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

Sep 2023

Project Reference Number

NIA_NGT0210

Project Registration

Project Title

Lower Cost Excavation and Repair for Hydrogen Pipelines

Project Reference Number

NIA_NGT0210

Project Licensee(s)

National Gas Transmission PLC

Project Start

September 2023

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Ian Bennett, box.GT.innovation@nationalgrid.com

Project Budget

£330,185.00

Summary

This project aims to identify the differences between excavating and repairing a high pressure natural gas pipeline as we do today with a Hydrogen transmission pipeline in the future. Using this information, we want to understand the procedure changes that may be needed for Hydrogen excavation and repair, as well as beginning to identify possible solutions to make these excavations more efficient in terms of safety and cost. This project shall outline the key safety considerations for Hydrogen excavations and therefore determine the requirements for safe and cost-effective Excavations and Repair, for Hydrogen pipelines.

Third Party Collaborators

Jacobs

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

On our gas networks there is a requirement to excavate to gain access for further inspection of possible defects and repair, to ensure continued safe and efficient operation of the network.

There are already robust procedures in place for the excavation and repair of our pipelines, specific to the transport of Natural Gas however if we introduce Hydrogen into the network, we will need to understand how excavation processes could be impacted. This will require an understanding of the differences between Hydrogen and Natural Gas in an environment where excavations are taking place. If there are significant new safety risks, we shall need to investigate methods of mitigating or removing these.

As typically excavations are a significant cost, this project also provides an opportunity to assess the efficiency of existing excavation and repair methods used on the gas network and investigate alternative methods that could provide cheaper excavations, whilst still maintaining the appropriate safety standards, for both the existing Natural Gas network and future Hydrogen network.

Method(s)

Work package 1 will begin with an information gathering phase, working closely with National Gas Transmission and Wales & West Utilities leveraging the considerable experience within Jacobs to build a full picture of the current methodologies used on pipeline excavation and repair, and the associated costs. This will involve reviewing documentation, learning from the experience of the Jacobs gas engineering team, and conducting interviews and workshops with relevant stakeholders. This information will then be reviewed by a multidisciplinary team of experts to understand how things are done, why they are done that way, the safety risks, and the costs for pipeline excavation and repair. All of this will then be summarised in a detailed report. This process will be used for both package 1a and 1b, creating reports for the NTS and local distribution system.

Work package 2 will similarly begin with gathering information, studying the IGEM's guidance on hydrogen, and using expertise within Jacobs to identify any potential differences between natural gas and hydrogen and looking at how they may impact on the excavation and repair processes. Using the knowledge from work package1a, a report will be produced highlighting how hydrogen may impact on pipeline excavation and repair, setting out the requirements for safe excavation and repair of hydrogen pipes. Again, two reports will be produced, one focussing on the NTS and the other on the local distribution system.

Work package 3 will begin with an investigation into global examples of hydrogen pipework excavation and repair, as well as looking at other innovative projects that may have faced similar challenges and where lessons can be learnt. This will be followed by a detailed look at excavation techniques, both existing processes and solutions that are in development, that could be used to meet the requirements for hydrogen excavation identified in work package 2. Using Jacobs extensive robotics knowledge, the use of robotics will be investigated to identify whether robotic solutions could meet the requirements and whether it could lead to cost saving and improvement in safety. A report will be compiled summarising potential solutions that are available based on the requirements from work package 2 and detailing if and where robotics could provide and a suitable solution. Based on the work from these 3 work packages, recommendations for possible next steps in how to take this forward will be provided.

Finally, for work package 4 a technical report covering all aspects of the work carried out will be produced and following review and acceptance an ENA closure form will be completed.

Measurement Quality Statement

The measurement approach used to meet Data Quality objectives will be through the identification of high calibre project partners who are experts in their given field. The methodology used in this project will be subject to our supplier's own ISO 9001 certified quality assurance regime and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and made available for review.

Data Quality Statement (DQS)

The project will be delivered under the NIA framework in line with the agreed Energy Networks Innovation Process document NGGT / NGET internal policies. Data produced as part of this project will be subject to quality assurance to 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. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Scope

IN

Process of excavating down to access buried high pressure natural gas pipelines, including onsite at Above Ground Installations
Hydrogen excavation considerations
Repair of pipelines after excavation
Pipeline operating processes required to facilitate excavations
Method/Technology review for excavation techniques

OUT

Development of solutions
Above ground pipework

There is a lot of ongoing work to identify the most effective route to meet net zero in the UK and this project is one of many projects to evidence the major or minor role hydrogen will have in different scenarios. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save £millions with minimal gas customer disruption verses alternative decarbonisation solutions'. The exploration into cheaper methods of excavation can also further support the financial benefits of the energy transition.

Objective(s)

Evaluate the existing excavation and repair processes for gas pipelines, to provide a baseline scenario to compare future Hydrogen requirements against
Investigate the potential changes required to our existing excavation processes for a Hydrogen network, taking into consideration any changes in safety risk associated with H2
Outline key requirements for future excavation and repair processes under Hydrogen/Hydrogen blends, identifying the key differences between Natural Gas and Hydrogen
Investigate existing or in-development excavation methods/technologies that could provide solutions to improve excavation efficiency in terms of costs and safety with Hydrogen pipeline operation
Determine whether the use of robotics could help improve the efficiency of excavate and repair activities
Provide next steps for further solution development using the information collected in the project

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

- Completed work package reports and technical summaries
- Evidence of thorough technical review on existing excavation and pipeline procedures
- Next steps for further development identified
- Final Technical report is delivered from supplier.
- National Grid review and accept technical report.
- ENA Project Closure form is also populated by supplier.
- Project is registered as complete.

Project Partners and External Funding

National Gas Transmission – £129,926

Wales & West Utilities - £117,713

The project partners for the project will be Jacobs (£247,639); the project will be fully funded via NIA.

Potential for New Learning

· Understand the impacts that the introduction of Hydrogen into our pipelines, whether blended or 100% H2, will have on our existing pipeline excavation and repair methods. The learnings from this will impact all other gas networks and so outputs shall be shared via ENA portal. Where necessary, separate dissemination events shall be completed with networks.

· Identifying potential new methods that could be applied to reduce the cost of excavations as well as identified safety aspects

Scale of Project

At this stage of the challenge, a desktop study is an appropriate project to identify the specifics of the challenge as well as determining whether or not there is value in carrying on with next steps and developing the TRL level. The duration of the project is ideal for answering this question, there would not be as meaningful output for a shorter project, and at the same time a longer project is not the right choice at this time.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

United Kingdom

Revenue Allowed for the RIIO Settlement

None – Hydrogen network focused project

Indicative Total NIA Project Expenditure

WWU External: £117,713 WWU Internal: £39,238 NG External: £129,926 NG Internal: £43,308.33 Total: £330,185.33

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:

If the existing gas networks transition to transporting Hydrogen, the requirement for accessing buried pipelines for maintenance activities will remain. Therefore we must explore what this will look like in practical terms for existing excavation and maintenance procedures. Being able to excavate and repair our pipelines containing Hydrogen will ensure that we can continue to operate and maintain our networks to the required standard.

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

n/a – Research project

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

Identifying new methods for improved excavations in Hydrogen will be replicable across GB if it is deemed to be successful. It could potentially be applicable across all Transmission buried pipelines as well as a significant number of distribution pipelines. It is important to note that there will also be benefits to the existing natural gas network, rather than just specific to a Hydrogen network.

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

This is something that the project itself will aim to establish on an individual case basis, rather than the costs associated with rolling out a solution across GB. This is something that would be confirming in a more developed TRL level 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

Excavation and repair procedures of buried pipelines are completed by all gas network operators and so the information that is gathered during this project, and recommendations for Hydrogen operation, can be utilised by all gas network operators.

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

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 is no duplication. Project has been notified to the other network operators to ensure this, and participation for collaboration offered out to all.

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

Excavation and repair procedures on a high pressure Hydrogen transmission pipeline have not been looked at previously; it is something that is not part of business as usual on the natural gas network. The potential for automating both processes would also be a first for transmission pipelines.

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 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@nationalgas.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

Hydrogen projects cannot be funded as part of business as usual activities

This project has been approved by a senior member of staff

☑ Yes