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_1303

Project Registration

Project Title

IEC 61850 Integration of Substation Protection and Control – Test Facility

Project Reference Number

NIA_SPT_1303

Project Licensee(s)

SP Energy Networks Transmission

Project Start

April 2013

Project Duration

3 years and 9 months

Nominated Project Contact(s)

James Yu (Future Networks Manager) & Ian Frame

Project Budget

£133,494.00

Summary

The IEC 61850 standard is intended to provide a standardised framework for the implementation of communication-based Substation Automation Systems (SAS). The principal benefits of employing the IEC 61850 approach are:

- Reduced engineering through re-usable designs
- Reduced time and cost for assembly and wiring
- Reduced site wiring and installation
- Increased off-line testing resulting in faster commissioning and reduced outage durations

Iberdrola's early experiences of attempting to engineer an IEC61850 compliant multi-vendor substation using the various files and software tools from each vendor led to unsatisfactory conclusions:

- It was difficult to achieve interoperability between devices from different vendors as each vendor has implemented the IEC 61850 standard according to its own designs. No two vendors implement the same functions to the same extent
- The engineering process was complex and time consuming. It required extensive work to create the Intelligent Engineering Device (IED) configuration files and an expert knowledge of the underlying format of IEC 61850 configurations.

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

The IEC 61850 standard is intended to provide a standardised framework for the implementation of communication-based Substation Automation Systems (SAS). The principal benefits of employing the IEC 61850 approach are:

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Method(s)

To further our knowledge, experience and understanding of a GB compliant IEC 61850 process and related compliant IED's we intend to create an IEC 61850 test facility in Cambuslang that would not only create a "station bus" simulation substation but also allow the pilot of the new IEC 60870-101 communication protocol to the Operational Control Centre (OCC).
This facility would provide the following benefits:

- Allow the testing of multiple IEC 61850 IED's from different vendors, RTU's and fault recorders for compatibility and operational adequacy
- Enable the risk free trial of the new (to us) IEC 60870-5-101 communication protocol and its support tools (the replacement of the existing Mk2A protocol)
- Allow the testing and programming of IED's before installation reducing outage time and streamlining work on site
- Future proofing: if the IEC 61850 standard ever changes/progresses, this centre will be able to prove compatibility with future versions
- Reduced support costs as SPEN would provide first line support for this system (i.e. reduced costly third party support).

Scope

The scope of the work is to install a test centre in the Cambuslang workshop fitted with multivendor IED's.

Objective(s)

The objectives of the work is as follows:

1. Prove the interoperability of all the IEDs and their performance in the SAS architecture proposed by ScottishPower
2. Prove communication between the test facility and the OCC using IEC 60870-5-101 (create a substation "Cambuslang") and prove all required functionality from the OCC (including support tools)
3. Thoroughly test compatibility of any new IED to be installed onto the network
4. Understand and document any issues faced and resolved from the above four activities
5. Share all knowledge gained.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be deemed successful if the test centre becomes fully functional and the learning from the centre has been used to enable novel protection systems in transmission substations.

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 simulate a few protection bays as oppose to a full substation. Any smaller scale project would reduce the learning potential as it would not fully simulate real time network operation.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The test centre will be established at ScottishPower's Cambuslang workshop on the south-eastern outskirts of Glasgow, Scotland.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

The total NIA expenditure is expected to be £133,494.

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 accelerate the adoption of IEC 61850 and IEC 60870-5-101. This will deliver financial benefits by the following means:

- Reduced engineering through re-usable designs
- Reduced time and cost for assembly and wiring
- Reduced site wiring and installation
- Increased off-line testing resulting in faster commissioning and reduced outage durations - More vendors are compatible with IEC 60870-5-101 compared to the existing Mk2A protocol and hence prices will be lower
- Less support will be required for external parties' software, saving considerable costs.

Please provide a calculation of the expected benefits the Solution

N/A

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

The implementation of Substation Automation Systems is a key priority for all network operators and manufacturers. This centre will allow us to test potential IEDs from different manufacturers to ensure correct operation and compatibility and to validate the proposed multi-vendor solutions which can be used across GB.

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

As all works and the development of solutions using the facility will be completed by ScottishPower and Iberdrola staff, there will be full knowledge transfer within the ScottishPower/Iberdrola group. The research will be available to the other Network Operators and we envisage them using this facility. We believe that manufacturers will be involved in the knowledge transfer process also. Consequently, it is not envisaged that there will be a cost to roll out a similar facility elsewhere.

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 benefits of IEC 61850 are well known and documented. However, as the technology is still relatively new, different levels of IEC 61850 adoption have occurred throughout the UK. As far as we are aware, no utility company in the UK has adopted a true multivendor IEC 61850 station bus solution. In Spain, a multivendor solution has been delivered using vendors that have been closely involved in the development of the E3 specification. However, our design policies state that we require redundancy in SCADA which has not yet been delivered in Spain. In summary, we are attempting to embed UK SCADA and protection policies and experiences in control system design utilising the Spanish E3 specification.

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