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NIA Project Registration and PEA Document

Date of Submission

Sep 2022

Project Reference Number

NIA_WWU_2_10

Project Registration

Project Title

Potential for Salt cavern storage of hydrogen in and near South Wales

Project Reference Number

NIA_WWU_2_10

Project Licensee(s)

Wales & West Utilities

Project Start

September 2022

Project Duration

0 years and -6 months

Nominated Project Contact(s)

Iain Morley

Project Budget

£253,333.00

Summary

Some natural gas storage capability already exists in the gas grid, but natural gas security of supply also relies on a diversity of sources. The hydrogen network of the future will not benefit from this diversity of supplies (particularly in the early stages) and the low volumetric energy density of hydrogen means that the gas grid cannot provide the same amount of “line-pack” storage for hydrogen as it can for natural gas. For fuel applications, hydrogen has the highest energy volume by mass of any fuel, but this lower ambient temperature density results in a low energy per unit volume impacting utilisation. To overcome its low density for all applications, large-scale hydrogen deployment in the gas grid and elsewhere will require unprecedented volumes of hydrogen storage capacity.

This project will assess the potential for salt cavern development for hydrogen storage in and near to South Wales.

Preceding Projects

NIA2_SGN0013 - Long Term, Large Scale Hydrogen Storage Database

Third Party Collaborators

Progressive Energy Limited

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

The UK government has committed to reducing greenhouse gas emissions to net zero by 2050 with the Scottish government targeting

net zero by 2045. All future energy modelling identifies a key role for hydrogen in providing decarbonised energy for heat, transport, industry and power generation. Significant decisions on the future of UK heat policy are expected from the UK government in 2026 so the need for further evidence to influence these decisions is of critical importance.

Currently, the UK's gas infrastructure is configured for North Sea gas, and as such this energy vector will need to be transitioned, either through repurposing/expanding or decommissioning, making way for alternate low-carbon fuels or new technologies (electrification etc.). The challenge is to understand what infrastructure is feasible for repurposing and how alternative low carbon gas, such as hydrogen, can be introduced, whilst ensuring value for money, ease of conversion and providing a consistent energy supply through any transition.

Some natural gas storage capability already exists in the gas grid, but natural gas security of supply also relies on a diversity of sources (European interconnectors, North Sea supply, liquefied natural gas (LNG) import and gas grid storage capability). The hydrogen network of the future will not benefit from this diversity of supplies (particularly in the early stages) and the low volumetric energy density of hydrogen means that the gas grid cannot provide the same amount of "line-pack" storage for hydrogen as it can for natural gas. For fuel applications, hydrogen has the highest energy volume by mass of any fuel, but this lower ambient temperature density results in a low energy per unit volume impacting utilisation. To overcome its low density for all applications, large-scale hydrogen deployment in the gas grid and elsewhere will require unprecedented volumes of hydrogen storage capacity.

Method(s)

The proposed project will

- Reassesses earlier work by Radioactive Waste Management (now part of Nuclear Waste Services) and other published literature, to identify potentially salt-prone areas in or close to South Wales
- Identify a limited number of seismic lines and boreholes for interpretation based on literature review
- Develop geological cross sections and quantitative assessments of salt (halite) development potential in the selected areas
- Assess and quantify the potential for salt cavern development in each of these areas, by
 - assessing potential storage capacity, number and size of salt caverns
 - evaluating operating pressure range
 - assessing "showstoppers"
 - developing and implementing ranking of potential development sites, considering
 - Capacity
 - Distance and potential for pipeline connectivity
 - Cost and technical development feasibility
- Develop preliminary pipeline routes from hydrogen backbone to preferred storage site(s), including potential for repurposing of existing pipelines
- Develop outline cost assessment (levelised cost of stored hydrogen) for salt cavern development

Data Quality & Measurement Statement

The technical data used will be vetted by the British Geological Survey for suitability, ensuring that only data of acceptable quality is used. Project partners include the British Geological Survey and Edinburgh University, as well as Progressive Energy. All partners have a total commitment to producing evidence-based, professional analysis.

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

The project scope is to deliver a thorough assessment of the potential for salt cavern development for hydrogen storage in and near to South Wales.

It will re-analyse and reassess existing seismic and wellbore data, including potentially reprocessing seismic data to better image potential halite-bearing formations, to identify, locate and evaluate areas where significant halite deposits may be found at suitable depths, and in suitable geological situations for development of hydrogen-storing salt caverns.

It will consider storage requirements and flow rates, informing pipeline sizing and routing options, and will recommend further work to develop this concept study to the FEED stage for preferred sites.

By implementing the methodology details above, the project will deliver:

- A quantified and detailed report on potential salt cavern development sites in and near South Wales
- A ranked assessment of potential salt cavern development locations in the study area
- An assessment of viability and outline costs for hydrogen storage locations

Objective(s)

The project's objectives are to identify, quantify and deliver concept studies on locations suitable for the development of salt cavern storage of hydrogen in and near South Wales.

Additionally, the study will develop a ranking protocol for such locations and develop outline cost assessments of the levelised cost of stored hydrogen for the identified locations.

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

The success of the project will either identify suitable locations for salt cavern development for hydrogen storage or find that there are no suitable locations.

Project Partners and External Funding

Project Partners: Progressive Energy, University of Edinburgh, British Geological Survey. The project will be fully funded by the NIA

Potential for New Learning

The study will identify suitable locations for salt cavern development for hydrogen storage. This will involve new interpretations of seismic and wellbore data, new assessments of the potential for salt cavern development (including sizing, location, operating pressures) and associated pipeline routing. Whilst focused in the south Wales region, directly impacting localised production opportunities, the identification of larger scale storage in the area will help shape the UK wide hydrogen storage and distribution strategy. Additionally the analytical techniques utilised could be applied elsewhere in the UK to identified other previously unknown geological storage opportunities.

Scale of Project

The scale of this project, is a desktop study. This is the appropriate level at this time, as there are many unknowns with regards to salt cavern storage in the area.

The project outputs will be critical to the Net Zero transition in South Wales, especially as it regards the replacement of natural gas with hydrogen.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project will focus on the South Wales area.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External Cost: £190k

Internal Cost: £63,33

Total Cost: £253,333

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 large-scale storage of hydrogen will be an essential element of the hydrogen supply/demand balancing system in the energy transition. It is not currently available in or near to South Wales. The project will identify potential storage sites closer to South Wales than existing sites (Cheshire/Teesside), and has the potential to impact the development of the UK-wide hydrogen storage and distribution strategy

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 to evidence the major or minor role hydrogen will have in different scenarios. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save £millions with minimal gas customer disruption verses alternative decarbonisation solutions

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

The methodology used in the project could be used by all networks in GB.

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

This is a research 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

RIO-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

As hydrogen storage presents challenges in both local and UK wide balancing, the identification of larger scale storage in south Wales will impact the development of the UK wide strategy. There are vast production opportunities within WWU's network, and significant storage facilities will enable the development of hydrogen utilisation for both industrial and domestic heat decarbonisation, not only for the local area but impacting national strategic decision making. Furthermore, the techniques used and identified by this study may also open up further opportunities elsewhere in the UK that have been previously overlooked.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIO-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 over duplication has 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

As hydrogen use as a fuel gains momentum and becomes a key energy system for the UK, there is a requirement for us to identify gaps in our knowledge base. The UK gas networks are working on a wide range of projects to understand how we can decarbonise the energy sector, as part of the net zero targets for 2050.

The potential for gas storage, and in particular hydrogen storage, in the subsurface geology in and around South Wales has not previously been assessed

Relevant Foreground IPR

A report will be published as part of the project, will form the foreground IP

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. 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