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 2017

Project Reference Number

NIA_NGGT0114

Project Registration

Project Title

Open Source SCADA Platform

Project Reference Number

NIA_NGGT0114

Project Licensee(s)

National Gas Transmission PLC

Project Start

September 2017

Project Duration

0 years and 10 months

Nominated Project Contact(s)

Jeremy Hunns; Mark Brookes;
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Project Budget

£799,512.00

Summary

Historically, the SCADA systems on National Grid's fleet of gas compressor stations have been designed and engineered independently on each site, which has resulted in differences between each site, despite the use of common design specification, commonality of plant equipment, configuration and operation across all sites. 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.

The following SCADA system challenges have been identified and have been categorised under as key National Grids needs:

- A common security and operating system solution across the compressor fleet.
- Ability to perform independent SCADA systems and Control systems upgrades.
- A common SCADA system strategy across the compressor fleet.

The Challenges

- Maintaining the existing SCADA systems to meet the current legislative and governmental cyber security requirements is complex.
- SCADA upgrades and other operational requirements are complex and costly across the existing SCADA systems.
- New SCADA builds are costly due to repeated design activities that could become common design activities across all sites.
- Existing SCADA Human Machine Interfaces (HMI) are exposed to human factor issues and do not fully comply with alarm management standards. .

Hence the two high level challenges, which are addressed by this project are:

- **Short Term (2-5 years) - Cyber Security and Obsolescence:** Will provide an improved solution that meets the current and future

security challenges and lowers the cost of addressing hardware obsolescence.

- **Long Term (>5 years) – Maintaining a consistent SCADA platform across the compressor fleet:** Ensuring and maintaining a compliant cyber secure architecture and control system solution that can be deployed with minimised CAPEX and OPEX impact. Focus will be on a centrally managed vendor-neutral modular SCADA application owned and managed by National Grid for use to upgrade the existing control systems.

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. 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.

Method(s)

The programme format will develop and deliver the following key outputs:
• Research and develop a common open source SCADA platform to be used on compressor stations as an alternative to current OEM solutions.
• Deployment of a modular Open source SCADA solution that can fit on any existing (and future) control hardware platform, with the view to getting the package G/19 approved (type approved).
• Vendor neutral SCADA solution, which creates independence between the control system hardware and the SCADA application software. This will ensure that migration of the OEM control system hardware can be done independently of the SCADA applications thus providing a step by step migration option for legacy systems and avoiding the need for a full control system upgrade.
• Use of open source technologies and commercial off the shelf (COTS) industrial grade hardware, to reduce the complexity of the SCADA package and remove reliance on Windows based OS.
• Use of pre-approved common templates with a focus on FPSA compliance for engineering activities such as Human Factors and Alarm Management.
• Centrally managed security and operating system updates and with a controlled rolled out across the fleet. Provides security hardening of the SCADA system and alignment with the National Grid's cyber security strategy identified by the ongoing National Grid review.
• National Grid ownership of the SCADA solution, such that vendors are issued with the latest design and implementation at the outset of any new control system projects.
The programme will 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: Review of TOTEX and operational benefits of the Open Source SCADA Platform developed and tested.
Phase 2: It is proposed that if Stage 1 is successful, additional innovation funding will be sought to develop the modular SCADA and type approved packages that would be suitable to be rolled out 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 on each site, which has resulted in differences between each site, despite the use of common design specification, commonality of plant equipment, configuration and operation across all sites. 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.
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Hence the two high level challenges, which are addressed by this project are:
Short Term (2-5 years) - Cyber Security and Obsolescence:
Will provide an improved solution that meets the current and future security challenges and lowers the cost of addressing hardware obsolescence.
Long Term (>5 years) – Maintaining a consistent SCADA platform across the compressor fleet:
Ensuring and maintaining a compliant cyber secure architecture and control system solution that can be deployed with minimised CAPEX and OPEX impact. Focus will be on a centrally managed vendor-neutral modular SCADA application owned and managed by National Grid for use to upgrade the existing control systems.

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 technology is the proposed software solution.
• Reduced operator training cost and wider core 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 during the OPEX phase.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

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 1 costs only - £799,512

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)

There are several key areas where material cost benefits will be realised. The summarised below sets out the items under 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 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 Licensee networks SCADA solutions.

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