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NIA Project Registration and PEA Document

Date of Submission

Jun 2023

Project Reference Number

NIA_NGN_424

Project Registration

Project Title

Network Diversification & Resilience

Project Reference Number

NIA_NGN_424

Project Licensee(s)

Northern Gas Networks

Project Start

August 2023

Project Duration

0 years and 4 months

Nominated Project Contact(s)

lkirkwood@northerngas.co.uk

Project Budget

£184,989.00

Summary

This project seeks to investigate the repurposing of gas distribution network assets for the installation of ducted infrastructure to support operation of utility systems. These systems could be used for alternative utilities, unlocking a new revenue stream for gas operators, as well as deployment of fibre optic monitoring, helping to better understand the state of their existing gas asset networks. To achieve this, any deployed system needs to be technically, commercially, operationally, and regulatorily feasible. The feasibility of using the ducted infrastructure for monitoring in pipe conditions and surrounding conditions will also be assessed as part of this project, providing a potentially significant benefit to gas distribution network operators as the system looks to transition towards net zero.

Third Party Collaborators

nuron

Analysys Mason

DNV

Nominated Contact Email Address(es)

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Problem Being Solved

The future of GB Gas Distribution Networks (GDNs) is uncertain and complex (2023). In some areas gas distribution networks providing energy for heat may potentially be replaced entirely by electric alternatives such as heat pumps/district heat solutions, leaving significant areas of gas distribution assets redundant/stranded. Alternatively, in a "High Gas Use Future" (HGUF), GDNs will be required to distribute a higher percentage of low carbon gases such as Hydrogen and Biomethane. To efficiently distribute higher

volumes of low carbon gases effectively, network operators need more information on how their networks are operating.

The High Pressure Transmission System and Local Transmission System (LTS) are well monitored and controlled, utilising SCADA technology, with any leaks being either readily detected by conventional technology or highly visible, however it should be noted that methane leakage at significant quantity on the LTS is an extremely rare occurrence. The Low and Medium Pressure Systems are not currently monitored to the same extent as the High Pressure Systems.

Traditionally, gas network emergency operations are managed reactively, with network operators responding to issues such as public reported gas escapes (PRE's) or pressure problems. The reactive nature of managing the Gas Distribution Network ("GDN") is in part due to digitised and sensitive monitoring equipment not being widely distributed enough to detect low-level leakage. Overall, this means it is not cost effective to deploy traditional monitoring technology at scale to the density required to fully detect issues in the network.

Transitioning the GDNs to a net zero future and managing the complexities of the transition will not be feasible without more real time data on network conditions. Given the uncertainty of the future of gas networks, it would also be prudent to explore the diversification of gas network asset utilisation to ensure the GDN organisations retain a high percentage of their asset value in the future.

Method(s)

The project will be split into 4 Work Packages.

WP1

- **Technical Requirements Report:** Operational, and technical requirements. This provides the basis that any designed system would need to meet to be considered viable.
- **Analysis of Network (Report):** Review of the network and features to be navigated
- **Literature Review:** Document existing techniques and prior work done on installing payloads into pipes
- **Concept Analysis:** Develop high level concepts for the installation of payloads into gas pipes

WP2

- **Monitoring Requirement Report:** Desired monitoring requirements of gas operator
- **Monitoring Literature & Patent Review:** Document existing techniques and prior work done on gas pipe monitoring from within pipes
- **Monitoring Feasibility Report:** Report setting out parameters that could be monitored and design considerations to be implemented

WP3

- **Regulatory Review Report:** Report setting out regulatory considerations and findings relating to the installation of infrastructure into gas pipes and use of infrastructure for commercial purposes
- **Commercial Review Report:** Report setting out a high level fibre market review, potential customers and analysis of demand potential

WP4

- **Final Report:** This report will summarise the project findings, evaluate the phases above the success criteria and recommend next steps.

Scope

In Scope

Technical Review (Installation)

- Current network coverage and architecture
- Operational processes
- Design requirements & considerations
- Overview of fibre deployment options and methodology

- Review of required payloads for other uses e.g. Hydrogen
- Example network architecture and design
- Simulation and modelling of typical installation ranges

Technical Review (Asset Monitoring)

- Monitoring requirements
- Overview of existing monitoring capabilities vs fibre monitoring options
- Recommend monitoring options to take forward to PoC

Technical Review (Legal and Regulatory)

- Analysis of existing contracts for limitations and allowances
- Review of relevant national and local regulation

Commercial Analysis

- High level market review of wholesale fibre market
- Existing service providers, market share and network owners
- Analysis of demand/potential demand for fibre
- High-level potential revenue opportunities
- Commercial model options to exploit revenue opportunities.

Out of Scope

- Commercial/Implementation business case development
- Building proof of concept prototypes

Objective(s)

1. Identify the risks of installing a ducted infrastructure into a live gas pipe
2. Identify the technical requirements for the installed system
3. Identify the operational considerations and potential feasible solutions that need to be made for the installed system so that it does not impact operation of the network
4. Identify the techniques best used to monitor in pipe conditions using the ducted infrastructure
5. Identify other revenue streams for the NGN network

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

For customers in vulnerable situations, it will provide a more reliable network as maintenance to the gas network is proactive and minimises disruptions. It will also provide them access to a competitive fibre-based broadband network.

By assessing alternatives for repurposing gas distribution assets will ultimately result in a reduction of stranded assets, this will prevent

commercial losses against assets that are invested in using gas bill contributions, overall enabling value for money for customers.

Real Time in-pipe monitoring is a new consideration for how GDNs monitor and manage their systems, this proactive approach to managing the network will result in lower network operating costs (OPEX) & more efficient and targeted maintenance. The fibre network installed into the infrastructure gives gas customers access to a competitive fibre broadband market, either expanding their choices for this or providing first access.

Success Criteria

Minimum Criteria (Must and Should):

Solution requires modest changes to standard procedure- Operational procedures are still possible with only modest changes

Some regulator objections- Regulators have some issues with installing ducted infrastructure, so technology requires modifications to be able to pass

Moderate cost- Solution is commercially viable in a reasonable subset of situations

Able to detect a few in pipe conditions with some design considerations required- The installed ducted infrastructure is able to detect a few parameters, but the system has to be adapted a moderate amount to accommodate the monitoring

NGN asset could be used to deploy fibre networks is available in areas of demand- Review market demand areas and overlay on NGN asset mapping across their service area.

Desirable Criteria (Could):

Solution requires minimal changes to standard procedure- Operational procedures are still possible with only small changes

No regulator issues- Regulators have no issues with installing ducted infrastructure so NGN can proceed as desired

Low cost- Solution is easily commercially viable in a wide variety of situations

Able to detect a wide range of in pipe conditions with minimal design considerations required-The installed ducted infrastructure is able to detect many parameters without having to adapt the system to accommodate the monitoring very much

Market for fibre networks in the region- There is demand in the region for fibre networks which could be served through NGN assets

Project Partners and External Funding

nuron - Performing the technology, operational and monitoring feasibility studies

Analysys Mason - Performing the high level commercial and regulatory feasibility study, including a review of common operating & health and safety standards.

DNV - to assess the impact of installing a ducted infrastructure into a gas pipe on the operational and regulatory procedures. They will:

- attend workshops with NGN and nuron on requirements capture and design review;
- provide a desktop review of proposed concepts against relevant requirements; regulations; and network operation methods to provide a risk-based assessment of each; and
- review proposed mitigations against identified risks.

Potential for New Learning

This project will develop an understanding of the technical, operational and regulatory requirements for a ducted infrastructure installed into gas assets. This will be done through requirements capture with key stakeholders and then assessing the different aspects of a solution against these criteria. The regulations relevant to such a solution will be investigated to determine if it is feasible and if any

special considerations will need to be made in order to deliver a workable solution. This can be combined with examining the use of fibre optic monitoring to extract actionable insights from the network. The commercial implications to the gas network operator can also be examined to see how best to exploit this new infrastructure. The project will also provide an opportunity to modify relevant operational maintenance activities to work with the installed infrastructure.

Scale of Project

This project seeks to combine the outputs from previous research, applications within the wastewater network and the latest fibre technology to develop a viability study. Developing the understanding of alternate approaches for GDNs in High & Low use gas scenarios. As such this is a research based project and not seeking to undertake capital build.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

This project will be limited to the North and North East of England within Northern Gas Networks geographical area

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External Costs- £161,757.20

Internal Costs- £23,232.00

Total Costs- £184,989.20

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:

This project seeks to develop techniques for installing ducted infrastructure into current gas distribution assets. This will allow for diversification of gas networks assets allowing for the transition towards greener gas sources and/or installing a fibre broadband network within the live pipelines.

How the Project has potential to benefit consumer in vulnerable situations:

For customers in vulnerable situations, it will provide a more reliable network as maintenance to the gas network is proactive and minimises disruptions. It will also provide them access to a competitive fibre-based broadband network.

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)

N/A

Please provide a calculation of the expected benefits the Solution

This is a research based project. The work will:

This project aims to determine the feasibility of repurposing existing (live) gas assets to include a multi-utility ducting system, capable of providing safe operating space for 3rd party utilities such as electricity networks and telecommunications (Fibre). The key principle behind this is to extend the asset value of existing gas distribution assets, additionally reducing potential value risks associated with future UK Government Policy decisions. Furthermore, the process behind repurposing existing assets also provides inherent societal value by reducing the cost and disruption associated with upgrading and extending existing utility networks.

Additional value for Northern Gas Networks centres around the future potential associated with using fibreoptics to identify asset damage, easement infringement and potential leakage.

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

Once this approach has been established and proven to be viable, there would be no obvious reason the same methodology could not be applied to the wider GB. Unlocking the potential for all GDNs to retain asset value after decommission and unlock additional revenue streams.

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

The cost of rolling out the method across GB is unknown at this time as the project will finish at a high end TRL 2, so to outline a cost further development would need to be completed.

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 will develop an understanding of the technical, operational and regulatory requirements for a ducted infrastructure installed into gas assets. This will be done through requirements capture with key stakeholders and then assessing the different aspects of a solution against these criteria. The regulations relevant to such a solution will be investigated to determine if it is feasible and if any special considerations will need to be made in order to deliver a workable solution. This can be combined with examining the use of fibre optic monitoring to extract actionable insights from the network. The commercial implications to the gas network operator can also be examined to see how best to exploit this new infrastructure. The project will also provide an opportunity to modify relevant operational maintenance activities to work with the installed infrastructure.

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

Is the default IPR position being applied?

- Yes

Please demonstrate how the learning from the project can be successfully disseminated to Network Licensees and other interested parties.

NGN and nuron will promote the project at forums and conferences to promote the project, its outputs and learnings.

Please describe how many potential constraints or costs caused, or resulting from the imposed IPR arrangements.<

The project has been conceived and scoped to comply with the standard NIA IPR arrangements. Therefore, there are no additional costs and constraints that are expected to affect the project.

Please justify why the proposed IPR arrangements provide value for money for customers.

The current IPR arrangements allow for Northern Gas to use the findings to plan for future scenarios whether that's in a HGUF or a LGUF, the viability determined can assist with the internal decisions. Specifically to increase the networks resilience and retain the assets value.

Similarly, nuron can continue the development of their optical fibre solution to meet the needs of the projects outcomes.

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.

While there has been work deploying fibre optics within the upstream oil, gas wells and water pipes, there hasn't been work on deploying a ducting for fibre in the downstream gas sector. This will be a first to determine the viability of having a ducted service within a live gas pipe.

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

Whilst installing fibre cables was attempted in the early 2000's it never progressed to scale in part due to not being commercially viable at the time. Since then, there have been numerous advances in both fibre cable, micro-duct and installation technologies. Maintenance procedures and regulation frameworks for GDNs have also advanced in this time. As such the feasibility of all aspects of a potential system will still need to be assessed in the current gas network environment to determine their suitability.

This research project is novel as there is no known GDN systems that currently incorporate fibre-based monitoring into the design. As such a dual-purpose ducted infrastructure/monitoring solution is novel and provides multiple benefits to gas operators.

Relevant Foreground IPR

The project and the resultant outcomes/deliverables will conform to the default treatment of IPR as set out under the agreed NIA Governance (where the default requirements address two types of IPR: Background IPR and Foreground IPR).

Data Access Details

For all data access requests, please follow the guidance set out in Northern Gas Networks Innovation Data Sharing Policy. <https://www.northerngasnetworks.co.uk/ngn-you/the-future/our-funding/>

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The projects low TRL and no other previous applications advancing to a suitable level makes this project beyond the scope of Northern Gas Networks business as usual activities. As GDNs move closer to the potential death of gas scenario and/or the potential for transporting alternate fuels it needs further investigation with ducting housing fibre being a potential solution.

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

This project is highly innovative and future-facing that supports Northern Gas Networks in supporting a market that has not yet emerged and still has a number of risks to overcome to develop into a mass market proposition.

This project has been approved by a senior member of staff

Yes