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 2015

Project Reference Number

NIA_SGN0069

Project Registration

Project Title

GasLight Q field portable nondestructive PE material analyzer

Project Reference Number

NIA_SGN0069

Project Licensee(s)

SGN

Project Start

March 2015

Project Duration

3 years and 3 months

Nominated Project Contact(s)

Alex Stewart, Innovation Project Manager

Project Budget

£483,285.00

Summary

The scope of the project is to develop the calibration, algorithms and conduct initial field trials using the Method, based on analysis of the condition, properties and performance of field and factory PE samples. This would be done in conjunction with PE pipe manufacturers and would also include drawing on data gathered from the IFI/NIA project NIA_NGGD0010 - PE asset life research.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

There are very few methods to assess the condition of installed PE pipe and joint materials non-destructively whether at both point of fit or on historically installed pipeline. In the field, pipe weld quality is limited to visual inspection. Joint quality is controlled by guidance on butt welding and electro-fusion procedures, with inspection of the evenness of the bead and, during installation, inspecting the underside of the removed bead for offsets, contamination and slit defects, based on correlation with knowledge of pipe and joint behaviour through destructive testing work. Due to variation in site conditions, weather factors and other external factors weld quality cannot be assured and quality inspection techniques are basic and very judgemental. These issues can result in subsequent leakage or joint failure. Additionally • There is no field portable method for assessing the materials properties (e.g. aging) or physical condition (e.g. fracture stress) of PE pipe and therefore no way to assess risk of potential failure or assessing the materials expected remaining life • There is no method to relate the pipe material properties and condition to the properties of the material when it was originally manufactured, or identify the source manufacturer

Method(s)

The project to develop a rapid and handheld spectroscopic based condition assessment tool for the condition assessment of pipe and joint materials, and validate the approach for the most common gas pipe materials, pipe and joint types. Such a device would be fibre optics based and have the ability to use different fibre-optic probes to suit the specific inspection scenario in the field. The device would use proprietary hardware with software and an inspection methodology that would be developed by the project. The device

would be truly field-portable, contained in a small robust suitcase. The software and methodology would be developed such that it would not be dependent on a specific model or make of spectrometer. When fully developed to TRL8 the software and calibration underpinning the device would be developed to give very clear and relatively simple information to an operator, to remove subjectivity and minimise the skill level requirement on the operator. This would result in much better, more consistent quality control and audit process being available.

Scope

The scope of the project is to develop the calibration, algorithms and conduct initial field trials using the Method, based on analysis of the condition, properties and performance of field and factory PE samples. This would be done in conjunction with PE pipe manufacturers and would also include drawing on data gathered from the IFI/NIA project NIA_NGGD0010 - PE asset life research.

Objective(s)

The objectives of the project will be to: • Produce a review report summarising current gas pipe and jointing QA and NDT methods and defining the application of spectroscopic methods to gas pipe measurement giving enough information to enable the confident specification and selection of the portable hand-held spectrometers that meet the application requirements for the project • Building a base spectroscopy library of PE pipe based on a wide variety of samples of different ages, manufacturers and mechanical conditions • Building on the above, to build up a spectroscopic library of different weld conditions and faults, including inclusions, air bubbles, welds with poor weld strength or alignment for different grades and manufacturers of pipe • Software development and fusion joint metric analysis to enable the above library to be used enable the most effective condition assessment protocols to be produced • Demonstration of the transferability of the method onto a variety of different manufacturers hardware platforms

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria of the project would be: • That the analysis report summarising current gas pipe QA and NDT methods and defining the application of spectroscopic methods to gas pipe measurement would give enough information to enable the confident specification and selection of the portable hand-held spectrometers that meet the application requirements for the project • The production of two working analysers that have carried out first level assessment of multiple gas pipes and materials grades and show good capability for materials identification and measurement of physical properties of currently produced pipe materials • The ability to construct measurement models for weld quality assessment related to key materials characteristics and to measure these spatially using spectroscopic methods to map the condition of the joint. • Demonstration that the software models will operate on alternative spectrometers that satisfy the application requirements. • A final report detailing the findings from the Project and giving recommendations for a final product which can be used by unskilled, trained operatives for all measurement applications.

Project Partners and External Funding

The project partners are listed below, the project will be wholly NIA funded. Scotia Gas Networks (SGN) Gnosys Global Ltd

Potential for New Learning

The Project is expected to develop the following new learning from the project: The Network Licensees, the research provider GnoSys and the cooperating pipe manufacturers Radius and GPS will develop knowledge and expertise in the construction and use of remote measurement models for the condition assessment of gas pipeline materials, pipe and components. Network Licensees will also develop experience in the use of these methods and how they complement other methods to qualify pipe and pipe joints including field identification of pipe age and manufacturer.

Scale of Project

The project will only consider the common types of PE pipe and problematic weld joint scenarios as advised by the Network Licensees during the project and informed by the data gathered of the PE Asset Life Research Project.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

All research and technology development work will be conducted off site at Gnosys Global Ltd facilities in Surrey. Field testing will be undertaken a number of regulator locations in each of SGN's regional networks; Scotland, South and South East England.

Revenue Allowed for the RIIO Settlement

No revenue allowed under RIIO settlement.

Indicative Total NIA Project Expenditure

SGN expenditure - £434,957

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 part of the PE Asset life project it was highlighted that SGN have a high frequency of failed PE joints, both electrofusion and butt fusion. The causes for this, historically, are numerous including inclement weather, changes to materials, poor site conditions and housekeeping. This is compounded by the limited scope of visually inspecting joints for alignment and fusion beads as the main quality control checks.

In 2013 / 2014 to date SGN have had approx 130 failed electrofusion joints reported and repaired. At an additional average cost of £2,000, over identification of onsite failure at the construction stage, per job, this equates to approx £260,000 which could have been avoided by the availability of a system to quality check joints.

The Gynosis Gaslight Q will allow a trained operative or team manager to quickly check a joint and ensure it is correctly fused before the main is backfilled and commissioned.

The introduction of this system would result in an improvement in joint quality and recording, thereby vastly reducing the number of failed PE joints.

Please provide a calculation of the expected benefits the Solution

On average, over the past five years in SGN's Networks we have seen approximately 80 failed joints per annum. With an average estimated cost to cut out and replace these joints of £2000 each this equates to a potential saving of£160,000 per annum.

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

The device developed as the Method could be adopted by all network Licensees.

On the basis that similar issues are being seen in the other networks:

National Grid – approx 160 joints = £320,000 per annum

Northern Gas – approx 40 joints = £80,000

Wales and West – Approx 40 joints = £80,000

This would equate to an over saving of £640,000 per annum on average based on current figures.

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

The cost of each device would be approximately £45k. It is suggested each Network would require 2 - 3 units to allow full implementation of the quality control procedure. This would equate to a roll out cost of approx. £585,000 across the Networks.

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

The learning from this project will benefit Network Licensees as it will provide them with a clear understanding of the capabilities of the Method and the knowledge it will reveal related to the specific causes of weld defects, in situ pipe conditions such as strain, and a better understanding of pipe condition degradation.

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 annual reports has been performed and no similar Projects have

been identified. The project partner is an expert in the field and very familiar with the university publications and activity in this area. They know of no other Project of this sort. The PE manufacturers supporting the project do not know of any similar work in this area

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