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

Aug 2018

Project Reference Number

NIA_NGGT0126

Project Registration

Project Title

In Pipe NTS Liquid Monitoring Systems

Project Reference Number

NIA_NGGT0126

Project Licensee(s)

National Gas Transmission PLC

Project Start

August 2018

Project Duration

2 years and 8 months

Nominated Project Contact(s)

Dinesh Kanagalingam

Project Budget

£168,891.00

Summary

The aim of this project is to address the problem of detecting liquid ingress at National Transmission System (NTS) Entry Points through the development and testing of a prototype analyser which identifies the presence of liquid by means of a video identification system.

Third Party Collaborators

IMA Limited

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Liquid contamination or carry over into the National Transmission System (NTS) at entry points has significant impact on local control and measuring asset of the network. This causes significant risk to the safe operation of the network and potentially impacting upstream customers. The aim of this project is to address the problem of detecting liquid ingress at NTS Entry Points through the development and testing of a prototype detection system which identifies the presence of liquid by high quality in pipe video capture and analysis.

An earlier innovation programme (NIA_NGGT0034) also attempted to address this issue but the results from the chosen laser based technology were inconclusive. Building on the learning from this (earlier) work, the light emitting diode (LED) illuminated video systems being proposed in this study are considered to offer a more suitable, flexible and cost effective solution, which if proven, can be readily deployed at critical points around the network providing real time monitoring of the network feeders.

Method(s)

A fixed and mobile in pipe video monitoring system will be installed at a UK reception terminal. Each system will be based on optical liquid monitoring detection providing demonstration of the performance of both temporary and fixed mounted equipment.

The programme will install two types of in pipe video liquid detection equipment at a UK gas import terminal. The systems will be commissioned as fixed and mobile (transferable) systems respectively. The units will provide live data as to the liquid content within the monitored pipe sections. The mobile solution will provide valuable information relating to suitability of these systems for deployment across the network as needed. If successful, the use of mobile liquid detection systems has considerable potential to ensure that National Grid can readily address any potential liquid contamination events.

Scope

Significant liquid contamination can result from a gradual build-up of liquid deposits on pipe surfaces, from components that may even be present normally in the gas phase. Depending on the specific components involved, dew temperature measurements may not predict the potential liquid deposition.
Gas composition may give an indication of increased concentrations of critical components in the gas phase, but these are not routinely monitored by the Gas Network Control Centre (GNCC).

In general on the NTS all sample points and measuring instruments are designed to sample and analyse dry gas. Any liquid contamination picked up by the sample probe causes damage to the analysers. This issue is further exacerbated by the fact it is not an easy process to remove liquids.

There are no instruments in place to monitor the concentrations of some potential liquid contaminants (glycols and methanol) across the NTS.

Objective(s)

The programe will perform a full review of each system (fixed, mobile) will be presented. If the trials prove successful, the systems will be adopted as a business as usual system for liquid monitoring within the NTS. The necessary procurement and National Grid specification/standards, inclusive of standard design templates, will be amended accordingly.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The programme will provide in service demonstration of video liquid detection systems for in pipe monitoring of gas transmission networks. The trial will be conducted at a site which has a history of liquid contamination and will thus be an effective validation of the video detection system.

Project Partners and External Funding

Project Partner – IMA Ltd.

External Funding – (nil)

Potential for New Learning

The programme will be first demonstration of high pressure liquid and small particulate contamination monitoring system that employs video image collection and subsequent analysis. Such systems offer considerable potential as both fixed and portable systems. The use of complex video analysis could have implications in other areas of the transmission network monitoring (third party interference) which utilises change detection.

Scale of Project

The programme will be a trial demonstration of the in pipe video liquid contamination systems.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The trials will be conducted at a UK Gas reception terminal.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£150100

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)

The projected savings per significant (as detailed below) contamination incident are £43,000. It is not possible to indicate the number of very short duration (small volume) contaminant excursions that may occur on the NTS per year, which while do not cause equipment damage, still results in small volumes of liquid residing in pipework. The proposed implementation of the video monitoring systems will enable for these to be logged and assessed as part of the ongoing site contaminant maintenance programme.

Please provide a calculation of the expected benefits the Solution

Method Cost of installed base system: £40,000
Cost of contamination incident (without video monitoring): Delayed control response.
Repair of damaged filters: £20,000
Minimum liquid contamination/incident: 300 litres
Removal and safe disposal of liquid contaminant/litre: £100
Approximate contaminant incident cost: £50,000
Cost of contamination incident (with video monitoring): Control liquid contamination incident more appropriately.
Repair of damaged filters: £2000
Minimum liquid contamination/incident: 50 litres
Removal and safe disposal of liquid contaminant/litre: £100
Approximate contaminant incident cost: £7,000
Base Cost/incident – Method Cost/incident: £50,000 - £7,000 = £43,000/incident.

These costs are based on a significant historical incident although it is expected that there are between one and two undetected contaminant incidents each year which would have been captured by the proposed systems greatly improving the ongoing asset maintenance.

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

The system being evaluated will be readily transferable across the gas distribution networks were high pressure (>15 BarG) liquid contaminant detection is required.

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

The base system costs, inclusive of installation are estimated to be ~£40,000/unit. This base cost is largely independent of location, although multi-unit set up at one site would result in bundled savings. It is envisaged that the main deployment of the video detection system will be fixed but with the hardware capable of redeployment as necessary. This will ensure total NTS coverage but minimise the number of systems required. The total number of systems eventually deployed will be dependent on the success of the trials.

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

Liquid or particulate, inclusive of atomised mists, are a potential contaminant in all gas transmission or distribution networks. Parts of the network that are at high (>40 BarG) or medium (>15 BarG) pressures, require detection systems that are capable of withstanding these pressures. The proposed video detection system offers this capability while also providing the complex real time data analysis such systems require. If the cost effectiveness of these systems is proven, with all the necessary standard design templates, the technology will be easily transferable to all the network licensees.

The current study will provide a benchmark of this in pipe liquid video monitoring 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)

The use of automated liquid detection systems will help National Grid ensure that the gas entering the NTS is free from liquid contaminants and thus forms part of NGGT's Safety & Compliance innovation strategy objective.

☑ 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.

The use of video liquid detection systems has not been trialed in the UK.

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

The use high pressure video streams with complex change detection algorithms for liquid detection in transmission pipelines has not be tried in the UK. The opportunity to provide real time early warning capability of liquid and particulate contamination in the pipe offers considerable safety and asset protection process improvements. Only recently has the high pressure camera capability reached the stage whereby it becomes cost effective as part of a real time liquid detection system. This coupled with the latest change detection software make these systems very attractive for these monitoring situations. Usually, pipe monitoring systems are a permanently fixed asset. The current programme will be evaluating a system configuration that can be readily deployed across numerous sites as necessary. This is a unique capability and greatly enhances liquid detection flexibility across the network as it allows deployment at sites of immediate concern.

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

Liquid contamination provides significant network safety and control issues when it occurs. Currently there are no online systems that have proven capable of meeting the installation and safety requirements required by such technologies. NIA funding will ensure the technology is tested with the results being articulated to all interested parties. This innovation programme will provide this baseline information which can be readily articulated to all interested stakeholders.

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 use of high pressure video cameras offers considerable potential as a liquid monitoring technology but the cameras are untried on the NTS. This programme provides the necessary testing and evaluation of the equipment and installation requirements to enable the business to make an informed decision as to how to implement this technology across the network. It is unlikely that the business would undertake this programme without an innovation programme as the technology capability has not been demonstrated. Once demonstrated, it will be possible to develop robust type approval (G/19) which will facilitate network deployment as necessary.

This project has been approved by a senior member of staff

☑ Yes