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NIA Project Registration and PEA Document

Date of Submission

Dec 2013

Project Reference Number

NIA_WWU_007

Project Registration

Project Title

Iron Mains Condition Assessment System Phase 3a

Project Reference Number

NIA_WWU_007

Project Licensee(s)

Wales & West Utilities

Project Start

December 2013

Project Duration

0 years and 3 months

Nominated Project Contact(s)

Ian Marshall (Green Gas Development Manager)

Project Budget

£89,244.00

Summary

The scope of Phase 3A is to:

- Conduct a number of destructive tests on representative samples of cast iron main to determine a baseline level of strain that the tool will need to be able to accurately detect and measure / the level at which cast iron would be expected to fail.
- To conduct a feasibility study on the options for inserting the tool into and extracting it from tier 2 cast iron mains to inform the design and development of the final tool.

Nominated Contact Email Address(es)

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Problem Being Solved

Today's gas distribution networks have been built up and developed from networks that date back over 100 years. For much of this time the material of choice for the manufacture of distribution mains was cast iron (either pit or centrifugally (spun) cast). As a result, there is a significant volume of this legacy cast iron remaining in these networks that are still being utilised for the conveyance of natural gas. Cast iron is prone to corrosion and also, being an inherently brittle material, sudden catastrophic failure through fracture. When such failures do occur there is a sudden and uncontrolled release of gas, each of these failures, depending on the proximity, has the potential to cause gas to enter into a building whereby it can form a hazardous or explosive atmosphere endangering the consumer and general public.

Through this project Wales & West Utilities and National Grid are looking to take a proactive approach to understanding the actual condition of these mains, rather than to continue to rely on the reactive indicators used until now. This is to ensure the continued security of supply and safety of the consumer and general public under the new Iron Mains Risk Reduction Programme. This project is

looking to develop a tool that will travel for extended lengths within tier 2 and 3 mains (9" and above) to determine their condition. This will be done by measuring corrosion depth / wall thickness on the inside and outside walls as well as the actual strain present in the pipe wall.

Knowledge of the asset condition, as determined from both the level of corrosion (loss in wall thickness) and strain in the pipe wall, will allow GDNs to:

- accurately determine the risk these main pose to the public and the network,
- predict remaining life of the asset to a level of accuracy not previously possible

allow for targeted, informed and innovative interventions to be undertaken in the most cost efficient manner

Method(s)

This project builds upon the initial development phases undertaken firstly through IFI and completed under the NIA registered project NIA_WWU003.

This project focuses on the adaptation of a specific Electro Magnetic Inspection (EMI) Versatile Array Technology into a tool to condition assess cast iron mains through the detection of corrosion and / or defects as well as the detection of induced strain within the main. This project is comprised of a number of distinct stage gated phases to adapt and further develop an existing commercial product originally developed for the nuclear industry. The phases are intended to take the technology from a desktop demonstration to a complete tool /system for the survey and condition assessment of extended lengths of cast iron mains (principally focused on tier 2 mains with a view to extending the technology to tier 3 as appropriate). An overview of the Phases involved in this development are detailed below:

- **Phase 1:** Development of technology from desktop demonstration into a basic prototype as a proof of concept; trialed and demonstrated in an 80 m section of abandoned 10" SI main. [COMPLETED under IFI]
- **Phase 2:** Development of proof of concept prototype into a full scale prototype with additional sensors and increased sensitivity for greater wall coverage / accuracy, increased survey speed and improved data processing. Trialed and demonstrated in 200 m section abandoned 12" SI. [COMPLETED IFI and NIA_WWU003]
- **Phase 3a: i)** Investigate the level of strain the tool will need to identify in a main for such strain to be cause for concern, through destructive testing of representative samples. **ii)** Conduct feasibility study to investigate options for inserting and extracting tool in and out of the mains to be surveyed.
- **Phase 3:** Develop the tool from the extended prototype of Phase 2 to a full scale prototype system including live entry solution. To be tested and demonstrated on a live tier 2 main, yet to be determined.
- **Phase 4:** Adaptation of prototype system into production version. Roll out and implementation of system. (not included in project cost)

Scope

The scope of Phase 3A is to:

1. Conduct a number of destructive tests on representative samples of cast iron main to determine a baseline level of strain that the tool will need to be able to accurately detect and measure / the level at which cast iron would be expected to fail.
2. To conduct a feasibility study on the options for inserting the tool into and extracting it from tier 2 cast iron mains to inform the design and development of the final tool.

Objective(s)

This phase of the project will identify the level of strain at which cast iron mains can be expected to fail and confirm the tools ability to detect this. Furthermore, it will identify & develop the options for entering the tool into the mains and traversing within the main.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- Demonstrate the conditions at which cast iron pipe failure occurs & ability of the tool to detect these.
- A report detailing the options for entering and traversing along the mains

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Phase 1 of the project provided a proof of concept of the technology, developing the technology from a desktop demonstration into a basic prototype; tested and proved in 80 m of abandoned 10" spun iron main.

Phase 2 developed this basic prototype into a full scale working prototype for further validation in longer lengths of abandoned iron mains.

Phase 3A –Will determine the level of strain that could be considered as a cause for concern when condition assessing cast iron mains / inform the required accuracy of the tool

- Will investigate and conduct feasibility study into the options for inserting and extracting tool from with the cast iron mains to be surveyed.

Phase 3 would provide further validation and development of the tool and the entry system for live entry into the network.

Phase 4 would involve the roll out and use of the technology throughout the network.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

UK mainland. Trial locations will be selected within WWU / NGGD geographic area or DVST locations as appropriate.

Revenue Allowed for the RIIO Settlement

No direct savings expected.

Indicative Total NIA Project Expenditure

The expected total cost is £67,000, 90% of which is allowable NIA expenditure (£60,300). This can be divided equally amongst the 2 participating GDNs as follows:

WWU

External expenditure - £33,500

Internal expenditure – £11,122.00

Total NIA - £44,622.00

NGG

External expenditure - £33,500

Internal expenditure – £11,122.00

Total NIA - £44,622.00

Total NIA expenditure - £89,244

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)

Knowledge of the actual main condition will allow GDNs to make informed decisions on the actions they take manage the risk from these mains. Allowing for informed, innovative solutions to be implemented at the most cost effect point at the assets life, or by justifying a mains continued operation. As such an accurate calculation of expected saving is impossible until the condition of the mains population has been assessed and intervention options identified.

Please provide a calculation of the expected benefits the Solution

We have calculated the benefits using the balanced scorecard in Appendix D of the ENA Benefits Guide v5.

Financial benefit – 5

Safety Benefit – 5

Environmental benefits – 3

Network Performance Benefit – 4

Carbon Saving – 2

Project benefits rating = 19/25

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

This method and the tool developed could applied across the whole of GB, it is principally focused on tier 2 iron mains however it is expected that further development for tier 3 iron mains will occur and similar solutions may be subsequently developed for and implemented on tier 1 iron mains should a requirement for this be identified.

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

The knowledge generated as part of this project will be disseminated to the other networks via several mechanisms as described. Costs would be incurred through the purchase of the tool and materials (yet to be determined).

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 generated will be in the form of a new tool for the condition assessment of cast iron mains. The results of this learning will be made available to all network licensees and the tool will be available for all networks to implement.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

Not applicable

- 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