

NIA Project Registration and PEA Document

Date of Submission

Jun 2023

Project Reference Number

NIA_NGT0204

Project Registration

Project Title

AGI Pipework Integrity Monitoring for Hydrogen – Phase 1

Project Reference Number

NIA_NGT0204

Project Licensee(s)

National Gas Transmission PLC

Project Start

June 2023

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Peter Martin, box.GT.innovation@nationalgrid.com

Project Budget

£86,666.00

Summary

This project aims to identify the possible new risks and threats to Above Ground Installation pipework associated with the introduction of Hydrogen into the National Transmission System as part of the transition to net zero and understand the capability of our current inspection and monitoring methods against them. There will also need to be a technology review to understand the potential technologies/techniques that could be applied to NTS AGIs in a future Hydrogen network to address any new integrity threats. This will help inform future phases of innovation work where we can demonstrate and test new integrity systems for potential use on a Hydrogen network in the future.

Nominated Contact Email Address(es)

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Problem Being Solved

On the National Transmission System there are hundreds of Above Ground Installations (AGIs) that comprise of above ground assets that enable Natural Gas to be transported around GB at sites such as block valves, multi-junctions, offtakes, terminals and compressor stations.

AGIs mainly consist of above ground pipework onsite, along with other connected assets and some sites are more complex than others. As these sites transport natural gas at high pressure, it is imperative that the integrity of assets is well maintained to reduce the risk of any gas escape, therefore GT&M have integrity management processes in place for all high pressure pipework to manage this.

Hydrogen is likely to introduce new threats and challenges to the management of our pipework on AGIs; there is already significant work going into investigating how we manage our main pipelines for Hydrogen operation where we can inspect using Pipeline Inspection Gauges, however most pipework on AGIs is much more challenging as we cannot internally inspect in the same way.

For one example, currently corrosion on site above ground pipework is monitored via visual inspections. These inspections always have an element of subjectivity in categorising the severity of defects and do not directly quantify the remaining pipe wall thickness on the pipework at the time of inspection. This is something that is only defined upon further targeted intrusive inspection which is carried out separately to the visual inspection. This is one area that could potentially be improved upon if required on a Hydrogen NTS.

Method(s)

The project will be divided into 3 Work Packages:

Work Package 1: Impacts of Hydrogen on AGI Pipework Integrity Management Review

Led by – ABB

- Gather required data to review the existing operation, inspection and maintenance for the AGI pipework.
- Confirm the scope and agree the boundary limits within a typical NTS AGI.
- Assess existing techniques being utilised by NG to inspect and monitor degradation of the AGI pipework.
- Assess existing ageing on typical AGI.
- Conduct an RBI to address the integrity threats for a typical AGI, operating with hydrogen gas
- From the RBI, identify potential gaps in current techniques for inspection and monitoring, for operation under hydrogen
- Write up and issue a summary, identifying new potential gaps or changes in operating under hydrogen (output from the RBI) and identify for a typical AGI, the ideal pipework integrity management system.

Work Package 2: Integrity Management Technology Review

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- Conduct a desktop review of existing and future technologies for inspection and monitoring of the threats identifies in workscope
- 1. ABB ACE Program would be utilized to enable this to be a collaborative view of both existing and future technologies.
- Identify the technical limitations, economic cost and effectiveness of each of the technologies identified.
- Benchmark the technologies and practices against TRL levels and other operators operating hydrogen pipework. Score and rank the technologies identified.
- Look at technical and economic advantages of integrating the technologies, utilising IoT connectivity, into a digital twin for a typical AGI

Work Package 3: Reporting

Led by - ABB

- Collate the findings from work scope1 and work scope2 into a report that can support knowledge sharing and collaboration with future projects and NIA funded projects.

Measurement Quality Statement

The measurement approach used to meet Data Quality objectives will be through the identification of high calibre project partners whom are experts in their given field and the use of real data and materials from National Grid sites. In this instance the project will be a demonstration to inform new insights into the use of Metering systems with the ability to measure varying blends of hydrogen. The design and fabrications of the testing unit will adhere to Gas Transmission technical standards and the test procedures will determine the optimum Design of Experiments for the variables and systems in question.

Data Quality Statement

The project will be delivered under the NIA framework in line with OFGEM, ENA and NGGT internal policy.

Data produced as part of this project will ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal SharePoint platform ensuring backup and version management.

Scope

IN SCOPE

- Integrity management for these assets:
 - o Above Ground Pipework assets on AGIs
 - o Unpiggable buried sections of pipework on AGIs
- All Integrity threats associated with introduction of Hydrogen. Examples including:
 - o Corrosion risk
 - o Embrittlement
 - o Vibration

OUT OF SCOPE

Buried pipelines outside AGI boundaries (i.e mainline feeders)

Objective(s)

- To assess the effectiveness of current integrity management processes on AGIs against potential new threats associated with the introduction of Hydrogen into the NTS
- To complete a technical assessment of integrity management technologies and techniques to understand and compare their potential for use on a Hydrogen network

To determine what an optimum integrity management system could look like on the NTS transporting Hydrogen

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register. This project has been assessed as having a neutral impact on customers in vulnerable situations. This is because it is a transmission project.

Success Criteria

- Assess technical capability of existing AGI pipework integrity management processes

- Hydrogen Impact Assessment Technical summary
- Technical Review completed
- Technical assessment
- Use case development
- Future test/demonstration regime developed
- Final technical and closure reports

Project Partners and External Funding

Gas Network – National Grid Gas Transmission

Main Project Partner - TUV

Potential for New Learning

- Identification of integrity threats associated with Hydrogen that may be unique to pipework assets on above ground installations
- Identify possible gaps in current integrity management techniques for above ground installations once Hydrogen is introduced, and also assessing new technologies that may assist with the transition

Scale of Project

At this stage, a 6 month desktop study is the appropriate scale to establish future requirements for managing Hydrogen pipework integrity on NTS AGIs. Future phases will be also scaled as appropriate, likely requiring more practical elements such as demonstrations and testing.

Technology Readiness at Start

TRL1 Basic Principles

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

United Kingdom

Revenue Allowed for the RII Settlement

None – Hydrogen network focused project

Indicative Total NIA Project Expenditure

Total Costs: £86,667

External Costs: £65,000

Internal Costs: £21,667

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:

So far, many Hydrogen focussed innovation projects are looking at the implications of Hydrogen transport on mainline buried feeder pipelines on the National Transmission system, however this project shall ensure that there is also the key consideration for pipework on Above Ground Installations as there may be unique challenges in this area. Once Hydrogen is introduced into the NTS, we need to ensure that the appropriate integrity management processes are in place, as today's natural gas focussed processes may not be entirely fit-for-purpose in a Hydrogen future, therefore this project is set out to understand whether this is the case, and what solutions may be options to use.

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)

RIIO-1 Question N/A

Please provide a calculation of the expected benefits the Solution

N/A

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

The findings from this project will be also applicable to the distribution network operators, as they also have AGIs they manage. The challenges identified in this project will also be faced by them, and so any findings here will be shared across all other operators.

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

The costs of rolling out a method across GB are not yet known, as the possible solutions are to be identified as part of this project.

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

All of the findings from this project shall be relevant to the other relevant network licensees, namely Distribution networks. Any AGI that is to be repurposed for Hydrogen service, either blended or pure Hydrogen, will need an effective integrity management approach that is suited to Hydrogen. The challenges we will face on the NTS shall be similar to those encountered by DNs.

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

RIIO-1 Question N/A

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.

There will be no duplication of activities done as part of this project. These efforts are to ensure the energy transition can be undertaken at as low a cost as possible to the consumer. The project scope has been notified to all other gas network operators to ensure that there is no duplication taking place.

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 is to explore the impacts of Hydrogen on the integrity of existing National Transmission System assets, something which has not required to be considered in the past for Natural Gas service. This therefore requires innovative solutions to overcome the potential new integrity threats associated with Hydrogen. This project will be looking at the existing integrity management techniques from a different perspective, which will not only benefit the future Hydrogen network but also the network as it is today.

Relevant Foreground IPR

This 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

Data for this project, and all other projects funded under the Network Innovation Allowance (NIA) funding scheme, can be found or requested in a number of ways:

- A request for information (RFI) via the Smarter Networks Portal at <https://smarter.energynetworks.org>. National Grid Gas Transmission regularly publishes much of the data arising from our innovation projects on the ENA portal, before submitting a RFI check this website.
- Via our managed mailbox box.GT.Innovation@nationalgrid.com. Further data can be shared upon request through the innovation mailbox. Each request will be assessed by the GT Innovation Team for its merits and viability.

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

Current business as usual activities are not funded for Hydrogen related work and so this shall be utilising innovation funding.

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 approach is unknown and there are many routes that could be taken, there is a risk that without this work the different energy networks would spend time and money on carrying out the research and testing. The NIA funding reduces this risk and enables

This project has been approved by a senior member of staff

Yes