

## NIA Project Registration and PEA Document

### Date of Submission

Dec 2016

### Project Reference Number

NIA\_NGGT0108

## Project Registration

### Project Title

Combined CP and P remote monitor

### Project Reference Number

NIA\_NGGT0108

### Project Licensee(s)

National Gas Transmission PLC

### Project Start

January 2017

### Project Duration

1 year and 11 months

### Nominated Project Contact(s)

Derek Comerford , box.GT.innovation@nationalgrid.com

### Project Budget

£369,410.00

## Summary

Nitrogen sleeves are used to provide additional protection to key short sections of pipework, for example road crossings. Sleeves are often located in remote locations, and there are over 1200 on the NTS. A nitrogen sleeve comprises a sealed and welded steel shell around the pipeline that capable of containing line pressure and is pressurised with nitrogen to provide an inert atmosphere against corrosion on the inside of the shell. Complementary cathodic protection (CP) is also applied to the shell to protect the outside from corrosion. The integrity of the nitrogen sleeve can degrade overtime through failure of the CP system or leak of nitrogen from the sleeve. National Grid policy is therefore to monitor the pressure of nitrogen and monitor the voltage of the CP to ensure the shell and pipeline are protected from corrosion.

### Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

## Problem Being Solved

Optimal asset management of nitrogen sleeves requires the monitoring of nitrogen pressure (P) within the sleeve and voltage of the cathodic protection (CP) applied to the sleeve. Currently the CP and pressure are measured by separate sensor units that require separate installations, separate batteries or power supply connections and separate communication systems where they are used for remote monitoring.

This project will develop and trial a low maintenance combined CP and Pressure remote monitoring solution

for nitrogen sleeves. By developing and trialing a combined solution for collecting and relaying integrity information the project will reduce manufacturing, installation and maintenance costs.

## Method(s)

The method comprises of the following steps:

1. Scoping of development works required – review of existing CP monitors and pressure monitors and development of a combined solution with low energy/long life remote monitoring capability.
2. Design – design of power and communications system, the interface of the sensor systems, the physical arrangement and packaging of the solution including installation
3. Prototyping (alpha) – manufacture and test of prototypes for communications range, power consumption, integrity of data transfer, sourcing of test rig etc.
4. Development of data interface with core data system including trial KPI development
5. Development of pre-production version (beta) – refinement of the prototype into a version optimised for long term field trials and use.
6. Live trial on NTS – production, installation and performance monitoring of a multi-unit trial on real nitrogen sleeves
7. Technical certification – proof that the solution is safe and meets the communications standards that will provide an enduring solution, achieved with CE marking formal testing.
8. Report – documenting the development process and evaluating the pre-production versions' performance in the trial, volume dependent production costing, and draft specification for a combined sensor system.

## Scope

Nitrogen sleeves are used to provide additional protection to key short sections of pipework, for example road crossings. Sleeves are often located in remote locations, and there are over 1200 on the NTS. A nitrogen sleeve comprises a sealed and welded steel shell around the pipeline that capable of containing line pressure and is pressurised with nitrogen to provide an inert atmosphere against corrosion on the inside of the shell. Complementary cathodic protection (CP) is also applied to the shell to protect the outside from corrosion. The integrity of the nitrogen sleeve can degrade overtime through failure of the CP system or leak of nitrogen from the sleeve. National Grid policy is therefore to monitor the pressure of nitrogen and monitor the voltage of the CP to ensure the shell and pipeline are protected from corrosion.

## Objective(s)

1. Scope, design and prototyping of low maintenance combined CP and pressure remote monitoring solution including interface with core data systems and direct KPI reporting
2. Technical certification and development of a pre-production version and specification

3. Completion of live field trial of pre-production versions for one complete pipeline and report on their performance and unit cost by volume.

### **Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)**

n/a

### **Success Criteria**

Successful design, development and trial of a low maintenance combined CP and pressure remote monitoring solution for nitrogen sleeves including interface with core data systems, KPIs and specification.

### **Project Partners and External Funding**

Project Partner – Des19ncor Ltd

External Funding – (nil)

### **Potential for New Learning**

This project will prove that a remote low power/long life combined CP and Pressure sensor unit for Nitrogen Sleeves can be developed and implemented more cheaply than standalone CP and Pressure systems.

### **Scale of Project**

Desk based and trial in working environment in order to deliver a solution fully tested and ready for full rollout across NTS sites.

### **Technology Readiness at Start**

TRL6 Large Scale

### **Technology Readiness at End**

TRL8 Active Commissioning

### **Geographical Area**

Desk based work at Des19ncor offices.

Trial based work on the NTS operational sites.

### **Revenue Allowed for the RIIO Settlement**

None

### **Indicative Total NIA Project Expenditure**

£369,410

## 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)

Savings are calculated from a combination of capex, opex and one-off savings with an estimated total of £3.9m. The calculation is provided below.

#### Please provide a calculation of the expected benefits the Solution

Savings will be derived from a mix of capex, opex and one-off savings.

Firstly, a reduction in capital costs (capex) by being able to install one unit instead of two separate units at each site assessed to require measurement of both CP and Pressure. Using existing products from the marketplace:

Capital cost (purchase and installation) of a standalone CP sensor unit is estimated as £2000

Capital cost (purchase and installation) of a standalone pressure sensor unit is estimated as £2050

Capital cost (purchase and installation) of £2500 per combined unit, the saving is £1550 per nitrogen sleeve.

Secondly, by a reduction in maintenance and asset management costs (opex) by having one unit instead of two to maintain, and by providing improved visibility of asset condition through remote condition monitoring removing the requirement for periodic site visits to record data and a high number of repeat visits for leak detection, trending and repair monitoring, also resulting in a reduction of CO2 emissions and reducing employees' exposure to risk.

Lifetime (10yr) opex cost for a standalone CP sensor unit is estimated as £1500

Lifetime (10yr) opex cost for a standalone pressure sensor unit is estimated as £1500

Lifetime (10yr) opex cost for a combined unit is estimated as £1500, the saving is £1500 per sleeve over 10yrs.

Thirdly, by a reduction of database data correlation costs for the whole population of nitrogen sleeves by integrating correlation into the solution through installation of shared remote reporting with implied shared ID. An additional data alignment project (including a KPI build) would be required to capture the data from separate remote monitoring sensors as a one-off opex cost of £125,000 to provide integrated reporting, and is therefore avoided by undertaking this project and roll out of the solution.

The cost of installation and operation for 10 years by the existing method is therefore:

CP capex + Pressure capex + CP opex + Pressure opex £2000 + £2000 + £1500 + £1500 = £7050 per nitrogen sleeve

The cost of installation and operation for 10 years by the innovative method is therefore:

CP & Pressure capex + CP & Pressure opex £2500 + £1500 = £4000 per nitrogen sleeve

The cost saving per sleeve is therefore £7050-£4000 = £3050 saving per sleeve

Assuming application to all 1249 nitrogen sleeves, the maximum saving for installation and 10 years of operation is estimated at:

$(1249 \times £3050) + £125k$  one off saving (against existing alternative) - £30k national database go-live cost = £3.90M maximum saving.

An additional £ 85k per annum of efficiency savings is achievable by remotely monitoring N2 sleeves rather than manually monitoring them.

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

The NTS is estimated to have 1249 nitrogen sleeves at which this solution could be implemented. Other

Network Licensees have similar or greater numbers of nitrogen sleeves at which the solution would also be applicable.

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

A low maintenance combined CP and pressure remote monitoring solution for 1249 nitrogen sleeves within a

National Grid Gas Transmission roll-out is estimated to have capital and operational costs (10 years' operation)

of  $1249 \times (£2500 \text{ capex} + £1500 \text{ opex}) + £30k$  national database go-live cost = £5.03M total cost.

### **Requirement 3 / 1**

Involve Research, Development or Demonstration

A RIO-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 trialed 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 learning and solution from this project could be applied to derisk the sourcing of similar solutions by all Network Licensees with nitrogen sleeves.

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

The project is aligned to our reliability 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.

There is no known and proven low maintenance combined CP and pressure remote monitoring solution for nitrogen sleeves currently available on the market.

### 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