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 2024

Project Reference Number

NIA_NGT0237

Project Registration

Project Title

CHIP Composite Pipelines

Project Reference Number

NIA_NGT0237

Project Licensee(s)

National Gas Transmission PLC

Project Start

September 2024

Project Duration

0 years and 6 months

Nominated Project Contact(s)

Helen Dugdale, box.GT.innovation@nationalgas.com

Project Budget

£229,464.00

Summary

This short-term project will explore the feasibility and practicality of using composite pipelines to transport hydrogen. Composite pipelines potentially offer a number of advantages over traditional steel, such as good corrosion resistance, high specific strength, whilst remaining lightweight and being less prone to infiltration. However, the industry is not mature and the feasibility of utilising composite pipelines in the short-medium term is not understood.

This project will look at the potential applications where composite pipelines could be used and review the composite technology available for this purpose. It will then provide an understanding of the competency landscape in the UK, both from the perspective of the UK workforce and available specifications and standards.

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

The potential for the use of composite pipelines is not well understood. From a technical perspective, they appear to offer an attractive solution for the transport of hydrogen, given their good compatibility with hydrogen, lightweight nature, high specific strength and good corrosion resistance. However, composite pipelines are not an industry standard and face a number of practical barriers to their use for hydrogen transportation. These potential issues will be explored during this project: such as understanding any capability of the UK workforce, the standards and specifications that are available and how these factors may affect the supply chain for composite pipelines in the short to medium term.

Method(s)

WP1: Understanding Composite Applications

1.1 Uses of Composites for CHIP applications

1.2 Identification of project use cases

1.3 Literature Review

1.4 Development of composite selection guidelines

WP2: Demonstrating Competency for Composite Pipelines

2.1 Availability of skilled composite workforce

2.2 Assessment of available training

2.3 Review of specifications & standards

WP3: Standards & Reporting

3.1 Technical Report

3.2 Technical Summary

3.3 Closure Report

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 and NGT 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

The scope of the project is to understand the potential for hydrogen transportation using composite pipelines across the value chain. This will be a desktop based study only.

In Scope:

- Hydrogen transport applications
- On-shore, Off-shore & subsea pipelines
- The range of pipeline sizes & pressures utilised by the CHIP partners
- UK industry skills capability
- Global specification systems

Out of Scope:

- Non-hydrogen transport applications
- Pipe sizes & pressures outside of the range used by CHIP partners

Laboratory testing composites

Objective(s)

The objectives of the project are as follows:

- Provide an overview of multiple factors which affect the use of composite pipelines for the transport of hydrogen.
- Understand how to determine the appropriate applications for composite pipelines.
- Understand how the need to transport hydrogen affects the maturity of the global standards and specification landscape.

Gain a deeper understanding for the size and capability of the skilled composite workforce and the training available to upskill existing workforces for maintenance purposes

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

This project will be successful if it meets the following criteria:

- A better understanding of the appropriate applications for composite pipelines
- A better understanding of the practical challenges faced by the utilisation of composite pipelines for hydrogen applications

The deliverables to be received are as follows:

- Literature review of composite pipeline applications
- Selection guidelines for determining the suitability of composites for pipeline applications
- Report regarding the UK competency landscape for composite pipelines
- Report regarding the global standards and specifications available for composite pipeline applications

Project Partners and External Funding

Network: National Gas Transmission

Project Partners: Carbon Trust, Levidian Nanosystems Limited, Scottish Power Energy Retail Limited, SSE Thermal Energy Operations Limited, Department for Energy Security & Net Zero (DESNZ) (the “CHIP” project partners)

Potential for New Learning

New understanding is expected to be gained that will inform whether composite pipelines are a feasible option for the transportation of hydrogen in the short to medium term. It is also expected to highlight the supply chain workforce challenges any deployment would face. It will also highlight the regulatory challenges, by investigating the global standards and specifications landscape (both technical and non-technical).

Learnings will be disseminated via final project reports which will be made available as pe the NIA publication requirements.

Scale of Project

The project will investigate the suitability of composite pipelines for a wide range of hydrogen pressures and applications. Investigations will be limited to understanding the potential applications for which hydrogen pipelines are most suitable, understanding the skills and competencies within the UK and the global regulatory landscape

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: this is a hydrogen focussed project

Indicative Total NIA Project Expenditure

External: £172,096

Internal: £57,366

Total: £229,464

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:

For the transmission of hydrogen, the National transmission System will need to ensure hydrogen can be supplied to customers reliably and safely. Investigation into the utilisation of new materials technologies is part of ensuring this can happen, and help ensure a cost of transition that delivers maximum value to the consumer.

The hypothesis of this project is that composite pipelines show potential technical benefits for the transportation of hydrogen over traditional materials. But the practical feasibility of the product is untested and needs to be investigated further prior to understanding whether the NTS is an appropriate application

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

Value Tracking	Data Point	Data Point Definition
Maturity	TRL2-3	
Opportunity	100% single asset class	All pipelines may be affected in the long term
Deployment costs	£0	No deployment as direct result of this project: more work required if results favourable, long term deployment costs unknown
Innovation cost	£229,464	Cost of project
Financial Saving	£0	No cost savings as a result of project, but construction costs of composite pipelines has potential to be lower due to lightweight nature of the material
Safety	0%	No safety improvement
Environment	5.0 tonnes of CO2	If deployed, a small carbon reduction is expected

Compliance No change

Skills & Competencies Individuals Individuals will increase competence as a direct result, it is expected that the project will highlight the need for wider skills and competency development

Future proof Supports business strategy Investigation into novel materials for hydrogen transportation is aligned with the business strategy of supporting a reliable energy transition

The net benefits delivered are expected to be a greater understanding of the potential of composite pipelines and enable discussion into business interest in composite pipelines. This will drive further targeted project work to be developed that can develop the concept further.

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

The results of this project are directly replicable across the UK

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

The costs of rolling out composite pipelines across the UK is currently unknown.

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 take a general look into the practicalities of using composite pipelines, generating knowledge that could be useful to other gas networks with an interest in composite pipelines. This knowledge will be disseminated with the use of final project reports as per NIA requirements

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 will be no duplication: a study into the practical feasibility of the use of composite pipelines for the transportation of hydrogen has not been previously conducted.

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

Composite pipelines are not currently utilised on the NTS and therefore represent a novel materials technology in this application.

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).

No foreground IPR will be generated as part of this project.

Data Access Details

Details on how network or consumption data arising in the course of an NIA funded project can be requested by interested parties, and the terms on which such data will be made available by National Gas can be found in our publicly available “Data sharing policy relating to NIA projects” at www.nationalgas.com/gasinnovation. National Gas data access is managed IAW provisions under 2.15-2.18 for the current NIA Governance Document.

National Gas already publishes much of the data arising from our NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

Data Quality Statement (DQS):

The project will be delivered under the NIA framework in line with the agreed Energy Networks Innovation Process document NGT 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.

Measurement Quality Statement (MQS):

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.

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

This is a low TRL activity, investigating the suitability for a hydrogen application and therefore not BAU.

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 is a low TRL activity, investigating the suitability for a hydrogen application. Therefore, there are risks that there is insufficient regulatory and/or competence in the UK to support the deployment of composite pipelines in the shortterm

This project has been approved by a senior member of staff

☑ Yes