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

Mar 2016

Project Reference

NIA_SGN0095

Project Registration

Project Title

PhotonFix™ (Seeker Particles - Stage 3)

Project Reference

NIA_SGN0095

Project Licensee(s)

SGN

Project Start

July 2016

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Hector E Salgado, Innovation Project Manager

Project Budget

£618,300.00

Summary

The concept that was developed in Stage 2 of the project will require formal testing to optimise the sealing process thereby confirming the best achievable sealant specification and the best achievable deployment (application and curing) mechanism. In addition to this, work will be carried out to understand the relevant standards and accreditation environment for this sealant within the Gas industry, confirming its fitness for purpose.

The wide range of applications where it can be beneficially used throughout the network will be explored specifically with respect to the deployment method through the robotics transport platform developed under SGNs NIC Robotics project.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

From the 1850's up until the 1950's cast iron mains were used extensively across the Great British (GB) gas distribution network. Since then the gas industry has moved away from this material and is using steel and polyethylene. However a significant portion of cast iron is still in use today. At present across Scotia Gas Networks (SGN), there are some 20,000 kilometres (km) of metallic mains that are ageing, requiring inspection, repair or replacement.

Extensive investigation, has demonstrated that the majority of larger diameter tier 3 mains (18-48" diameter) are less likely to fail

through cracks and fractures, and more likely to leak from the existing joints and other features such as cotter plates, redundant service connections, dome plugs and riser leaks.

In the past Network Licensees would either fully replace these ageing assets, which is a high cost activity or aim to maintain them prolonging the asset life. To date the options available to repair large diameter joints have been limited to the use of mechanical joint clamps, encapsulation, or injection of anaerobic sealant into jute packing. While cheaper than full replacement, these repair techniques have a number of disadvantages including the costs incurred due to significant excavations and material requirements, and considerable disruption to SGN customers.

Method(s)

Following on from the successful completion of Stages 1 and 2 (SGN NIA 0012 – Seeker Particle and SGN NIA 0050 – Seeker Particle Stage 2) the engineering optimisation of joint/feature sealants and sealant delivery systems of metallic mains will be carried out.

Stage 3 will take the liquid based sealants and UV curing process that was conceived under Stage 2 through development to field trial readiness. This programme of work focuses on detailed testing of the product and the sealing method. To do this it has been split up into 11 discrete Work Packages (WP) under 4 broad headings.

Group 1: Harnessing Technical Capability and Knowledge

- Sealant Supply Chain
- Deployment Methodology (Integration into Robotics Platform, CIRRIS)
- Fitness for Purpose

Group 2: Optimisation and Lifecycle Testing

- Design and Build of Test Bed
- Sealant Application Testing
- Joint Pressure Testing
- Lifecycle Testing

Group 3: Next Steps

- Additional Application
- Optimised Specification
- Offsite Trial Phase

Group 4: Reporting

- Project Management & Reporting

Upon completion of Stage 3, the project will have the PhotonFix™ sealant technique tested and optimised. This will be for a range of applications and the specification for full integration into CIRRIS Robotic platform which has been conceptually designed under stage 2 of the project.

Scope

The concept that was developed in Stage 2 of the project will require formal testing to optimise the sealing process thereby confirming the best achievable sealant specification and the best achievable deployment (application and curing) mechanism. In addition to this, work will be carried out to understand the relevant standards and accreditation environment for this sealant within the Gas industry, confirming its fitness for purpose.

The wide range of applications where it can be beneficially used throughout the network will be explored specifically with respect to the deployment method through the robotics transport platform developed under SGNs NIC Robotics project.

Objective(s)

The specific objectives for Stage 3 are:

- Design and manufacture test bed suitable for 12” to 24” pipes.
- Optimise the specification of the sealants to be used in the field.

- Optimise the specification of a field ready UV light.
- Optimise the specification for sealant application tooling to be integrated with the preferred robotic deployment platform in Stage 4 of the project. This will ideally be the CIRRIS Robotic Platform developed under SGNs NIC project.
- Assess the performance of the chosen sealants under using the test rig.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are as follows:

- Define the sealant(s) specification
- Define the specification for integration into the robotic platform
- Define the specification for the field ready UV light
- Outline requirements of relevant standards and accreditation for the sealant within the Gas industry.
- Confirm applications where the sealant can be used throughout the network.

Project Partners and External Funding

N/A

Potential for New Learning

This project is expected to provide all network licensees with an understanding of the newly developed sealant that will enable the internal sealing of joint gaps, cotter plates, redundant services and dome plugs. The specification will be defined with respect to the relevant GIS standard.

The successful completion of this project will allow the potential to move onto Stage 4 (Field Trials). Specific development will need to be carried out for the design and development for a payload to be integrated into CIRRIS, developed under SGNs NIC Robotics project, and methods of deploying the sealant for external repairs if applicable.

Scale of Project

This is a small scale project to determine the requirements and learning to allow for progression to Stage 4.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

This project will be undertaken off-site by Steer Energy at their premises.

Revenue Allowed for the RIIO Settlement

During RIIO-GD1 it is estimated that SGN will spend approximately £255.7m and £209.6m on emergency and planned repairs respectively on all metallic mains. As this project is the development phase of the overall project to raise the TRL level, the full potential savings that could be achieved under RIIO-GD1 will be determined upon completion of this stage.

Indicative Total NIA Project Expenditure

The total project expenditure will be £618,300 90% of which is allowable NIA expenditure (£556,450)

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)

N/A

Please provide a calculation of the expected benefits the Solution

For the purpose of the CBA a total of 5500m of tier 3 metallic mains are conventionally replaced per year. The base cost breakdown below shows the allowance/costings per 500m. Included in this is the cost per encapsulation.

Base Cost.

Cost of current conventional replacement method -	£762,000	per 500m
Total Base cost:	£8,382,000	

New Method Cost.

Estimated cost of using robotic remediation techniques for tier 3 asset based on current commercial arrangements -	£590,000	per 500m
Total method cost for robotic solution:	£6,490,000	

Total Savings.

Total estimated savings per annum:	£1,892,000

If it is assumed that the potential benefit across GB can be calculated using a 4:2:1:1 split amongst the GB GDN's then the potential saving across GB could be approximately £7.5m per annum.

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

This project is designed to reduce leakage of gas distribution networks which have been identified through robotic internal inspection. The focus area will primarily be between 12" to 48" metallic mains, which SGN have approximately 425km of tier 2&3 main have been targeted to be remediated under the RIIO GD1 price control across its network. Based on a 4:2:1:1 split the total length of mains

across GB that this method will apply to is approximately 1700km

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

This information will be determined following the submission of the final report as this has been defined as one of the criteria to be achieved.

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

n/a

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 project is designed to reduce leakage of gas distribution networks through the insertion of liquid sealants into the live gas environment. The focus area will primarily be metallic mains but will also have PE capabilities. SGN have approximately 20,000km of metallic mains across all range diameters. As a result, based on a 4:2:1:1 split the total length of mains across GB that this method could ultimately apply to in future years is approximately 80,000km.

The repair and maintenance of these mains are high cost areas for all Network Licensees and the project has been designed to develop potential solutions to clearly defined industry challenges. Therefore, this confirms how replicable the project is across the industry and how easily the technology could be rolled out.

☑ 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 Annual Reports and NIA portfolios has been performed and no similar projects have been identified.

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