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

Jul 2024

Project Reference Number

NIA2_SGN0068

Project Registration

Project Title

MASiP H2– Technical Development

Project Reference Number

NIA2_SGN0068

Project Licensee(s)

SGN

Project Start

June 2024

Project Duration

0 years and 7 months

Nominated Project Contact(s)

James Heywood

Project Budget

£245,000.00

Summary

MASiP Phase 2 is a technical development project with identified go/no-go milestone as key factors as to whether further qualification testing should be completed. This necessity is due to the requirement to have a repair technique prior to any deployment for onshore pipelines. The project intends to deliver detailed methods statements created for the qualification testing plan require for product qualification. The most stringent testing parameters were defined from IGEM, ASME, API 15S in phase 1 to ensure that industry wide acceptance of this new approach would be received.

Third Party Collaborators

Sustainable Pipeline Systems Ltd

Pipeline Integrity Engineers 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. Transporting hydrogen has a impact on the metallurgy of steel pipelines, changing its mechanical properties. Additionally, hydrogen has a lower calorific value than natural gas, meaning that the pipelines need to be operated at an increased volume and pressure do deliver the same energy to the end consumer. RTP pipelines have been developed aiming to address these needs by enabling HDPE to be uprated to transmission pressures. 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 despite this technical approach being utilised in the offshore industry. As such 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)

Following from the results of phase 1, the project will progress the technical development outcomes from phase 1 gap analysis work identifying the required repair techniques, tight radius bends and increased safety factors for hydrogen transportation. The qualification plan will highlight the key testing requirements and will be aligned to industry standards. The primary standard will be API15S due to having more difficult testing parameters, supplemented by other UK and international standards. In addition, a review of the IGEM standards will be undertaken to understand any particular testing requirements specific to the GB gas industry.

These aspects will confirm the operational readiness of MASiP as a viable pipeline technology as these elements need to be fully assured through the qualification testing, we will do in this phase 2 prior to any future trial or adoption. This work will be closely monitored and scrutinised by SGN and PIE to ensure the outputs achieve the required industry requirements, there is also further engagement included in this phase with UKOPA and PIE to ensure integration with current industry standards.

Scope

This programme can provide a real alternative to conventional high pressure pipeline technology avoiding the problems and limitations of a limited supply of welders and large diameter pipe sections. It would showcase UK technology and provide a UK advanced technology solution that may have future export opportunities and benefits. It will help the UK be seen as being in the forefront of the development of sustainable hydrogen infrastructure for the energy systems of the future. The cost and safety ameliorations of this system will benefit gas consumers and may also help bring hydrogen gas infrastructure to rural communities by contributing to the technology needed for localised energy generation and distribution.
This scope of works package aims to bring together all the design and planning tasks, building on the deliverables from phase 1.

Objective(s)

This Stage 2 project proposal is based in the results of Stage 1, and in this phase the objective is to develop the TRL of MASiP to a TRL 9 over the course of the project and adjust it to the requirements needed by SGN.

The report will address the feasibility of using MASiP technology by:

1) Developing test method statements in the qualification test plan.

2) Delivering FEA (Finite Element Analysis) of thicker steel reinforcement options with tight bends.

3) Detailed method statements for each qualification test and test programme design including the testing of repaired pipe sections.

4) Analysis of key manufacturing stages (forming and winding) for options selected in WP1.

5) Developing a concept design for the mobile pipe manufacture subassembly for thicker steel.

6) Design analysis of end fitting options for higher pressures and larger diameters.

7) Concept design of mobile pipe machine to make larger diameter pipe

8) HOF System Strategy and agree HOF specification for demonstrator with SGN

9) Procurement specifications for subcontractors

10) Initial Site Planning and Strategy for the mini-grid demonstrator

Qualification test equipment proving trials;

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable

Success Criteria

Deliver the following:

1. Detailed Technology Qualification Plan

2. Repair methodology report with draft procedures

3. 3D Finite Element Analysis Report of pipe design options to increase pressure rating with thicker steel

4. MASiP forming and winding analysis and preliminary testing report for implementing increased pressure rating of pipe with thicker steel.

Project Partners and External Funding

Sustainable Pipeline Systems Ltd.

Pipeline Integrity Engineers 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

TRL3 Proof of Concept

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

Offices: Aberdeen
Site office: Yorkshire

Revenue Allowed for the RIIO Settlement

£326,667

Indicative Total NIA Project Expenditure

External: £245,000

Internal: £81,667

Total: £326,667

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:

The MASiP technology presents a new pipeline system which ulitises PE material; it is better suited for transporting hydrogen, providing a safer network. The modifications made will provide further options for lower-cost pipeline construction and a reduced carbon footprint during manufacture compared to traditional steel pipelines.

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

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

N/A

Please provide a calculation of the expected benefits the Solution

During the course of the project, the project team will work with SGNs systems transformation 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 the appropriate TRL, will be able to be installed in most areas across the GB network

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

This cost would be defined on a project by project basis, due to the amount of variables including the types and sizes of steel, as well as the length of pipeline that would be implemented.

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)

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.

This project will build on previously funded NIA projects which achieved TRL 6/7 development. 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

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

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 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

- [x] Yes