

NIA Project Registration and PEA Document

Date of Submission

Dec 2023

Project Reference Number

NIA_NGN_432

Project Registration

Project Title

MASiP- Digital Integrated Monitoring System

Project Reference Number

NIA_NGN_432

Project Licensee(s)

Northern Gas Networks

Project Start

September 2023

Project Duration

0 years and 4 months

Nominated Project Contact(s)

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Project Budget

£37,500.00

Summary

The project seeks to investigate the deployment and use of MASiP (Mobile Automated Spiral Intelligent Pipe) in NGN's network. MASiP is an integrated approach to digital integrity monitoring, automated mobile pipe manufacture and flexible pipe structure. The system allows for a better monitored network, increased network resilience and prepare the network for elevations in pressures, transporting of green fuels and gather data on high priority locations. The project will be a desktop study to identify the feasibility and viability of deploying such a system onto the network. Detailing the applications within high priority crossings and the creation of new hydrogen pipelines.

Nominated Contact Email Address(es)

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Problem Being Solved

A challenge faced by NGN is that inspection – especially of sensitive pipeline sections like crossings - is infrequent and usually only provides visual examination or external direct assessment data about pipeline integrity. There will be enhanced challenges regarding pipeline integrity, including from customer concerns about hydrogen. NGN are currently in the process of replacing all Tier 1 gas pipes, to ensure that Tier 1 pipes are removed by the end of 2032 or earlier. As well as replacing these pipelines, NGN are looking towards the future with the introduction of hydrogen into the pipeline system. For a system where hydrogen is being introduced, higher pressures or flows will be required to maintain an equivalent calorific value as per natural gas. Assuming this is primarily pressure, anything below HP operates under 7Bar. To accommodate the lower calorific value with the introduction of Hydrogen, without increasing the diameter of the pipes the pressure would need to be increased up to '21Bar or higher'. Current use of PE Low Pressure, Medium Pressure & Intermediate Pressure pipelines on their own would not be achievable due to the limiting operational pressure of 7Bar.

Method(s)

WP1: Review of information on two chosen use cases-

- Collate existing data on number, diameter, pressure rating, material and installation data of existing crossings
- Introduce high level potential benefits of MASiP
- Evaluate areas of key assumptions and/or missing data for case 1 crossings
- Evaluate areas of key assumptions and/or missing data for case 2 hydrogen

WP2: Questionnaire to identify quantum and potential value of first use cases-

- Draft questionnaire and help with the collection of detailed information
- Review and amend as necessary based on WP1
- Issue for completion
- Responses developed
- Completed Questionnaires returned

WP3: Feasibility review-

- Project risk matrix developed and updated
- Engineering feasibility evaluation for use cases
- Commercial feasibility evaluation for use cases
- HSE feasibility evaluation for use cases
- Regulatory feasibility evaluation for use cases

WP4: Cost Benefit definition

- Identify the key evaluation criteria for MASiP cost benefit against existing installation
- Develop simple economic model for use categories
- Evaluate results with NGN input and iterate as required

WP5: Feasibility study review with NGN-

- Technical and regulatory review for both categories
- Commercial review for both categories
- Identification of key next steps

WP6: Project reporting-

- Project review meeting
- Develop rolling report
- Prepare final report
- Project final report

Scope

In Scope:

- Review of NGN's existing network and identify data issues in particular with regards to crossings
- Identification of the key challenges both short and long term
- High level feasibility assessment of MASiP in relation to GDNs challenges
- Preliminary cost benefit analysis

Out of Scope:

- Detailed technical evaluation of MASiP installation
- Detailed cost estimation
- Integration with NGN systems

Objective(s)

- Assess the feasibility of implementing the MASiP pipeline system into the NGN network for the chosen use cases.
- Investigate the technical, operational, commercial, and safety aspects of deploying MASiP in high-priority crossings and new hydrogen pipelines.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

The MASiP pipelines have the ability to increase the Networks Resilience by maintaining a continuous supply to the customer, protecting those in vulnerable positions. The risk of loss of supply to the customer will be reduced from an enhanced digital monitoring inspection regime.

The solution will help reduce the eventual cost of transitioning to net zero through future proofing the gas grid for Hydrogen use. Additionally to the pipe itself, the construction of the pipeline can be completed faster, safer and more environmentally friendly with reductions in the Carbon footprint and greater operational efficiency.

Success Criteria

Minimum Criteria (Must and Should):

Moderate cost- Solution is financially viable to be deployed within the Gas Distribution Network

Ability to monitor a few pipe conditions- the optical fibre could detect a few parameters for pipe condition and real time monitoring

Ability to increase the pressure threshold of PE pipe- the addition of the steel wrapping should increase the working pressure capacity of the system

Desirable Criteria (Could):

Low cost- Solution is easily financially viable to be deployed within the Gas Distribution Network

Ability to monitor a wide range of pipe conditions- the optical fibre can detect a multiple parameters for pipe condition and real time monitoring

Ability to increase the pressure threshold of PE pipe- the addition of the steel wrapping should significantly increase the working pressure capacity of the system

Project Partners and External Funding

Sustainable Pipelines Solutions- Performing the Operational, Technical, Regulatory and Commercial Feasibility studies

Potential for New Learning

This project will develop an understanding of the operational, regulatory and technical requirements for an optical fibre wound asset. This will be done through exploring two specific use cases for the system and assessing if the specific criteria can be met. The project will look to provide an opportunity to modify relevant operational maintenance activities to work with an optical fibre integrated pipeline. The regulations specific to this solution will be investigated to determine the viability of deploying such a system within both use cases.

Scale of Project

This project is a desktop based research piece, therefore not seeking to undertake capital build.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The 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- £30,000

Internal Costs- £7,500

Total- £37,500

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:

The MASiP pipeline structure is more resistant to hydrogen embrittlement than girth welded steel pipe and its introduction will facilitate the hydrogen transition enabling pressures to be raised across the network for hydrogen pipelines. The introduction of integrated optical fibre allows for real time monitoring assisting the GDNs with the management of their asset.

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)

N/A

Please provide a calculation of the expected benefits the Solution

This project is a desktop study, at this stage of the project there has been no calculations however with further phases this could be achieved.

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

Once this solution has been established and proven to be viable, there would be no obvious reason the same methodology could not be applied to the wider UK GDNs.

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

The cost of rolling out the method across the UK is unknown at this time as the project will finish at a TRL3, in order to outline a roll out cost further development would be required.

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 project will create the following insights:

- Potential to reduce pipeline cost, construction schedule and [L1] [a2] carbon footprint
- Potential to improve insights into pipeline condition by real time digital monitoring inside the pipe without invasive procedures
- Gain knowledge about the deployment of integrated optical fibre and data interpretation for real-time monitoring of operational parameters and threats to enhance the overall integrity management practices across the NGN network.
- Preparing NGN for the potential transition to hydrogen as an energy source and help them select appropriate infrastructure for hydrogen.
- On how to optimise construction processes, reduce project timelines, and minimizing environmental impact for future pipeline projects.
- Add to NGN's knowledge base for pipeline material selection and maintenance practices

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.

The feasibility report documenting the findings, technical evaluations, operational considerations, commercial implications, and safety assessments of implementing MASiP can be made available to all stakeholders, including gas distribution companies, industry regulators, and relevant government agencies. Additionally, joint technical papers and presentations can be planned at workshops, seminars, and conferences to present the project's outcomes and share best practices with key players in the gas distribution sector.

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

N/A

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

The proposal will utilise knowledge specific to SPS and apply that for the benefit of the network

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.

There has been background research put in prior to look at previous projects, with no similar solutions existing within the market. The project notification form has been uploaded onto EIM GIGG, with other networks having sight of the project and will be posted onto the Smarter Networks Portal.

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 project is innovative due to the introduction of new technology within the onshore pipeline construction market with three elements a) composite pipe structure b) automated in-field manufacture c) built-in real time integrity sensing. The potential for future proofing for possible hydrogen use could be a game changer. Using helically high strength steel strip with a patented steel interlock system and optical fibre has not been tried before as a means of enhancing the pressure rating. Sustainable Pipeline Solutions patents are evidence of innovation.

Further evidence is that the technology has won a series of Innovate UK funding awards over several years for which technology that has already been used or tried are ineligible.

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 project looks at a solution that is going through testing but is unproven for the use cases we will look to deploy. The solution itself will look to incorporate many vectors that currently aren't within the gas distribution network and its capabilities currently haven't been explored. As GDN's move towards a future where data from the network and monitoring will become more important. On top of that the potential to have a reinforced green fuel ready pipe that can handle higher pressure tiers than current HDPE pipe.

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 explores aspects of a system that haven't been deployed within a gas distribution network in the UK. One of the solutions main benefits is the pipe systems compatibility with Hydrogen and the ability to handle gas at higher pressures than traditional HDPE pipes. This aspect to the solution poses a risk to the scale of benefits the system may produce, due to existing regulations stating pipes 7Bar and above must be Steel. This will be an obstacle that would need to be overcome to enhance the solutions potential benefits.

This project has been approved by a senior member of staff

☒ Yes