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

May 2024

Project Reference Number

NIA_WWU_02_39

Project Registration

Project Title

Transitioning and Repurposing Oil Pipelines for Hydrogen (TROPHy)

Project Reference Number

NIA_WWU_02_39

Project Licensee(s)

Wales & West Utilities

Project Start

May 2024

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Robert James Pugh

Project Budget

£123,167.00

Summary

This project will investigate what further work may be required to repurpose a pipeline designed for transporting oil-based products to instead transport hydrogen.

Preceding Projects

NIA_WWU_2_02 - Regional Decarbonisation Pathways

NIA_WWU_2_01 - SWIC Hydrogen Supply Pipeline Infrastructure

NIA_WWU_2_03 - SWIC Market-Accelerating Hydrogen Distribution and Storage

NIA_WWU_2_07 - SWIC: Assessment of potential hydrogen demand in 2030 - 2050

NIA_WWU_2_08 - SWIC - Hydrogen Peaking Plant Feasibility Study

Third Party Collaborators

ROSEN

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

Following our Hydrogen for Aviation project (NIA_WWU_02_14) and the forecasted increase in hydrogen demand for aviation, it is expected that some kerosene pipelines will need to be repurposed to serve this demand in the future. Additionally, the

decarbonisation of transport is likely to add redundancy to existing crude oil pipelines, giving way to opportunities for repurposing these pipelines for hydrogen transmission and/or distribution with possible adoption by gas networks.

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 which will assist in this area. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save millions of pounds with minimal gas customer disruption verses alternative decarbonisation solutions. This project could help with demand in certain sectors, with reduced costs as no new infrastructure would be needed.

The project will investigate what further work may be required to repurpose a pipeline designed for transporting oil-based products to transport hydrogen instead.

Method(s)

The core of this work will be desktop based, although some stakeholder engagement will be required to inform a case study. The first part of the project will undertake a literature review to understand the extent of work to date in both academic and industrial fields, and what learning can be applied within this study. It will then assess the scale of the opportunity and forecast the redundancy of oil pipelines, (including those for crude oil kerosene, and other products as identified in the literature review) in the UK to serve anticipated hydrogen demand from airports, Sustainable Aviation Fuel (SAF) production facilities, and industrial clusters. Following these work packages the project will then map existing oil pipelines alongside WWU's existing LTS to highlight key opportunities for system integration alongside developing production and demand projects.

The project will also review the SGN led project 'LTS Futures' blueprint, which details the methodology for repurposing the LTS in Great Britain's network for hydrogen. This will inform a gap analysis to understand what additional parameters will be needed to repurpose oil pipelines for future hydrogen distribution and apply this as case study to a known oil pipeline.

Measurement Quality Statement and Data Quality Statement

ROSEN will conduct a literature review based on available literature, industry studies, codes, standards, and ROSEN project experience. An assessment of the literature will be performed on the basis of several key factors:

- Relevance
- Recency
- Number of citations
- Related authors / institutions
- Publication location

Where publicly available data is used as an input, an assessment will be performed of that data to identify unusual or non-physical values. Experience and engineering judgment will used to guide this assessment and if possible and useful, a comparison will be performed against another similar data source. Data will be taken only from reputable sources such as Ofgem, government websites, or well-known and highly regarded 3rd party websites, or other such sources.

The project is rated low in the common assessment framework detailed in the ENIP document after assessing the total project value, the progression through the TRL levels, the number of project delivery partners and the high level of data assumptions. No additional peer review is required for this project.

Scope

WP1 - Literature Review

ROSEN will conduct a literature review based on available literature, industry studies, codes, standards, and ROSEN project experience. The technical review will focus on the following topics:

1. Requirements for safe repurposing of pipelines to hydrogen service, based on consolidation of requirements specified in current codes and standards, and ROSEN knowledge of developing requirements in the industry.
2. Functional and operational requirements including modifications that may be required, such as addition of block valves, AGIs, compressors, metering and odorisers.
3. Challenges resulting from integrity threats specific to oil-based product pipelines and how these differ from natural gas pipelines.
4. Challenges resulting from likely or possible differences in the properties, attributes and risks resulting from design, manufacture and construction of liquids pipelines as compared to gas transmission or distribution.

Commentary on the state of liquids pipelines in the UK where previous projects, testing and inspection have assessed assets identified as potentially relevant under scope item 3. Note this may only be possible with consent of the relevant asset owners.

WP2 - Assess Scale of Opportunity

ROSEN will identify the scale of the opportunity, based on 3 keys areas:

1. Industrial Clusters - Focus will be given to the key industrial clusters planned in the UK. Following the oil pipeline mapping exercise (WP3) any further clusters or locations of interest will be added to the review.
2. Airports - From the mapping exercise airports with and without direct oil-based product pipeline access will be identified.

SAF - A review of proposed SAF locations will be undertaken. Pipelines within the vicinity of these locations with potential to link to airports will be identified.

WP3 - Map Existing Oil Products Pipeline

ROSEN will complete the mapping concurrently with WP2 to support the assessment of oil-pipeline redundancy and repurposing opportunities. ROSEN will use WWU's Regional Decarbonisation Pathways project as a basis to identify relevant assets and opportunities in Wales and the South-West.

WP4 - Review LTS Futures Blueprint

The LTS futures 'blueprint' will be reviewed and its applicability to oil pipelines determined. The blueprint will be summarised and a gap analysis will be conducted.

The gap analysis will identify additional parameters, threats or knowledge gaps that may require further appraisal to understand the capability for repurposing an oil pipeline for future hydrogen distribution. Where gaps are identified, ROSEN will comment on the implications with respect to viability of repurposing and the scale of any activities required to fill the gap.

WP5 - Extension of the LTS Futures Blueprint

An extension to the LTS futures blueprint will be proposed and applied to an oil pipeline of interest identified in the during the work completed in WP2 & 3. ROSEN will also consider the latest industry repurposing methodologies defined in the Energy Policy Research Group (EPRG) white paper published in 2023 and those being developed in the Pipeline Research Council International (PRCI) project to replace standard B31.12 (Hydrogen Piping and Pipelines), which ROSEN is leading.

WP6 - Reporting and Deliverables

A final report documenting the findings of all work packages will be produced.

Objective(s)

To understand the scale of the opportunity and forecast the redundancy of oil pipelines, as well as mapping existing oil pipelines alongside WWU's existing LTS to highlight key opportunities for system integration alongside developing production and demand projects.

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.

Success Criteria

Success will assist networks to understand the scale of the opportunity of repurposing oil pipelines.

Project Partners and External Funding

Project partners: Rosen. This is wholly funded via NIA.

Potential for New Learning

The project will provide learning on what further work may be required to repurpose a pipeline designed for transporting oil-based products to transport hydrogen instead.

Scale of Project

This is a desktop study, which is the required scale at this time, this ensures that we are able to develop the initial valuable learning to assess feasibility and enable planning for later iterative project phases if needed.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project is a desktop study but will be relevant to all networks across Great Britain.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

- External Cost: £92,375
- Internal Cost: £30,792

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:

Following our Hydrogen for Aviation work and the forecasted increase in hydrogen demand for aviation, it is expected that some kerosene pipelines will need to be repurposed to serve this demand in the future. Additionally, the decarbonisation of transport is likely to add redundancy to existing crude oil pipelines, giving way to opportunities for repurposing these pipelines for hydrogen transmission and/or distribution with possible adoption by WWU.

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

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 which will assist in this area. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save millions of pounds with minimal gas customer disruption verses alternative decarbonisation solutions. This project could help with demand in certain sectors, with reduced costs as no new infrastructure would be needed.

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

This would be replicable across the whole of GB.

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

This is a desktop study, so cost of conversion are 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 location of the oil pipelines are inconsequential when in comes to conversion, so any outputs can be used by all networks.

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.

All networks have been made aware of this project and no concerns of duplication have been raised.

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

No work has been undertaken that investigates the use of Oil pipelines for hydrogen and no oil pipe has ever been converted. This is a unique piece of work that could benefit all GDNs.

Relevant Foreground IPR

The foreground IP created will be the production of a report.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

- A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click ‘Contact Lead Network’. WWU already publishes much of the data arising from our innovation projects here so you may wish to check

this website before making an application.

- Via our Innovation website here
- Via our managed mailbox innovation@wwutilities.co.uk
- Details on the terms on which such data will be made available by Wales & West Utilities can be found in our publicly available “Data sharing policy relating to NIC/NIA projects” here

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

Ofgem published its final determinations which included a variety of provisions to enable necessary development work on Net Zero projects but also to ensure vulnerable customers are thought about in any decision making. This project has the potential to facilitate the energy system transition and is therefore eligible to use the NIA funding mechanism.

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 project would only be undertaken with support from NIA funding, it is in the interests of gas customers, the regulator and the UK government and the realisation of any benefits are outside the control of the gas networks. There is no allowance in BAU business plans for this type of work and there is a risk that if hydrogen is not accepted as a means to heat homes in 2050 that this work is no longer valid.

This project has been approved by a senior member of staff

☑ Yes