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 2016

### Project Reference Number

NIA_SGN0098

## Project Registration

### Project Title

Oxford Flow Optimised Pressure Reducing Station

### Project Reference Number

NIA_SGN0098

### Project Licensee(s)

SGN

### Project Start

September 2016

### Project Duration

3 years and 1 month

### Nominated Project Contact(s)

Mark Skerritt, Innovation Project Manager

### Project Budget

£521,448.00

### Summary

SGN are now looking to develop improved PRS designs based on the Oxford Flow Regulator and associated technologies for pressure reduction from 7Bar to 2bar. The project is broken down into work packages with each package requiring the production of a report for approval by SGN.

An independent Technical Services Provider has also been appointed to provide technical review of key aspects of the project and assist with production of technical documents and procedures.

WP1: Test regulator with current Pressure Reduction Sled

- General design for fitting and instrumentation
- Specification of main components including regulator
- Assemble regulator, sled and configure
- Test regulator on rig in laboratory
- Model performance and scale

WP2: Customer scope and specification, concept design

- Review standards, scope and general needs
- Site visits investigation and Initial definition of site for field trial
- Market and international needs
- Define specification for the sled
- Complete concept layout and initial performance modelling

WP3: Development of regulator and silencer package (7 to 2 bar)

- Define spec and complete concept design
- CFD, FEA, mathematical and other modelling: virtual prototype
- Commission prototype components
- Assemble and test in laboratory

WP4: Development of filter

- Define spec and concept design: Design approval.
- CFD, FEA, mathematical and other modelling. Virtual prototype
- Commission prototype components
- Assemble, instrument and test in laboratory
- Final design drawings for other size ranges for different skid applications

WP5: Development of pilot

- Define spec and concept design: Design approval.
- CFD, FEA, mathematical and other modelling. Virtual prototype
- Commission prototype components
- Assemble, instrument and test in laboratory

WP6: Communications package

- Specification, integration, commission and test

WP7: Element Procurement

- Identify contractors (prototype and volume)
- Costings

WP8: Detailed design of PRS

- Review elements, customer need, sites, scope
- Complete layout design. Design approval.
- Identify client sites
- Full sled costing
- Plinth and acoustic housing specification / sourcing

WP9: Live field trial - individual elements of PRS

- Extended test of regulator - parallel in stream (was task 1.10)
- Scope and set-up trials
- Regulator and silencer (and pilot) field trial
- Filter field trial

WP10: Live field trial - full PRS

- Commission, assemble
- Field trial

- Skid modifications if required

WP11: Pressure Reduction Station of the Future

- Research, conceptual design, initial performance estimate

## Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

## Problem Being Solved

Pressure Reduction Stations (PRSs), whether above or below ground, are a fundamental element of the gas distribution network. SGN has thousands of pressure reduction stations with inlet pressures ranging from 2 > 80bar.

PRSs are largely robust, solid and reliable systems, but with a high capital cost and requiring regular high quality maintenance. Designs for some of the stations and in some cases the regulators and other equipment on site date back many decades. Regular replacement of the diaphragms in Pressure Reducing Valves is key to ensuring performance. Innovation and development common in other industries has been little applied to the design of the PRS.

SGN has a need for PRSs with: reduced capex, improved reliability and maintenance, improved ease of maintenance, reduced installed size and (in some locations) reduced noise. SGN is now looking at approaches to reduce the whole life costs of its PRSs, based on technologies currently available, innovative technologies near to market, and longer term innovations.

## Method(s)

Oxford Flow, a spin-out from Oxford University, has developed an innovative Pressure Reducing Valve. The Oxford PRV is a compact, responsive PRV with only one moving part and no diaphragm. The company in addition has designs in development for innovative filters, silencers, pilots and other elements for an optimised PRS.

The project has the overall objective of field testing an optimised PRS in the network, with a scoping exercise for further innovation to improve Pressure Reduction Stations.

Oxford Flow will:

- Work in partnership with SGN and other stakeholders to characterise current PRSs and define performance targets
- Test and assess the individual elements of a traditional PRS
- Field trial the IM Series PRV over two seasons
- Design, develop and test an optimised PRS in the lab, including innovative designs for:
    - Regulator
    - Pilot
    - Silencer
    - Filter
    - Overall layout, optimised for efficiency of maintenance and reduced footprint
- Test individual elements of the improved design in the field
- Test the full improved PRS in the field over two seasons
- Scope the PRS of the future

The overall output is a 7bar-2bar PRS tested in the field, with full designs for above ground, semi-submerged and below ground options, with a scoping exercise for more long term PRS developments.

## Scope

SGN are now looking to develop improved PRS designs based on the Oxford Flow Regulator and associated technologies for pressure reduction from 7Bar to 2bar. The project is broken down into work packages with each package requiring the production of a report for approval by SGN.

An independent Technical Services Provider has also been appointed to provide technical review of key aspects of the project and assist with production of technical documents and procedures.

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## Objective(s)

The objectives of the project are to:

- Develop a market-ready optimised PRS delivering significant improvements in whole life costs over current PRSs
- Complete designs for an above ground, semi-submerged and below ground PRS
- Test the Oxford Regulator in the field
- Evaluate the fully optimised PRS in the field

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

n/a

## Success Criteria

The project will be deemed to have been a success if the following criteria have been met,

Testing and evaluation will be conducted offsite at the Oxford University flow test centre and on site during field trials.

- The PRV, pilot and cyclonic filtration unit operates in the field continually over two seasons with no maintenance and control issues.
- A notable reduction in noise levels is recorded when used with the silencer when compared to traditional PRS designs under high flow conditions.
- Construction and whole life costs prove to be lower than the current traditional PRS designs
- The PRS of the future conceptual study is evaluated by SGN and TSP and considered viable.

## Project Partners and External Funding

Oxford Flow

## Potential for New Learning

This project is expected to offer Network Licensees new products and technologies for above and below ground pressure reduction assets. It will provide an optimized PRS design which has the potential to improve performance and be more cost effective when compared to traditional solutions.

SGN aims to disseminate the learning from this project via technical reporting and practical demonstrations if required. This project may deliver reduced noise, improving customer satisfaction, and reduced size of PRSs.

## Scale of Project

The project involves detailed design, development and modelling of all individual elements in Oxford University facilities. This is followed by the testing of each component in the lab, with long term field testing of all individual elements of the PRS over two seasons. The field trials will allow SGN to assess the benefits of this innovative solution and deliver learning as outlined above.

The Project duration allows SGN to carry out all evaluation and testing in the laboratory and field testing prior to the production of a final report that will make recommendations on the use of this technology within the GB gas distribution networks. There would be less potential for learning if the scale of the project was reduced in scale.

## Technology Readiness at Start

TRL3 Proof of Concept

## Technology Readiness at End

TRL7 Inactive Commissioning

## Geographical Area

Design, development and lab testing will be undertaken at Oxford Flow's test facilities at Oxford University. Field testing will take place on one or more SGN sites within the Southern region.

## Revenue Allowed for the RIIO Settlement

While no associated operational expenditure savings are expected during testing, field trial and implementation there is a potential for this technology to deliver considerable future capital and operational savings during this current PCR due to a reduction in construction and maintenance costs.

## Indicative Total NIA Project Expenditure

The total predicted project expenditure is £521,448, 100% of which is NIA eligible expenditure.

# 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)

The development of this technology has the potential to deliver substantial financial benefits.

The benefits of deploying this in terms of cost savings will vary depending on scale of PRS programmed replacement under RIIO by each of the Network Licensees. But based on early assumptions the target cost reduction per site based on existing PRS procurement and construction strategies is estimated to be in the region of 20%..

It is difficult to accurately quantify the actual financial benefit at this stage; as indicated by the low start TRL and the conceptual stage of development so the cost estimates will need to be refined as the project progresses. However, It is envisaged that deployment of this technology may lead to financial benefits in the following areas:

- Reduction of capex
- Reduction of maintenance costs
- Reduction of installation size, and thereby cost.

## 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 Oxford Flow regulator and control system has the potential to be used across all pressure ranges so should be applicable to all Transmission, Intermediate, medium and low pressure PRS designs. So based on SGN's RIIO program for governor and PRS replacement for the remainder of RIIO it could be potentially used to replace the following types and number of installations:

| | SGN | UK licensees |
|---|---|---|
| Above 7 bar PRS | = 15 | 60 |
| Medium Pressure Governor replacement | = 52 | 208 |

Medium Pressure governor refurbishment = 58 232

ERS replacement = 80 320

The number for UK Licensees is a pro-rata figure using SGN data as a basis.

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

The cost of roll-out will be determined when the project concludes and final report is complete as cost reduction is one of the success criteria

## 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

Network licensees will be able to use the learning generated from this project. It will be presented in a final report that will demonstrate the suitability of this pressure reduction technology to deliver both an ideal engineering and cost effective solution. The report will enable Network Licensees to establish whether the Oxford flow solution to pressure control will reduce the capital and whole life costs of pressure reduction stations and their associated control systems.

## 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 has been designed to test and evaluate the performance of a pressure reduction valve, pilot and cyclonic filtration system that works over all pressure ranges. This innovative Pressure Regulator has the potential to be at the core of a much improved Pressure Reduction Station (PRS). It should enable a reduction in construction & whole life cost, reduce environmental impact Reduce noise and offer finer control, it should also enable the standardisation of PRS design.

The maintenance, inspection and repair of Network Licensees pressure reduction equipment is high cost so this project has been designed to develop potential solutions associated with the whole life costs of these installations and so address these clearly defined industry challenges.

☑ 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.

A review of all other Network Licensees Innovation Funding Incentive (IFI) Annual Reports and NIA portfolios has been performed and no similar projects have been identified.

A similar review of current academic literature and journals has also been performed to avoid any potential overlap with the current project.

SGN have also engaged with the project partner and they have provided clarity that no unnecessary duplication of this project is currently being undertaken in GB that they are aware of.

### 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 proposed new technology being offered by the main Project Partner for trialing and proving this new concept through this Project is unique and has never been tried before across the GB Gas Industry. SGN will actively support the main Project Partner with the development of their initial concept, to in turn enable a working prototype to be manufactured during the Project that can be effectively trialed on SGNs Networks.

### 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

There is a lack of competition in the current market, a situation faced by all GDNs, and existing technologies do not offer best economic value. It is anticipated that the proposal being evaluated under this Project will offer a viable solution to this problem, this new regulator technology has not yet been trialed within the GB Gas Industry and is therefore considered to be a 'Research & Development (R&D)' project, entirely in keeping with expected NIA eligibility requirements, but not currently appropriate to consider funding through business as usual (BAU) activities.

### 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

The NIA funding mechanism is specifically designed to support Projects that have potential to have a direct impact on the Licensees Network and/or its Operations, and this Project proposal unquestionably meets the required NIA eligibility criteria. Albeit considered to be unlikely, a specific business risk exists for this Project, should we fail to produce a viable and potentially marketable solution that fully meets the need of the GDNs. However, the amount of knowledge and learning expected to be captured during this Project should also enable positive follow-up work to be undertaken by the GDNs if necessary, to ultimately identify a final solution to the problem definition.

### This project has been approved by a senior member of staff

☑ Yes