TO Innovation Team

Project Budget

£347,000.00

Summary

In July 2009, the three Great Britain Transmission Licence holders supported by a Project Working Group published their report to the Electricity Networks Strategy Group (ENSG) on the strategic reinforcements required to facilitate connection of the generation mix to the GB transmission networks by 2020. The report presents generation and demand scenarios consistent with the EU target for 15% of energy to be produced from renewable sources by 2020 and identifies and evaluates a range of potential electricity transmission network solutions that would be required to accommodate these scenarios.

Among the options currently under consideration is the use of a multi-terminal High Voltage Direct Current (HVDC) link to provide additional capacity across transmission boundaries in the onshore transmission system and potentially to be used in the connection of offshore generation. Such a multi-terminal High Voltage Direct Current (HVDC) link might prove to be the most overall economic and efficient solution available when wider developments are taken into account. National Grid has not previously implemented Voltage Source Converter (VSC) HVDC converters on the transmission system and no multi-terminal VSC HVDC system has been implemented anywhere in the world. The introduction of this technology onto the transmission system must be managed in a manner that takes due consideration of any potential technology risks.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

Method(s)

Scope

Objective(s)

The key objective of the proposed work is to simulate a multi-terminal VSC HVDC link using a Real Time Digital Simulator (RTDS) in

order to study its operation on the electricity transmission system. An RTDS is a powerful state of the art simulator that allows power system simulation of various power system components in real-time timescales. The use of an RTDS will allow for the technology to be modelled in significantly more detail and accuracy than available via software solutions such as PowerFactory, PSSE or PSCAD. RTDS systems are also capable of outputting analogue signals allow for the testing of equipment such as protection relays etc.

The simulation will fulfil the role of a phantom trial in accordance with National Grid's policy for the introduction of new technology. The work aims to demonstrate that a multi-terminal VSC HVDC system as proposed is feasible, to identify potential problems with application of the technology, areas of further research and to inform specifications.

The use of the RTDS will allow for the simulation and evaluation of any converter topologies or control strategies that have been made public by suppliers or proposed by other parties.

Further to the primary objective of this research is the added benefit of developing the UK research capability in the field of HVDC. It is the aim of industry and academia to establish significant expertise in HVDC in the UK in order to ensure that the rapid expansion of complex HVDC systems across the UK and Europe occurs as smoothly as possible. This project supports this aim and will be followed by further proposals in the future.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

n/a

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

n/a

Geographical Area

Revenue Allowed for the RIIO Settlement

Indicative Total NIA Project Expenditure

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)

n/a

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

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

n/a

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

n/a

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

Please demonstrate how the learning from the project can be successfully disseminated to Network Licensees and other interested parties.

Please describe how many potential constraints or costs caused, or resulting from the imposed IPR arrangements.<

Please justify why the proposed IPR arrangements provide value for money for customers.

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