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NIA Project Registration and PEA Document

Date of Submission

May 2023

Project Reference Number

NIA_WWU_02_42

Project Registration

Project Title

Hydrogen Storage Feasibility Study

Project Reference Number

NIA_WWU_02_42

Project Licensee(s)

Wales & West Utilities

Project Start

May 2023

Project Duration

0 years and 5 months

Nominated Project Contact(s)

Robert James Pugh

Project Budget

£79,438.00

Summary

The UK Government's Energy White Paper (2020) has identified hydrogen as a potential source of decarbonised heat in buildings. In order to prove the viability of hydrogen the UK Government requires a strong evidence base before deciding whether to promote hydrogen distributed in the existing gas network infrastructure (at all current pressures) to decarbonise heat.

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

A number of different areas of evidence will be required to satisfy the use case for hydrogen including evidence on the feasibility, cost, convenience and safety of transporting 100% hydrogen.

This local methane gas distribution network is "line-packed" to ensure that there is always pressure to deliver gas on demand to homes and businesses. Throughout the current network there are high volume gas storage cylinders (4m diameter) to store gas for pumping around the system and supporting fluctuating demand.

This project is investigating the requirements for future distribution of hydrogen gas to homes and businesses.

Method(s)

This Project focusses on a feasibility study to investigate the requirements of a hydrogen gas distribution network, focusing on the storage and gas pressures gas networks would be required to provide in order to meet the demands of the grid. The National Composites Centre (NCC) will investigate the feasibility of the existing methane gas storage architecture to transition to support hydrogen distribution and also investigate conceptual designs for storage solutions.

The objectives of this project are as follows:

Determine and document the requirements for hydrogen storage to support a distribution network
Report on the suitability of the existing gas storage for hydrogen or the potential modifications required
Generation of design concepts for future gas storage, downselected to one concept
Written report detailing findings and recommendations
In order to deliver against these objectives the project will follow the below method:

Requirements Capture Phase

Requirements capture workshop to be held with WWU to assess the existing infrastructure and document the requirements to transition to hydrogen distribution
A visit to WWU Weston-Super-Mare site will be conducted and where applicable used as a case study for requirement capture and subsequent concept generation.

Design concept generation

Generation of multiple design concepts utilising the existing infrastructure and “blank paper” design
Development of design concepts to deliver against the requirements captured
Storage tanks at the WWU Weston-Super-Mare site will be used as a case study for concept generation where applicable
Evaluation of materials and manufacturability
Downselection of most promising solution

Conclusions and future work recommendations

A final report summarising findings from the project.

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.

As per Page 7 of the NCC Proposal, section “Quality Plan” the NCC’s service is designed in compliance with industry best practice and the ISO 9001 standard. The NCC’s proposal is inclusive of a structured plan for delivery, consisting of a number of project milestones. In regard to project milestones that are specific to data sourcing, generation and distribution there are a number of key milestones included in the project, including; S2 “Requirements Capture Workshop” & S7 “Final Report”. The NCC deliverable will be in the form of a written report; conceptual design work will pull on the Weston-Super-Mare case study but will be relevant to storage across the network.

Upon review of this project’s method and scope, it has been concluded that data will not be used to inform any of the project’s outputs. As such, the brevity of the following data quality statement has been deemed adequately proportionate to the risk (or lack thereof) associated with the measurement and quality control of data that this project requires.

Scope

1. Assessment of the requirements for hydrogen storage as part of a future distribution network
2. Assessment of the feasibility (and/or modifications required) to utilise the existing gas storage solutions, focusing on the storage volumes required
3. Generation of multiple (2-3 concepts) design concepts for future storage architecture
4. Downselection of most promising concept

Objective(s)

1. To determine and document the requirements for hydrogen storage to support a distribution network recommending, where appropriate. the potential modifications required.
2. To generate design concepts for future gas storage and downselection to one concept

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 project will be a success when the report is issued outlining the most promising concept of storage needs for a hydrogen network.

Project Partners and External Funding

NCC. The project will be wholly funded via NIA.

Potential for New Learning

WWU will gain an understanding of where and how modifications to the gas storage solution in the existing network must be made to maintain energy supply.

Scale of Project

This is a desktop study, with design concepts being created. This is the appropriate scale for the project at this time. It keeps it at a low TRL to understand what steps may look like, therefore minimising risks to the project.

The project includes work packages focusing on requirements capture, design concept generation, downselect and future recommendations. This pulls on experts from across Hydrogen Pressure Vessels, Concept Engineering and Systems Engineering teams with the aim of providing a robust and thought out view of the future hydrogen infrastructure requirement. If the project were of a smaller scale, insufficient evidence would be produced to assist with the transition to the future energy distribution network.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This project does not focus on one area of the GB network. As this is research based, all work will take place at NCC offices.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External: £59,578

Internal: £19,860

Total Cost: £79,438

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:

There is a need to understand the requirements the of a hydrogen gas distribution network, focusing on the storage and gas pressures that would be required to provide in order to meet the demands of the grid. The project will also inform on the current capabilities of the network and provide potential solutions to facilitate the energy system transition.

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

This is a research project.

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

The findings from the project will be relevant to the entire UK.

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

This is a research project, roll out costs are not currently available

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 trialed 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 challenge of transitioning to a Hydrogen network is relevant to all GDNs and storage is a key part of this transition.

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

The results of this project will allow a more comprehensive assessment of the feasibility of conversion of existing UK gas infrastructure for the use in transporting hydrogen. While the output of this project will be integral in quantifying the feasibility of large scale hydrogen conversion of existing natural gas infrastructure, and will allow new design considerations and targeted investment in the lead up to a net-zero network.

Relevant Foreground IPR

The project will produce a report which forms the foreground IPR.

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, while also keeping vulnerable customers front and centre of our thinking 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