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 2020

Project Reference Number

NIA_NGN_256

Project Registration

Project Title

LeakVision

Project Reference Number

NIA_NGN_256

Project Licensee(s)

Northern Gas Networks

Project Start

March 2020

Project Duration

2 years and 6 months

Nominated Project Contact(s)

Richard Hynes-Cooper

Project Budget

£1,531,098.50

Summary

LeakVision is a novel leakage detection sensor. The system is used for the inspection of features to indicate the presence of leakage from pipeline features (joints, connections & defects). This project builds on and is de-risked by a successful and previously completed NIA project completed by Cadent (NIA_CAD0019) and additional prior and post independent work by Synthotech Ltd. The additional work developed a proof of concept demonstration unit that has shown the ability to indicate leakage within a simulated leakage scenario.

Preceding Projects

10027276 - Thermal imagery analysis - Condition assessment fluid and pressure

10037368 - Thermal Imagery Analysis

Third Party Collaborators

Synthotech Limited

Nominated Contact Email Address(es)

innovation@northerngas.co.uk

Problem Being Solved

The current predominant methodology for leakage detection is through above ground bar holing. Holes are made within the road surface along the assumed length of the pipeline. Gas readings are taken from these locations and used to triangulate the leakage location and ultimately support the asset management process.

The challenges around these leakage detection methodologies are:

• The triangulation method can be inaccurate and imprecise
• Bar holing can be physically demanding and straining
• The current method cannot determine how many leaks contribute to the above ground readings
• Without a profile of pipeline leakage, decision making could in some cases be improved
• Inaccurate leak pinpointing can create high workloads in false positives and unrequired excavation and reinstatement
• There is no information on the relative size of leakage or deterioration detected

Method(s)

LeakVision is a novel leakage detection sensor. The system is used for the inspection of features to indicate the presence of leakage from pipeline features (joints, connections & defects). This project builds on and is de-risked by a successful and previously completed NIA project completed by Cadent *(NIA_CAD0019)* and additional prior and post independent work by Synthotech Ltd. The additional work developed a proof of concept demonstration unit that has shown the ability to indicate leakage within a simulated leakage scenario.

The aim of this project is to build on prior learning and develop a system to identify bulk leakage, enabling pinpointing of leaking features and defects. The project will develop a comparable simple traffic light reporting model relating LEL/GIA, PREs and joint leakage indications and locations. The simple model will highlight features that show leakage requiring action (red) and those that may be in a state of failure (amber) as well as the potential combined effects which may cause PRE/GIA.

The project will take place across two phases which are broken down into six stages.

Phase 1: Research and Development
At the end of stage 1 the project will have developed, tested and demonstrated the technology from TRL4 to TRL7. It will also deliver pre-conformance testing and live field trails, demonstrating the technology in a real-world environment (field trials).

Phase 2: Certification and Productionisation
At the end of stage 5 the project will have delivered certification of the system (from TRL7 to TRL8) and will have achieved full network approval enabling operational use as to roll out to BAU.

Scope

The scope will include four key constituent elements:

• Sensor system to locate leakage/deterioration on pipelines allowing for leakage pinpointing
• Development of sensor delivery mechanism
• Development of sensor system for leakage detection
• Modification of the existing required ancillaries

The scope will include two key technology packages:

Package 1 - Manufacture and build of one TRL8 LeakVision™ system for size range 12”- 36”
• 150m scanning inspection coverage
• Operate at pressures that are between the range of 22 mbar and 75 mbar (LP)

The aim is to develop a system to identify bulk leakage. The project is aimed to develop understanding of the correlation between LEL/GIA, PREs and joint leakage rates. This will be further evaluated in Phase 1 testing and verification.

Package 2 - Manufacture and build of one TRL7 for size range 8”-12”
• Undertake trials to document and improve performance and assess business case
• Enable pre-certification unit to be developed to an agreed standard within budget

The development of a small diameter sensor will allow identification of future potential as a separate project to develop a commercialised system that will be reviewed in Phase 1.

LeakVision –details highlights:
• Operate at pressures that are between the range of 1.5 Bar to 2 Bar (MP)
• 20m scanning inspection coverage (stretch target 30m)

Objective(s)

• **Develop SLS concept (3D printed)** - Concept should provide real world data on performance within laboratory test and simulated rigs for data on applicability of technology to NGN.

• **Create gas verification rig** - Provide a gas rig to test project assumptions and provide data and calibration. The rig will allow the concept to be assessed for suitability.

• **Complete modelling** - Provide detailed data modelling to allow the optimisation of the detection within the project.

• **Create prototype** - Create a prototype system for deployment across the network to assess the detection, operation and potential of the technology in a real-world environment.

• **Completion of gas trialling** - Provide a minimum of 10 and maximum of 20 network field trials for the assessment of the LeakVision technology within the real-world environment. This will be summarised in a short report.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

• The sensor can access the pipelines
• The system is efficient able to sense leakage over 100m of pipeline
• The sensor can detect bulk leakage to the specification
• The sensor can detect leakage hotspots within the defined criteria and the systems highlight and records bulk leak locations
• The sensor is developed to ATEX or D7 (suitable to operate in a 100% GIA environment) with ATEX certification and the process is considered suitable and can be approved for use on UK networks

Project Partners and External Funding

• NGN - £983,058.50
• SynovateLtd - £330,572
• TTP
• Rosen
• University of Leeds

Potential for New Learning

The ability to use thermal sensing technology for asset deterioration and leakage detection present NGN with an opportunity for transformational change in the way that these tasks are managed.

Traditional methods rely on interpretation of data from disconnected sources and often making assumptions based on experience and unknown site conditions, such and correlating the gas reading detected in a bar hole and relating that to the location of a pipe feature, such as a joint or plug.

Scale of Project

The use of this analysis creates an opportunity to maximise deployment of precision repair techniques (core and vac) and change the future method of operations deployment.

This new technology will capture data that can be used to support evidenced based investment decisions, such as do we repair or replace a pipe that has been identified as for condition replacement. The data generated is expected to be able to support a CBA to decide is we proceed with replacement of undertake repair activity with the confidence, and knowledge that the repair can be targeted and once complete that the asset is in a good state of health.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be based in the NGN network area

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External funding = £983,058.50

Internal cost = £593,040.00

Total Cost = £1,531,098.50

Note - The external project cost of £1,318,630.50 consists of a mix of NIA and third-party funding:
• **NIA** - £983,058.50 (75%)
• **Third party funding** (Synovate Ltd) - £330,572 (25%)

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)

£122,968 per annum over a forecasted workload of 92 jobs per year with one unit. The assumed benefits in this use case are a positive cost benefit of £1,336.61 per operation, this will be tested throughout the project.

Please provide a calculation of the expected benefits the Solution

The CBA is a combination of cost, customer and environmental factors and can be split into 4 areas:

Operations: PRE - Large diameter/extended site - The solution is envisaged for use to determine precise location of leakage to enable a reduction in repair impacts and associated benefits.

Operational: PRE - MP/high volume gas escape - The small diameter solution is envisaged to enable positive identification of MP leakage prior to operatives excavating directly on top of a leak site.

Asset Management: Non-Mandated/Condition repex - The information generated from the solution will be available for use to enable assessment and data driven decision making with regards to Non-mandated asset replacement. The potential cost benefit from this use case is the ability to make evidenced based investment decisions with regards to condition replacement and if 'repair' or 'replace' is the most viable option.

Asset Management: Post survey - data transfer and asset information - The information generated from the solution will have potential for integration into NGN systems to enable geospatial of asset condition (RAG status) such as is common for live traffic networks and road delays.

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

The research and learning undertaken as part of this project is applicable to all GDNs. The system could be easily applied through standard operational processes and is replicable across all GB networks, once successfully developed, tested and proven.

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

The cost for widescale roll out will become clear once technology packages are developed and proven in the field. At that time a quantified implementation plan will be possible.

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

With RIIO-2 on the horizon and increasing challenging operating costs, the need to balance investment decisions and the associated safety, environmental and stakeholder impacts s significant. This is consistent across this challenge for all networks relating to this activity. The use of thermal sensing creates an opportunity to maximise deployment of precision repair techniques (core and vac etc.) and change the future method of operations deployment. This new technology will capture data that can be used to support evidenced based investment decisions, such as do we repair or replace a pipe.

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

Asset and network management, Repair

☑ 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.

This project is the extension of a previously completed NIA project (completed by cadent). This project has been discussed at relevant industry forums e.g. GIGG, a search of the SNP has been undertaken and a market scanning exercise completed.

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

This project will build on the original work of the previous NIA project and subsequent developments undertaken by Synthotech Ltd. The technology will be developed using a community of project partners with Synthotech Ltd as lead in the technology development. The project will develop scientific understanding of the mechanics that underpin the process. Key to the development is a detailed understanding of the data modelling allowing for optimisation and detailed design of the system. This is significant development and has not been attempted previously.

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

This project is challenging in terms of technology development and presents significant risk in terms of TRL progression albeit with the potential for transformational change. These is no guarantee of success due to the challenging developments required and presents investment risk greater than allowed through usual business activities.

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

The project would only be undertaken with support from NIA, to compliment the additional third-party funding that has been secured. This innovation project is transformational and there is no allowance in BAU business plans for this type of activity. The commercial, technical and operational risks and challenges associated with this project is significant and could lead to a step change in operational and asset management decision making.

This project has been approved by a senior member of staff

☑ Yes