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NIA Project Registration and PEA Document

Date of Submission

Mar 2017

Project Reference

NIA_SGN0111

Project Registration

Project Title

Ironclad (Component Prototype Phase - Graphitisation Stage 2)

Project Reference

NIA_SGN0111

Project Licensee(s)

SGN

Project Start

March 2017

Project Duration

1 year and 10 months

Nominated Project Contact(s)

Keith Ellison, Innovation Project Manager

Project Budget

£357,600.00

Summary

The concept that was developed in Stage 1 of the project will require formal testing to optimise the sealing process. This will confirm 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.

A wide range of applications will be explored to determine where the technique can be most beneficially used throughout the network. The deployment method particularly of interest is the robotics transport platform developed under SGN's NIC Robotics project. Additional applications across the transmission network will also be investigated.

Nominated Contact Email Address(es)

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Problem Being Solved

Corrosion is the process by which, in certain conditions, the metallic components of pipes is selectively leached out, leaving wall thinning and a much weaker pipeline. This results in increased pipeline failures and their associated remediation costs.

During the current CIRRISM Robotics Pilot and previous CISBOTSM programs that were carried out across SGN's network, pipeline coupons have been routinely analysed by a Technical Services Provider. Graphitic corrosion has been detected on all samples to date

with pipelines suffering from between 20% and 60% graphitisation in localised areas along the length and around the circumference of large diameter metallic pipes. It can therefore be assumed that this is an issue that affects all cast iron pipelines within SGN's gas distribution network.

Ofgem's definition of 'Decommissioning' includes other risk intervention measures and is not limited to physical decommissioning, therefore any development that can address pipeline issues such as graphitisation has the potential to assist in creating both cost and time efficiencies in meeting our GD1 Tier 2 and 3 targets.

Stage one (NIA_SGN0077 – Graphitisation Feasibility Study) was a 'blue-sky' concept development exercise carried out by Steer Energy Solutions, a specialist research and concept development company, completed in June 2016. The focus of the project was the identification of existing technologies as well as technologies that could be brought together in new ways to create products for the prevention, arrest, remediation, and potentially condition monitoring of graphitisation within cast iron pipes.

The target was to take a number of technologies to the "Proof of Concept" stage. During the time of the project, three promising techniques for addressing graphitisation and corrosion of buried cast iron pipes have been tested successfully. These were:

- Unloading the pipe
- Highly localised impressed current
- Functional coating - injecting a magnetically responsive fluid onto the outer surface of the pipe and manipulating it by magnets aboard an in-bore robot

Of these technologies, it was concluded that the '**functional coating**' technology offered the most significant impact against graphitisation, and external corrosion.

Method(s)

This project will aim to develop the magnetically manipulated functional coating for system prototyping. This programme of work focuses on the development of the key technology components in parallel so that fundamental challenges can be identified and worked on in a timely manner. The work has been split into 7 Work Packages (WP) that fall into three categories.

Framing

- Further definition of the problem requirements and solution specification to cover distribution and transmission mains
- Definition of requirements for system prototype testing
- Component development

Fluids

- Magnetic manipulation
- Robotics & moling
- Coating verification

Delivery

- Project Management, reporting and steering group activities

Upon completion of this work, the key components of the Ironclad coating technique will have been prototyped and the groundwork laid for system prototyping.

Scope

The concept that was developed in Stage 1 of the project will require formal testing to optimise the sealing process. This will confirm 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.

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Objective(s)

The specific objectives for this project (Stage 2 Component Prototyping) are:

- File patent application to secure freedom to operate
- Provide test rig demonstrations of coating fluid manipulation and curing
- Provide test rig demonstrations of coating fluid solidification
- Confirm subcontractors that would be used for System Prototype work
- Refine scope of Phase 3 – system prototyping and controlled testing

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are as follows:

- Patent filed and search results reviewed and reported on.
- Demonstrate a 'first-generation' magnetically manipulated coating fluid
- Demonstrate the size and power of magnetic tooling required by the technique
- High level robotic & moling interfaces with particular attention on magnetic compatibility defined.
- Options for coating verification techniques identified and assessed

Project Partners and External Funding

Steer Energy Solutions Limited

Potential for New Learning

This project is expected to provide all Network Licensees with an understanding of the feasibility of addressing graphitisation in cast iron pipes without excavation and replacement.

Scale of Project

This is a small scale project to develop component prototypes and allow for progression to system prototyping in a subsequent project.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This project will be undertaken off-site by Steer Energy Solutions 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 £298,000 90% of which is allowable NIA expenditure (£357,600).

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)

As this project solely focuses on the feasibility study of the technology it is difficult to quantify the potential financial benefits at this stage.

It is envisaged that deployment of this technology would lead to financial benefits in the following areas:

- Avoided/Reduced Public Reported Escapes and associated costs; including excavation and reinstatement.
- Risk reduction and risk management demonstration.
- Leakage reduction within the national leakage model.
- Have the potential to extend asset life and provide an alternative to full direct replacement

A module will be added to the NIC Robotic project increasing its versatility.

Please provide a calculation of the expected benefits the Solution

N/A This is a research project

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

There are approximately 2,460 km of large diameter (Tier 2 and 3) metallic mains (>12") across SGN's Scotland and Southern license areas. 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 can be estimated at approximately 9,480km.

It must be noted that these figures are roughly based on averages and a number of unqualified assumptions, and therefore subject to a large sensitivity margin. However these large diameter mains are high cost areas for all Network Licensees and the project has been designed to develop potential robotic 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.

Additional benefits could be achieved through the development into transmission mains increasing the total length this technique could be applied to. Further understanding of where the technique will be utilised has been defined an outcome to the project which will be put forward into an appropriate CBA.

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

There are no costs associated with sharing the conclusion and recommendations of this study with the other Network Licensees, which will be the first step towards roll out across GB. As stated above, the very early technology readiness level means that it is not possible to estimate the costs of deployment at this stage.

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)

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.

A review of all other Network Licensees Innovation Funding Incentive (IFI) Annual Reports and NIA projects 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 supplier and informed them that they must not work on another NIA project on the same topic with any other Network Licensees. The supplier has provided clarity that no unnecessary duplication of this project is currently being undertaken across GB.

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