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NIA Project Registration and PEA Document

Date of Submission

Sep 2013

Project Reference Number

NIA_NGN_0035

Project Registration

Project Title

Fracture Monitoring Using Acoustics

Project Reference Number

NIA_NGN_0035

Project Licensee(s)

Cadent

Project Start

March 2013

Project Duration

3 years and 7 months

Nominated Project Contact(s)

NGN – D Carter (Distribution Validation Manager) – lead
GDN, Syrinix – Paul Linford (Consultant), SGN – Steve
Tomlinson (Innovation Project Manager), NGG – Paul
Slater (Project Manager)

Project Budget

£433,963.00

Summary

Under the current 30/30 rule (all metallic mains 30m from property must be replaced within the next 30years) gas distribution networks (GDNs) have to prioritize which mains need to be replaced. A number of these mains are in highly populated areas and although don't have known leakage issues, still need to be replaced under the above rule. There is no method currently available to monitor live mains and to report any significant approaching failure. The 30/30 rule stipulates all mains must be replaced regardless of history so using the 30/30 rule in all cases will result in some mains being replaced many years before the end of their serviceable life.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

Under the current 30/30 rule (all metallic mains 30m from property must be replaced within the next 30years) gas distribution networks (GDNs) have to prioritize which mains need to be replaced. A number of these mains are in highly populated areas and although don't have known leakage issues, still need to be replaced under the above rule. There is no method currently available to monitor live mains and to report any significant approaching failure. The 30/30 rule stipulates all mains must be replaced regardless of history so using the 30/30 rule in all cases will result in some mains being replaced many years before the end of their serviceable life.

Method(s)

Networks need to only replace mains that are at risk, but there is currently no system or method to monitor these mains so pipe replacement can be deferred with minimal risk. Syrinix are designing, testing and deploying a system, using acoustic technology in pre-determined locations, to monitor metallic gas mains remotely and inform the respective Network Licensee of major leaks so they can react immediately thus efficiently managing the risk. The proposed solution would consist of an instrumentation and control unit

which would be situated at either end of the pipeline with acoustic monitoring sensors placed along the line of the main at pre-agreed distances. The sensors will listen for the specific acoustic signatures given by pipe fracturing or pipe movement communicating with each other along the pipeline. If there is any significant movement or a break within the pipeline wall, this will be reported in via text message. Data from the system will then provide an early indication of leakage enabling the networks to take appropriate action. This will enable asset lifetime to be maximised and renewal intelligently deferred.

Scope

Scope

The purpose of this Project is to design a system that remotely and continually monitors a pipeline and reports to a central location via text message should an incident occur, with the added benefit of giving a location of the incident on the pipeline.

The Project is in four stages:

1. Stage 1 To set up an experiment to record signals created by real pipe fractures in a suitable representative location. Detailed analysis will be undertaken to determine the practicalities of the proposed detection system
2. Stage 2 Upon successful completion of Stage 1, this Stage will determine the detection algorithm structure, parameters and decision rules. Syrinix would develop their existing TransientMinder product platform to incorporate the sensors and the new detection algorithm. Any issues surrounding intrinsic safety, practical deployment, sensor design and similar would be addressed during this Stage

Stage 3 This stage involves a trial and demonstration of the prototypes. The location would be as per the location identified during Stage 1. Two cycles of Stage 3 will be allowed for in case of failure and subsequent redesign on the first cycle

?

1. Stage 4 This is the final engineering and Product Acceptance stage including Procedural and Policy changes.

Objective(s)

Syrinix's existing product, TransientMinder (which detects, interrogates and analyses damaging pressure transients within both distribution and trunk main infrastructure) works on water mains of >16" in diameter in the GB, and the objective of this Project is to investigate and demonstrate that the technology can be transferred on to the GB Gas Network, for the same pipe diameters.

The primary objectives of the Project will be:

- To give an immediate notification of a fracture event to the pipe line operator enabling a much improved response time
- To locate the fracture event (assuming it falls between monitor stations)
- To potentially detect the onset of a fracture event if pre-failure signals are generated (this is unknown at this time)
- Monitor pipeline 24 hours / day, 7 days / week.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Throughout the Project there will be monthly reports from Syrinix, to update all Project steering group members on the progress of the Project. There will be face to face meetings every 6-8 weeks and key deliverables reviews at key points with accountable parties clearly identified. Each stage will have its own deliverables and targets which the Project will measure itself and report on monthly as it progresses. When issues are identified recovery plans will be adopted to ensure minimal impact on time scales, and avoid additional costs.

Success of the Project will be based on:

- The ability to objectively characterize a pipe fracture event as it is believed that this has never been investigated before. This represents the most significant Project risk
- The ability to synthesis or model fracture events for the purposes of testing

- The success in sensor choice, and of a data acquisition technique that can distinguish genuine fracture events from background noise
- The degree to which knowledge from use of the technique can be translated into the gas environment

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The Project, though collaboration, could not be scaled down as the main costs are associated with the research and development of the technology.

The design, production and operation of this sensory system will be completely unique and will represent significant new technical innovation in the understanding of the nature of the prorogation of fracture signals, sensor development and application as well as delivering the ability to react quicker to fracture incident.

The Project includes removing a 6 metre test sample from a live site, transporting it to the Syrinix test laboratories and conducting trials under workshop conditions in order to gain confidence in the acoustic system. The information gained from the small section can be scaled up, in order to replicate conditions on site. Once this information is gained, and an algorithm developed it will be transferred, from workshop testing, to the buried section of the same Gas pipeline to confirm the algorithm is correct. Further tests on site will confirm results found previously during initial development.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

GB only, with trials under taken in NGN and another location yet to be determined.

Revenue Allowed for the RIIO Settlement

During RIIO-GD1 it is estimated that NGG has a total REPEX £3225.9M. This technology would be utilized in the Tier 2 pipe population of which is approx. £700M forecast spend.

Assuming 40% (56km) can be deferred indefinitely using this system at £500/m replacement cost, there is a potential saving to NGG of £28m over RIIO-GD1 period.

Indicative Total NIA Project Expenditure

NGN

External Costs - £63,648

Internal Costs – £21,131

Total Project Costs - £84,779

NGG

External Costs - £164,791

Internal Costs - £54,710

Total Project Costs - £219,501

SGN

External Costs - £97,360

Internal Costs - £32,323

Total Project Costs - £129,683

Total NIA Costs - £433,963

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 primary focused on expenditure deferral in tier 2 pipelines within the tier 2 category. As an example, NGG has 140km pipeline in this category.

Assuming 40% (56km) can be deferred indefinitely using this system at £500/ m replacement cost, there is a potential saving to NGG of £28m.

Please provide a calculation of the expected benefits the Solution

There is a total of 280km of Tier 2 pipelines in the GB. A summary of the cost to replace this pipeline is noted below.

Base cost – The current cost to replace a 1km section of Tier 2 pipeline is a minimum of £500,000. (The allowed values are based on 3 bands, 9", 10-12" and 14-17", the costs range from £500 to £800 per metre). Method cost – The cost to install a Syrinix system is estimated to be between £20,000 to £30,000 per km with estimated annual costs of circa £1,000 to cover monitoring costs.

Assuming replacement is deferred for 10 years, the cost of the fracture alert would be estimated at £35,000, including installation and communication, (Method Cost), compared to the cost of replacement £500,000 (Base Cost).

Base Cost of £500,000 less Method Cost of £35,000 = Expected Financial Benefits of £465,000 per km of tier 2 pipeline

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

The method is replicable across 100% of the tier 2 pipelines, further testing will be required to establish whether it could also be rolled out in all tier 2 & 3 pipelines or whether further development will be required to ensure compatibility.

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

The maximum anticipated costs of the rollout are in the order of £35,000 per unit installed. The cost will vary based on the applicability to different types of pipeline, but assuming this figure, if rolled out across the full 280km of tier 2 pipeline the total roll out cost would be £9.8m

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

This Project would allow larger pipelines with no history of failing to be monitored 24/7. This Project would deliver an automated monitoring/alert system will detect fractures in cast-iron gas mains whose diameter is in the range 18-48", and report them automatically to the pipeline operator providing new learning of pipe life expectancy.

Ofgem statement in RIIO-GD1: Final Proposal(2.5)"Fortier 2 and 3, in general, the new policy only requires GDNs to replace mains if the pipe replacement is justified in cost benefit terms. The exception is high risk tier 2 mains, where there is a mandatory requirement" This system therefore gives a possible solution to the problem of identifying Tier 2 mains at high risk from mains from other mains within the Network.

Once established, this method could be applied to the Tier 3 pipeline category providing an alternative to replacement in certain high profile, urban areas if desirable.

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