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

Dec 2023

Project Reference Number

NIA2_SGN0042

Project Registration

Project Title

MASiP H2 Technical & System Development

Project Reference Number

NIA2_SGN0042

Project Licensee(s)

SGN

Project Start

December 2023

Project Duration

0 years and 4 months

Nominated Project Contact(s)

James Heywood

Project Budget

£200,000.00

Summary

The aim of this project is to complete a Gap Analysis for full industry qualification requirements, complete independently certified testing, develop bends, crossings, and repair techniques. The gap analysis and detailed research into current IGEM/API industry standards will be used to define independent testing to qualify the system beyond what has already been completed. It has also been identified that key features are required to integrate the system more easily into current operating requirements. This will include numerical modelling of the additional concept designs and methodology that will need to be developed. Further work to realise the ongoing maintenance requirements and suitable integration to current regulatory and gas operator policies will be determined. This will subsequently specify the design requirements for a large-scale trial.

Third Party Collaborators

Sustainable Pipeline Systems Ltd

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

SGN is currently exploring opportunities to build a green future and start working with hydrogen in blends up to 100% in order to start working towards that future. One of the issues when using blends is the need for higher pressure in the pipeline as well as a need to closely monitor pressure at various points. RTP pipelines have developed a new technology which aims to address this need by utilising a new internal lining mechanism. The pipeline system, named MASiP (Mobile Automated Spiral Intelligent Pipe), is an integrated approach to digital integrity monitoring, automated mobile pipe manufacture and flexible pipe structure. Its structure, using HDPE as an internal liner with steel reinforcement, offers the possibility for pipeline operation to higher pressures compared to traditional unreinforced HDPE.

This modification makes it ideal for hydrogen transportation as it mitigates to the issues around hydrogen embrittlement of comparative steel pipelines. In addition, the use of digital fibre technology which forms part of the pipeline structure, provides real time 24/7 monitoring of the pipeline for integrity purposes. Thus, it is perfectly poised to provide the monitoring needed to ensure the safe operation of the network.

However, it has never been implemented into the GB gas network, meaning that further development work needs to be undertaken to enable full qualification as an approved product. It has previously achieved TRL 5 through other NIA funded projects and is seeking to progress the technology to higher TRL levels .

RTP pipelines could be a feasible long-term solution for delivering large quantities of gaseous hydrogen over long distances and distributing it in urban and rural settings, meaning that it could have a large impact on the GB network.

Method(s)

Further development work will be carried out to fully clarify the what the current industry operational requirements to make MASiP a fully approved product. The impact of maintenance on daily operation will need to be explored, along with repair techniques, construction comparison, and the technology's ability to adapt to complex needs of field operation.

· A gap analysis and detailed research into current IGEM & API industry standards will be used to define independent testing to qualify the system beyond what has already been completed.

· Numerical modelling of additional concept designs will be carried out, and methodology developed for installation requirements.

Engineering analysis of maintenance requirements and suitable integration is suitable for the current regulatory and gas operator policies. Once this has been determined, it will help specify the design requirements for a large-scale trial.

Scope

The focus is building a hydrogen demonstrator with MASiP technology that will satisfy TRL 9 requirements to address energy network requirements. In a localised network hydrogen may be generated from electrolysers powered by green electricity from renewable sources, which operate at 30-35bar pressure but in low volumes.

The project will address pressures above 16bar Maximum Allowable Operating Pressure with 12inch diameter pipe and address extending the pipe diameter for larger volumes.

Higher pressures than are normal for a gas distribution network are desirable for hydrogen because of its lower calorific value than methane. To inform feasible pressure limits and test accreditation methodology a limited amount of hydrostatic pressure testing will be performed. Pipelines have an energy storage role through line packing as well as well as gas transport. The project will address this and regulatory aspects with research into and review of the HAZOP requirements for hydrogen testing and demonstration in the context of the national and international standards. The deliverable focus is on initiating a hydrogen demonstrator concept design at 100-200m scale with flow and bends. This will include connections to a hydrogen electrolyser producing hydrogen from a renewable source such as a solar array. The study will include evaluating options for the demonstrator accreditation, construction and operation – e.g. including using an experienced independent accreditation agency such as Lloyds Register to verify testing at any third-party site.

Objective(s)

The objective is to develop the TRL of MASiP to a TRL7 over the course of the project, by adjusting it to the requirements needed by SGN.

The study will address the feasibility of using MASiP technology for crossings and bends in addition to straight pipe sections. It will also address connecting with the existing infrastructure in SGN's gas network, including connectors, valves, and control systems

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

NA

Success Criteria

Deliver the following

· A report on use cases, focusing on the design basis and including a qualification plan for the pipeline

· A preliminary qualification test report

- A concept stage Hydrogen Demonstrator Design
- A plan for monitoring digital integrity

A preliminary installation plan

Project Partners and External Funding

Sustainable Pipeline Systems Ltd

Potential for New Learning

The project will provide the opportunity to integrate new technology into the GB pipeline system, as well as delivering a better understanding of the methodology to develop new pipelines to operate with blends of hydrogen up to 100%.

Scale of Project

MASiP technology has the potential to be a feasible long-term solution for delivering large quantities of hydrogen over long distances and in many settings. Thus, proving its readiness to fully develop a technical solution could impact the wider GB network

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

Yorkshire and SGNs Gas Network areas

Revenue Allowed for the RIIO Settlement

200,000

Indicative Total NIA Project Expenditure

Total: £200,000

External: £150,000

Internal: £50,000

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 technology presents a new pipeline system that, with real-time monitoring, is able to provide a safer network. The modifications made will provide lower costs financially for pipeline construction and a reduced carbon footprint during manufacture compared to traditional steel pipeline.

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

Hydrogen is going to be used in future, in blends up to 100%, in order to achieve the [EG1] UK governments zero emissions target. MASiP will facilitate the safe pipeline operation and deployment of hydrogen heating for consumers, fulfilling their needs while also providing a significant environmental benefit, by reducing or even eliminating the resulting emissions.

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)

NA

Please provide a calculation of the expected benefits the Solution

During the course of the project, the project team will work with SGNs Hydrogen Solutions team to determine cost comparisons to traditional steel pipeline installation.

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

The technology, once it has reached a TRL level of 9 will be able to be installed across GB in most areas.

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

Costing for this type of activity is defined on a project-by-project basis. This is because the variables including types of steel and blends using hydrogen, as well as the extent of new pipelines being implemented will determine the overall cost of each 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

The project will provide unique and referenceable information for Network licensees and Industry on a potential new transmission pipeline materials option with 100% hydrogen. The learning gained from the project can be applied to Network Licensees and their network operations to facilitate safe transition to hydrogen from natural gas

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

NA

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.

This project will build on previously funded NIA projects which achieved TRL 4/5 development. Other development and testing work funded by Innovate UK and private investors advanced the technology to TRL 6 overall. Previous development has been clearly defined to ensure the scope does not repeat any previously funded development work. Engagement with other networks has been completed to ensure no duplication. The MASiP system is a single source vendor. The findings from the project will be shared with all key stakeholders

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

NA

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

The technology uses HDPE as an internal liner with steel reinforcement, offers the possibility for pipeline operation to higher pressures compared to traditional unreinforced HDPE. This modification makes it ideal for hydrogen transportation as it mitigates to the issues around hydrogen embrittlement of comparative steel pipelines. In addition, the use of digital fibre technology which forms part of the pipeline structure, provides real time 24/7 monitoring of the pipeline for integrity purposes.

The pipeline structure is also assembled on site, using a mobile automated manufacturing and installation machine, thereby reducing

transportation and environmental impact.

Relevant Foreground IPR

The qualification test plan applicable to UK gas networks for new hydrogen pipelines, the digital pipeline monitoring plan for hydrogen gas networks and the hydrogen demonstrator concept design as embodied in the relevant reports.

Data Access Details

Any consumer data gathered throughout this project will be anonymised and will be compliant with General Data Protection Regulations (GDPR) and the UK Data Protection Act. Any compliant data can be made available for review upon request.

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

This project isn't being funded as business as usual because it is deemed an essential part of the 100% hydrogen trials process which is a key step towards conversion of the existing gas network to 100% hydrogen.

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 conversion of the GB gas network to 100% hydrogen is key on the road towards net zero. A reliable supply and the assurance of safe operations for workers and the public are crucial to support the viability of the hydrogen transition. The NIA framework can support works that ensure results that play an essential part in the roll-out of hydrogen.

This project has been approved by a senior member of staff

☑ Yes