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NIA Project Registration and PEA Document

Date of Submission

Dec 2021

Project Reference Number

NIA2_SGN0012

Project Registration

Project Title

Recommissioning Grangemouth to Granton

Project Reference Number

NIA2_SGN0012

Project Licensee(s)

SGN

Project Start

November 2021

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Nancy Thomson

Project Budget

£226,334.00

Summary

All future energy modelling identifies a role for hydrogen in providing decarbonised energy. A key element of transition to hydrogen is to evidence the enduring use of LTS assets and pipelines. The Grangemouth to Granton pipeline has been earmarked as part of the LTS Futures project to be repurposed for hydrogen. The pipeline provides an excellent representation of GB LTS pipelines. The project will provide key learning on recommissioning existing LTS pipelines to hydrogen, in addition to understanding potential uprating of LTS pipelines to improve linepack capacity with transition to 100% hydrogen from natural gas.

Nominated Contact Email Address(es)

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Problem Being Solved

The UK government has committed to reducing greenhouse gas emissions to net zero by 2050. All future energy modelling identifies a key role for hydrogen in providing decarbonised energy for heat, transport, industry and power generation. With significant decisions on the future of UK Heat Policy expected from Government in 2025, evidence to influence Heat Policy ahead of this is of critical strategic importance. The Future of LTS project is leading national project relating to above 7 bar pipelines. The project is designed to develop the safety, technical and practical evidence to support the use of hydrogen in the LTS. The research work proposed, underpins many aspects of the decarbonised pathway.

Phase 1 of SGN's Future of the LTS project considered the repurposing of the LTS to hydrogen and CO2. An assessment has shown that a significant percentage of SGN's LTS network consists of relatively low-strength pipeline grades that operate at low stresses. Both factors are conducive to the pipeline's suitability for hydrogen transportation and storage as the use of higher strength steels and higher pressures leads to potential increased susceptibility to hydrogen degradation and an increased demand on the pipeline steels in terms of stresses.

A decommissioned 30km LTS pipeline runs from Grangemouth to Granton and has been earmarked as part of the LTS programme to

be repurposed for hydrogen distribution. The Grangemouth to Granton pipeline provides an excellent baseline material for the LTS. The material (vintage X52) is representative of 93% of the population of LTS pipeline assets, and the pipeline's construction includes key components which are typically included in LTS pipelines, such as block valves, cold bends, forged components and sleeves. The controlled demonstration will validate the interactions of these features together and with hydrogen.

The Grangemouth to Granton pipeline also presents an excellent opportunity due to its route and location. It passes through rural and suburban areas and includes key environmental features that influence the safe operation and management of LTS pipelines within GB. These features include major and minor road, rail and river crossings, crossings of other high-pressure pipelines, power network proximity and buried utilities.

To be able to recommission the pipeline to hydrogen and potential uprate we need to understand the condition of the pipeline. As the pipeline has not previously been subjected to an In-Line Inspection (ILI) assessment, in order to understand the integrity of the pipeline and therefore its safety for hydrogen repurposing, an ILI is of critical importance. In addition, above ground surveys of the pipeline and river crossing assessments will be required to identify any defects or pipeline encroachments. All surveys of the mothballed pipeline will provide valuable understanding on recommissioning an LTS pipeline to hydrogen and form part of the blueprint methodology of the LTS Futures programme.

Another key aspect of LTS repurposing to hydrogen will be to assess potential losses in linepack capacity due to the inherent characteristics of both natural gas and hydrogen in terms of energy density. The project will undertake an assessment of current design factors in LTS pipelines and identify the potential scope to increase pressure within LTS assets to mitigate against line pack capacity losses. From this assessment, further uprating assessments of the Grangemouth to Granton pipeline can commence.

LTS Futures has been submitted to the NZASP reopener in October. With a decision on funding scheduled in February, it was agreed with Ofgem to continue the momentum of the project through funding initial programme elements of the project under NIA.

Method(s)

The project will cover 3 main workstreams, outlined below:

- A recommissioning feasibility study for the Grangemouth to Granton pipeline identifying specific requirements and constraints of the pipeline to produce a strategy for carrying out the In Line Inspection (ILI).
- A feasibility study into uprating of LTS pipelines for distribution of 100% hydrogen. The study will involve an assessment of current design factors for existing LTS pipelines and provide the potential scope to increase pressure of individual pipelines, developing a checklist to identify factors which must be assessed in order to determine whether the increase in pressure is acceptable and completes the viability control stage defined in IGEM/TD/1 standard.
- Completion of above ground surveys of the Grangemouth to Granton pipeline to assess integrity of the pipeline and potential to repurpose the pipeline to hydrogen.

Scope

The scope of work includes the following:

In Line Inspection

Initial Vendor Capability Assessment

- Review pig dynamics and performance of current inspection tools in low pressure, low flow gas lines, including track record.
- Review potential for improving low pressure low flow capabilities of ILI tools in gas lines
- Review of operation of ILI tools in liquid / water slugs

Work Package 1: Review implications of using various mediums for ILI including:

1. Compressed air
2. SuLiquid Assessment
3. Full pipeline Liquid Assessment

Each option will be reviewed including considerations for flow, data accuracy with each option and practicalities (e.g. water required for an ILI and engagement of waste water with SEPA).

Work Package 2: Design / construction / operational review

Review pipeline design / construction records to establish any limiting factors for future inline inspection, e.g. bends, tees etc. Consider wet gas history.

Work Package 3: Document future operational requirements

Document pressure / flow characteristics (nominal and minimum) and potential hydrogen use

Work Package 4: Specify ILI requirements

Output from (1) and (2) used to define ILI requirements, e.g. flow characteristics (use of air compressors), bend / tee configurations, technology requirements (pipeline grade assessment / MFL etc)

Work Package 5: Pipeline route safety evaluation

Review pipeline encroachment details (provided by SGN) and qualitatively assess risk. Include review of HSE SD Hydrogen assessment

Work Package 6: Vendor ILI assessment

Assess ILI capabilities vs SGN ILI requirements (3) and recommend ILI strategy to SGN.

Work Package 7: Cost benefit analysis

Support SGN conducting cost benefit analysis implications throughout study for all options of compressed air/water slug/full line water.

Work Package 8: Technical reporting of above tasks

Work Package 9: Feasibility study for pipeline ammonia transportation options/technical issues

Upgrading LTS pipeline assessment

Analysis of UKOPA pipeline data for each LTS network to identify current design factor of each pipeline section for the following networks:

- Cadent (East Anglia, East Midlands, North West, North London and West Midlands)
- NGN
- SGN (Scotland, Southern)
- WWU

From this data, a calculation of the pressure for each pipeline at design factor of 0.3 and 0.5 will be made. An assessment on any limiting factors preventing upgrading will also be made i.e. excessive cost, disruption etc. A checklist will be developed for completion of the IGEM/TD/1 viability control stage.

Above ground surveys

Above ground surveys of the pipeline to understand pipeline integrity and potential to repurpose for hydrogen service.

Objective(s)

The objectives of the project are to develop a recommissioning strategy of the mothballed Grangemouth to Granton pipeline to be repurposed for hydrogen service. Above ground surveys and in line inspection will provide an understanding of the integrity of the pipeline and provide knowledge of the viability for hydrogen conveyance utilising similar LTS pipelines in future. A high-level assessment of potential LTS upgrading to minimise linepack capacity losses with transition from natural gas will also be a key output of the project that will provide understanding on safe, future network operation for hydrogen.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable

Success Criteria

Key success criteria of the project include:

- PIE final report recommending a recommissioning strategy to SGN including safety evaluation, specific ILI requirements etc.
- Feasibility study to assess the potential upgrading of LTS pipelines to improve linepack capacity with transition from natural gas to hydrogen

- Completion of above ground surveys on the Grangemouth to Granton pipeline to assess integrity and understand viability for hydrogen service.
- Presentation of findings to SGN.

Project Partners and External Funding

Pipeline Integrity Engineers Ltd (PIE)

R&R corrosion

Northern Divers

External Funding (NIA)

Potential for New Learning

The project will provide key new learning on the process for recommissioning an existing LTS pipeline to hydrogen, in addition to understanding future operating conditions to ensure diurnal security of supply through linepack storage. The Grangemouth to Granton pipeline asset has been identified as statistically representative of the GB network, therefore key findings from recommissioning can be disseminated to other Network Licensees looking to convert LTS infrastructure to hydrogen.

Scale of Project

The project will be a combination of desktop study and above ground surveys on the Grangemouth to Granton pipeline to understand integrity.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project will assess the Grangemouth to Granton pipeline to illustrate any limiting factors for potential future operation with hydrogen. The pipeline has been shown to be representative of GB LTS pipelines, allowing results for recommissioning of the asset to be applied to the GB LTS network.

Revenue Allowed for the RIIO Settlement

Not applicable

Indicative Total NIA Project Expenditure

£226,334

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 project will develop an ILI strategy for the assessment of the Grangemouth to Granton pipeline for hydrogen distribution both for the live trial as part of the LTS Futures programme and also wider commercial opportunities linking potential future hydrogen production at Grangemouth refinery to hydrogen demand in the Greater Edinburgh region. The project is a critical steppingstone in understanding the integrity of the currently mothballed asset and identify any remedial works that need to be undertaken prior to live trial operations.

Completion of live trial operations on the pipeline as part of the LTS Futures programme will provide a blueprint methodology for repurposing of existing LTS pipelines to hydrogen. This will be key to ensure distribution of hydrogen gas from new industrial cluster production points to consumers, providing at scale decarbonisation of domestic heat.

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

Not applicable

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)

Not applicable

Please provide a calculation of the expected benefits the Solution

Not applicable

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

The Grangemouth to Granton pipeline is representative of the GB LTS network. The project findings will provide key learnings on assessing integrity of existing LTS pipelines through ILI and above ground surveys. Completion of these studies will be key when looking to transition to hydrogen to allow a future decarbonised network. Up-rating assessments on current LTS design factors within the project will take into account all GB LTS assets with findings able to be applied to LTS assets to improve overall linepack capacity.

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

The project will close current knowledge gaps on the viability of the Grangemouth to Granton pipeline to be utilised for hydrogen distribution for the live trial of the LTS Futures programme. Findings of the up-rating assessment of LTS pipelines will incorporate all GB LTS assets. The use of this pipeline infrastructure for the transport and storage of hydrogen within the UK and at the local level would be highly advantageous for the supply and delivery of low carbon energy to consumers. In this specific case, potential hydrogen production from Grangemouth refinery can be distributed to Granton, a region of potential future hydrogen demand.

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

In keeping with the NIA governance framework, learnings from the project will be disseminated to all network licensees to understand the process of ILI assessment on future hydrogen pipelines, identify any limiting factors and defects that will require remedial work to ensure safe distribution of hydrogen in the future.

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

Not applicable

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.

The project scope has been reviewed against all existing projects and no areas of duplication have been identified. During development of the LTS Futures programme for Net Zero Pre Construction Work and Small Projects Reopener (NZASP), the project team have heavily engaged with all GDN's and NGGT where scope has been shared and no duplication was mentioned.

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

Not applicable

Additional Governance And Document Upload

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

The project is understanding the integrity of an existing mothballed LTS asset (which is representative of LTS GB pipelines) for future hydrogen service through completion of above ground surveys and development of an ILI assessment for the hydrogen pipeline. In addition, assessment on current LTS design factors and potential to uprate for hydrogen service to improve line pack capacity has not previously been completed before. These form a critical part of the repurposing works for the Grangemouth to Granton pipeline and LTS repurposing blueprint to be developed as part of the LTS Futures programme.

Relevant Foreground IPR

Not applicable

Data Access Details

Not applicable

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

The project aims to identify the condition of the Grangemouth to Granton pipeline and its suitability for hydrogen transport. Testing forms a key part of SGN's pathway to decarbonisation to Net Zero through transition to hydrogen from existing natural gas. As such, it is not part of the usual activities of the business.

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 NIA framework offers a robust, open framework to support this work and ensures the results are disseminated to all licenses. The repurposing of the GB LTS involves potentially significant technical risks. The project addresses the question of the suitability of vintage line pipe steels under hydrogen service in addition to the potential for existing assets to be uprated to improve line pack capacity with transition away from natural gas.

LTS Futures has been submitted to the NZASP reopener in October. With a decision on funding scheduled in February, it was agreed with Ofgem to continue the momentum of the project through funding initial programme elements of the project under NIA.

This project has been approved by a senior member of staff

Yes