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

Jul 2014

Project Reference Number

NIA_SGN0058

Project Registration

Project Title

Gas Polymerisation - Proof of Concept

Project Reference Number

NIA_SGN0058

Project Licensee(s)

SGN

Project Start

August 2014

Project Duration

1 year and 0 months

Nominated Project Contact(s)

Stephen Tomlinson, Innovation Project Manager

Project Budget

£150,200.00

Summary

As part of the Seeker Particles project (NIA_SGN0012), a number of ambitious and highly innovative technology opportunities were identified. This proposal aims to demonstrate 'proof of concept' of one of those innovative technologies, namely gas polymerisation, which uses gas sealants that are transported with the gas and remotely repair leaks by exploiting chemistry that reacts with unique environmental factors found at leak points.

- Construction of the testing rig
- Evaluation of alkyd technologies
- Organoborane catalysis studies.
- Thiol disulphide substitution reactions.
- Integration with Mechanical Deployment Devices.
- IP Evaluation and recommendation for next stage progression.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

There are a number of contributory factors to Scotia Gas Networks' (SGN's) direct carbon footprint; however, approximately 95% is from Natural Gas Leakage. The majority of leakage is from lead yarn and mechanical joints within low pressure distribution networks.

One of the highest operating cost areas for SGN is in response to Public Reported Escapes (PRE's), it is estimated, based on data from 1998-2008 that joint repairs accounts for around 85% of all repairs.

This project aims to build on the work carried out under the project entitled “Seeker Particles” (NIA_SGN0012).

As part of the Seeker Particles project, a number of ambitious and highly innovative technology opportunities were identified. This proposal aims to demonstrate ‘proof of concept’ of one of those innovative technologies, namely gas polymerisation, which uses gas sealants that are transported with the gas and remotely repair leaks by exploiting chemistry that reacts with unique environmental factors found at leak points.

Method(s)

During the “Seeker Particles” project, various patent filings were identified that described volatile gas transported chemistries to seal leaks within a gas pipeline.

Steer Energy Solutions has engaged with their technology partners to produce a review of chemistry options, comprising both step growth and chain growth polymerisation chemistries and including nanoparticles and microparticles, to highlight technology areas that warrant further evaluation as in situ reactive leak remedies.

During that work, three main development streams were identified that would allow an initial ‘Proof of Concept’ evaluation to be achieved. The chemistries that have been selected for investigation are:

- Alkyd chemistry
- Organoborane /oxygen initiated polymerisation
- Reactive Nanoparticles.

The proposed solutions target the environmental factors at the leak site or within the gas stream.

Scope

As part of the Seeker Particles project (NIA_SGN0012), a number of ambitious and highly innovative technology opportunities were identified. This proposal aims to demonstrate ‘proof of concept’ of one of those innovative technologies, namely gas polymerisation, which uses gas sealants that are transported with the gas and remotely repair leaks by exploiting chemistry that reacts with unique environmental factors found at leak points.

- Construction of the testing rig
- Evaluation of alkyd technologies
- Organoborane catalysis studies.
- Thiol disulphide substitution reactions.
- Integration with Mechanical Deployment Devices.
- IP Evaluation and recommendation for next stage progression.

Objective(s)

The overall objective of this project (Stage 1) is to provide experimental ‘Proof of Concept’ for a series of potential gas sealant chemistries operating within the gas flow, and to investigate how these could be deployed the gas distribution mains and network riser systems.

Recommendations for and progression to next stage of technology development.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- Development and validation of the experimental testing rig
- Completed evaluation of Alkyd Technologies and their potential for use in the gas distribution mains and network riser systems.
- Completed studies of Organoborane Catalysis.
- Completed evaluation of thiol disulphide substitution reactions.
- IP review and strategy for next stage progression
- Final Project Report

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This is a small scale initial development project that will be carried out off network. Due to the low TRL it is not possible to accurately comment on the potential future scale until the completion of the project.

However, should the 'proof of concept' provide positive outcomes, any future methods/products arising from the successful completion of this phase and all required future phases will be applicable throughout GB.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This project will be undertaken by Steer Energy and their technology partners at their respective sites.

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 mains. As this project is a feasibility study for a technology at a low TRL, it is not yet possible to determine whether revenue savings are likely during RIIO-GD1.

Indicative Total NIA Project Expenditure

The total project expenditure is £150,200, 90% of which is allowable NIA expenditure (£135,180).

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)

This project is at a low TRL and it is therefore not possible to provide an accurate estimate of the potential saving to customers.

However, the estimated repair cost of leakage from SGN's distribution mains and network risers, based on SGN's total repex allowance of £209m for repair over RIIO-GD1 and the assumption that joint repairs account for 85% of this is £178m. Based on a 4:2:1:1 split for the GDN's in GB, this means that the total approximate joint repair activitys could be in the region of £89m per annum.

Depending on findings and outcomes of this project and its potential follow on projects, environmental emissions due to leakage in distribution mains and network risers could potentially be reduced to zero.

Please provide a calculation of the expected benefits the Solution

N/A - low TRL

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

This project is designed to reduce leakage of gas distribution networks through the use of gas sealants that are transported with the gas and remotely repair leaks by exploiting chemistry that reacts with unique environmental factors found at the leak site. The focus area will primarily be metallic distribution mains and network risers. 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. Similarly, there are approximately 600,000 Network Risers that could also potentially benefit from any outcomes of this project and its future follow on projects.

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

All Network Licensees will be able to use the learning from this project as the outcomes will be presented in a clearly defined report that will be available to them on request.

The successful completion of this project will provide all UK GDN's with an understanding of the potential of using gas polymerisation technology to seal gas leaks in distribution mains and network risers and to remediate pipeline walls.

Although the TRL is too low at this stage to provide an accurate cost benefit analysis, future phases, if carried out, will determine potential benefits, this will then allow the Network Licensees to make informed choices as to whether to invest in this technology.

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