

NIA Project Registration and PEA Document

Date of Submission

Sep 2013

Project Reference Number

NIA_SPT_1304

Project Registration

Project Title

Smart Transmission Zone Proposal

Project Reference Number

NIA_SPT_1304

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

£300,000.00

Summary

This tender is for the delivery of a feasibility study to investigate and identify the future requirements for SMART transmission control systems.

There is an increasing quantity of onshore and offshore wind generation and as a result the power flows across the transmission system are becoming increasing variable and unpredictable. In time this will compromise the security of the network as control engineers will lose the ability to ensure the system is operating economically.

In addition as the system becomes more complex previous security systems, such as inter-trip systems which are designed to automatically trip generation or carry out automatic system reconfiguration, will become compromised. The system modelling effort required to manage special protection systems will increase and the duration and opportunity to engage special protection system may reduce significantly.

The determination of the power system 'state' pre and post fault is a key requirement in determining the post fault control action. The connection of generation to transmission boundary circuits leads to a very complex set of variables since the amount of generation to be tripped to restore security/stability will vary with the fault point, pre-fault transfers, generation background, parallel HVDC flows and other pre-fault network contingencies.

Nominated Contact Email Address(es)

SPInnovation@spenergynetworks.com

Problem Being Solved

There is an increasing quantity of onshore and offshore wind generation and as a result the power flows across the transmission system are becoming increasing variable and unpredictable. In time this will compromise the security of the network as control engineers will lose the ability to ensure the system is operating economically.

In addition as the system becomes more complex previous security systems, such as inter-trip systems which are designed to automatically trip generation or carry out automatic system reconfiguration, will become compromised. The system modelling effort required to manage special protection systems will increase and the duration and opportunity to engage special protection system may reduce significantly.

The determination of the power system 'state' pre and post fault is a key requirement in determining the post fault control action. The connection of generation to transmission boundary circuits leads to a very complex set of variables since the amount of generation to be tripped to restore security/stability will vary with the fault point, pre-fault transfers, generation background, parallel HVDC flows and other pre-fault network contingencies.

Method(s)

This proposal will include a generic feasibility study that will identify the performance requirements and functionality of a Smart Zone control system identifying technology limitation i.e. state measurement, system modelling and communications etc. The benefits of employing PMUs in the determination of network states to inform post fault control will be evaluated. The project will identify project development costs for appropriate hardware and software system components.

Having established the generic building blocks of a SMART transmission control system these will be applied to Anglo-Scottish transmission boundary where a range of technical solutions will be developed. The study will take into account the nature of the boundary limits, the volatile nature of boundary flow, the system configuration, the disposition of generation on or near to boundary circuits and the presence of embedded HVDC and Series Compensation OHLs across the transmission boundary.

Any system proposed will require graceful degradation features such that failure of the system or its components will not cause a widespread failure of the transmission system. A key requirement of the study will be to understand the reliability and performance of IT comms systems and how these may need to change to full the future needs of the transmission system.

Scope

This tender is for the delivery of a feasibility study to investigate and identify the future requirements for SMART transmission control systems.

Objective(s)

The objectives of the work is as follows:

1. Carry out a generic feasibility study on the performance requirements and functionality of a Smart Zone control system.
2. Increase security and stability of the transmission system.
3. Understand the performance and how reliable the IT comms system is along with any changes which may be necessary to withstand the future needs of the system.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be deemed successful if a portfolio of network transmission control strategy is developed that may be applied across Scottish Power transmission boundaries to facilitate the integration of large volumes of renewable generation onto the transmission system, in a safe, secure and sustainable way.

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 take into account the latest development of PMU data and the evolving nature of transmission network. The scale is controlled to address SPT's concerns only at this stage, although most of the learning will be applicable to the GB transmission network. Any smaller scale project would reduce the learning potential as it would not fully simulate real time network operation.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

SPT transmission network.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

The total NIA expenditure is expected to be £300,000.

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 carry out feasibility studies regarding existing/potential control strategy/method on transmission zonal control by taking into account the boundary transfer characteristics, uncertainty of renewable generation and the higher controllability of the HVDC. This will deliver financial benefits by the following means:

- Reduced engineering through re-usable designs Make full use of the existing asset, and push the network potential
- Enhanced understanding on the network control and dynamic/thermal capacity
- Making full use of the real time data (including PMU)
- Facilitate a WAMPC solution in due course.

Please provide a calculation of the expected benefits the Solution

N/A at this stage, one outcome is to address the roll out costs.

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

N/A at this stage, one outcome is to address the roll out costs.

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

N/A at this stage, one outcome is to address the roll out costs.

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

RIO-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

It is a common problem seen by all the network licensees that the change of generation mix and the deployment of new technology made the previous control/protection not optimal anymore, hence 'smart transmission zone' concept is timely, necessary and possible across the GB transmission network. The studies carried out by this project, and the outcome (i.e. an optimal control strategy by using real time information available) will serve as a valid reference for other network licensees.

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