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

Jul 2018

Project Reference Number

NIA_NGGT0128

Project Registration

Project Title

Open Source SCADA Platform Phase 2

Project Reference Number

NIA_NGGT0128

Project Licensee(s)

National Gas Transmission PLC

Project Start

June 2018

Project Duration

1 year and 9 months

Nominated Project Contact(s)

Jeremy Hunns and Mark Brookes

Project Budget

£1,339,215.00

Summary

Following the success of the Open SCADA programme, this completes the implementation at the trial compressor site and developing the full business implementation (inc. all processes and standards updates) plan.

Preceding Projects

NIA_NGGT0114 - Open Source SCADA Platform

Third Party Collaborators

Belcan Advanced Solutions Limited

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

The supervisory control and data acquisition (SCADA) system is a data-centric system that provides high level control and is installed on every compressor station and terminal across the National Transmission System (NTS). SCADA allows National Grid to:

- Operate, configure and manage the compressor stations and terminals locally on site.
- Monitor and log real time process data and alarms.

The SCADA system typically consists of a Personal Computer (PC) Windows based operating system (OS) platform, human machine interface (HMI) application software and historian (data capture) application software. The SCADA system interfaces to the control and protection systems which perform the process level control.

National Grid have the following needs which this programme will address:

- To upgrade or replace the legacy SCADA and control systems independently from one another and consider future new works under a common strategy.
- A common SCADA strategy across the compressor fleet.
- To integrate and implement with a common cyber security solution across the compressor station fleet which is currently being assessed separately by National Grid.

Since September 2017, National Grid Gas Transmission (NGGT) with Lagoni Engineering, commenced work on an Open Source SCADA NIA funded project to address the above requirements. This extensive programme was divided into two Phases to allow the necessary review of the milestones and delivery and testing of the software solutions to ring fence sanction exposure in the event of any technological difficulties. The ultimate objective of Phase 1 (NGGT_0114) of the project was to research and demonstrate the technical solution required in order to realise operational expenditure (OPEX) reductions via the use of an Open Source SCADA platform (as an alternative to the traditional OEM-tied solutions used on NGGT sites). February 2018 saw the successful completion of the initial phase of testing of the initial open source software architecture solution for deployment on a single compressor unit in March 2018. To fully realise the full potential of the solutions developed in Phase 1, Phase 2 is proposed to complete the full development and deployment of the Open Source SCADA solution for an entire compressor site. Sucessful completion of this Phase will ensure that the Open Source SCADA solution is suitable for deployment across National Grid's entire fleet.

Method(s)

The Open Source SCADA programme has been structured to be delivered in two stage gated Phases.

Phase 1: Will develop and deploy the pilot the Open Source SCADA Platform at a nominated compressor site. The delivery of Phase one will conclude with a review of the realised TOTEX savings the Open Source Platform.

Stage Gate & Status: Review of TOTEX and operational benefits of the Open Source SCADA Platform developed and tested. This was successfully demonstrated through February and March 2018

Phase 2: Upon successful delivery of Phase 1, it is proposed to develop the full modular SCADA architecture and type approved packages suitable to be rolled out across the National Grid compressor fleet.

Phase 2 is to demonstrate the benefits of a modularised Open Source SCADA system and the ability to roll out a SCADA upgrade on a compressor site. Activities forming part of Phase 2 include the development and undertaking of:

A common strategy / solution to include:

- Two factor authentication (TFA) within the specific Cyber Security implementation.
- Independent SCADA system upgrade capability.
- Modular packaging suitable for cross fleet deployment with G/19 type approval.

Phase 2 is to also to include a roll-out demonstration, replacing / upgrading the existing SCADA systems for all compressor units of the site used during the Phase 1 testing and evaluation. Phase 2 will further demonstrate the potential CAPEX and OPEX reductions which can be realised as it will incorporate a landscape study into the use of SCADA platforms which will expidite business as usual (BAU) implementation of Open Source SCADA techniques across the National Grid compressor fleet.

Scope

Historically, the SCADA systems on National Grid's fleet of gas compressor stations have been designed and engineered independently for each site. This has resulted in differences between sites despite the use of common design specification, commonality of plant equipment, configuration and operation. The SCADA systems have also generally been designed in conjunction with the control systems as a single package by the original equipment manufacturers (OEM) or system integrators which has resulted in the SCADA systems being over embedded with the control systems. This, coupled with aging firmware architecture means that the existing SCADA system infrastructure across the compressor fleet is proving operationally challenging for National Grid to meet its current needs.

Phase 1 Results

A number of activities were agreed as being necessary and were delivered in order to demonstrate the suitability of Open Source SCADA solutions and are summarised as:

- Research, testing and selection HMI and historian application software.
- The identification of applicable National Grid and international standards applicable to the engineering of SCADA and open source technologies.
- The identification and determination of cyber security requirements.
- Development, Verification and pentration testing of the open source platform.
- The engineering of an open source platform (both hardware and operating software).

The software engineering related to the Open Source SCADA application (HMI and historian) for the designated compressor station was chosen as the pilot site upon which to trial Phase 1 of the project, with the final installation being successfully implemented in March 2018.

Following the demonstrated success of Phase 1, the development of the key Open Source SCADA concepts are proposed in Phase 2 to complete the programme objectives that are listed below.

Phase 2 will culminate in the successful roll out that will provide a complete SCADA upgrade solution at the designated site to include all the compressor units thus producing a holistic solution for the site.

Objective(s)

This innovation project seeks to design and develop a standard SCADA system using open source technology that removes the complexities and demonstrates reduced TOTEX costs currently associated with SCADA systems as well as being:

- Be fully compliant and aligned with National Grid's cyber protocols.
- A common strategy / solution across National Grid's compressor fleet.
- Upgradable / maintainable independently from control systems.
- A modular package.
- G/19 type approved that would be owned and managed by National Grid.
- Open source platform with National Grid retaining the intellectual property and independence from the OEM and system vendors.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The programme has been structured (via a Stage Gates) to ensure the respective benefits outlined below are demonstrated:

- Development of a common system, which National Grid owns and manages. Any new projects or project modifications can then be managed centrally, reducing the cost for redevelopment for each subsequent SCADA project.
- Reduced cost of development of new SCADA projects as they would be based on a common modular template.
- Reduced cost of hardware and software licensing as the open source route is the proposed software solution.
- Reduced operator training costs and wider core SCADA knowledge across the fleet due to standardisation of firmware architecture.
- System ownership and retained control over the system via an open source solution.
- Reduced time on site to install and commission upgrades and new SCADA solutions.
- Reduced reliance on specific vendors for future software support.

Project Partners and External Funding

Project Partners – Lagoni Engineering Ltd.

External Funding – (nil)

Potential for New Learning

The programme will offer a demonstrable insight into the potential of modular open source SCADA platforms for National Grid Gas Transmission. The fundamental basis of the programme will inform the debate as to the suitability of this approach for all other National Grid above ground infrastructure (AGI) infrastructure.

Scale of Project

The programme will develop the full modular open source SCADA platform and demonstrate this approach at a nominated compressor site. The solutions developed and rigorously tested and evaluated will form the basis of a package solution for the rest of National Grid's compressor fleet.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

All work will be conducted in the UK and only involve Gas Transmission assets.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

Phase 2 costs only included for this PEA - £ 1,183,310

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)

Following the successful completion of Phase 1, the intial savings of the proposed implementation of Open Source SCADA are still considered justified. These are summarised below interms of both the CAPEX and OPEX cost base comparing traditional costs (current costs expected under legacy systems) versus the proposed the open source SCADA platform costs.

Average CAPEX for SCADA Upgrade/site:
Saving/site: £688,000 equivalent to £17.4M total saving if rolled out across the entire compressor fleet.

OPEX Savings:
Saving/site/year: £62,500 (equivalent to £500,000/site/8 year Regulatory period)

Please provide a calculation of the expected benefits the Solution

Average CAPEX for SCADA Upgrade/site:
Traditional Methods (Baseline): £865,000
Open Source SCADA Platform(Method): £197,000

Saving/site: £688,000 equivalent to £17.4M saving if rolled out across the entire compressor fleet.

OPEX Savings:
Existing Cost/site/annum (Baseline): £90,000
Open Source SCADA Platform/site/annum (Method): £27,500

Saving/site/year: £62,500 equivalent to £1.63M/year if rolled across the entire National Grid compressor fleet (26 sites).

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

The development of a robust and fully evaluated Open Source SCADA platform will enable this modular approach to be implemented across the respective Licensee networks as the technology solution will be inherently agnostic to application.

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

From above section, indicative costs to implement the Open Source SCADA Platform across the National Grid compressor network is ~ £5.2M.

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 programme will offer a demonstrated insight into the potential of modular open source SCADA platforms for National Grid Gas Transmission. The fundamental basis of the programme will inform the debate as to the suitability of this approach for all Licensee networks.

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

This programme addresses the cyber protection and reduced redunacy of legacy software and forms part of NGGT's Congitive & Cyber Compution innovation theme.

☑ 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.

The current NIA portfolio of other gas distribution networks does not indicate similar type of programme. All networks will be fully informed of the progress of the current initiative.

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

The provision of an Open Source SCADA platform offers considerable potential benefits for NGGT. The innovative approach to develop a common set of SCADA modules across a unified platform will ensure that the SCADA systems can be readily maintained and offer a comprehensive solution to obsolenscence and security.

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

The NIA funding offers the most expedient route for NGGT to evaluate the technology with a carefully controlled and ring fenced programme. Only this approach will enable NGGT to develop and test the SCADA system without it being compromised by the needs of business as usual programmes which require tested and proven business ready solutions at the time of installation.

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

To fully realise the potential of the Open SCADA interms of the technical advances the approach affords and the the resulting efficiency and finacial benefits, it will be necessary to complete the package development being propsed in this final Phase of the programme. Only when the full technical and operational functionality of the software solution has been demonstrated, will National Grid be in a position to roll it out across the compressor fleet. The compressor fleet is a highly strategic asset for the NTS and thus any operational improvements need to be fully validated before implementation. This innovation programme provides that governance and framework and will facilitate the roll out phase of this SCADA solution.

This project has been approved by a senior member of staff

☑ Yes