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 2022

Project Reference Number

NIA_WWU_2_09

Project Registration

Project Title

Industrial Fuel Switching Phase One

Project Reference Number

NIA_WWU_2_09

Project Licensee(s)

Wales & West Utilities

Project Start

June 2022

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Henry James

Project Budget

£61,973.00

Summary

This project is part of the HyNet Industrial Fuel Switching suite of work and will identify barriers and solutions to allow industrial users, within the GDN and new connections, to accelerate their decarbonisation. As well as identifying how a dual fuel network will function and how the business model for new connections will work.

Preceding Projects

NIA_WWU_2_02 - Regional Decarbonisation Pathways

Third Party Collaborators

Apollo

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. The Industrial Fuel Supporting innovation in fuel switching, including for hydrogen, is a key action in the government's Industrial Decarbonisation Strategy.

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.

This project will seek to solve the technical and commercial issues surrounding the transition of the current gas distribution network for industrial users to 100% hydrogen. As part of the study, the transition mechanism will be investigated as it is likely there would be a period where dual fuel (hydrogen and natural gas) is required to ensure supply resilience

Method(s)

The project seeks to address the challenge of industrial conversion to low carbon fuels and focuses on the gas network distribution of hydrogen. By linking into the HyNet project, some of the challenges, such as the source of hydrogen, can be addressed elsewhere, allowing WWU to concentrate on its area of expertise i.e. the transportation of gas.

Taking the boundary as the hydrogen National Transmission System/Local Transmission System (NTS/LTS), connection to the industrial meter location allows for a focused effort to fully define the requirements, barriers, business model and cost for what will be a very similar conversion process throughout the UK. The approach of first the transitioning to dual fuel and ultimately a full switch to an alternative fuel source is likely to be the blueprint for conversion.

The methods used to address the requirements will initially be driven from a technical standpoint with the commercial being addressed though a highlighted business model for connections. The following outlines the assessment that will be completed as part of phase 1 of this project:

- Understand the high-level design and associated infrastructure costs for connection to a local hydrogen NTS/LTS based on each industrial sites' existing natural gas meter location.
- Explore connection sizing based on a future-proof model whereby the interim dual-fuel service can be installed with no future reinforcement.
- Analysis of design and costs against the current regulatory regime and business model for connections, with the recommendation made towards a future business model for industrial dual-fuel connections.
- Final report detailing the suitability of the existing connection business model for a new industrial hydrogen connection, and the proposal of future business model options for installing and operating the connection, including:
  - Report sections detailing each site
  - A tool allowing applicability of the preferred future business model to apply to other industrial sites.

Data Quality Statement

Data will be obtained from multiple sources including documented information held within WWU and information held by the industrial sites. At the start of the project a "request for information" document will be generated creating an auditable trail of information. Where information/data is not readily available then assumptions will be made but these will be detailed.

To understand the demand requirement for the fuel at the industrial sites, actual meter readings will be requested. If these don't contain enough granularity, further data will be obtained from Xoserve through a formal request.

Network analysis will be completed using industrial recognised tools allowing the same methods to be adopted by different organisations and projects.

For specific equipment/material data including costings, operation and maintenance then consultation will be requested from vendors (as appropriate) or previous experience held by the organisations within the project.

Within the final report the methods used to build the data profiles will be documented for ease of disseminating the knowledge forward. Where assumptions are likely to have a material impact these will be highlighted.

The final report will clearly detail all reference material.

Measurement Quality Statement

Data quality will be met by ensuring all gathered data is from a credible source – either WWU document control system or the industrial sites document control system. Data such as meter readings will be from Xoserve. Only measured meter data taken for billing purposes will be used as this has the required measured quality and is auditable.

All data will be fully referenced and where justifiable assumptions have had to be made, these will be clearly documented.

The project is rated low in the common assessment framework detailed in the Energy Networks Innovation Process (ENIP) document

after assessing the total project value, the progression through the TRL levels, the number of project delivery partners and the medium level of data assumptions.

No additional peer review is required for this project

Scope

The main scope of the study is to solve the technical and commercial issues surrounding the transition of the current gas distribution network for industrial users to 100% hydrogen. To achieve this, the following outlines the main scope of the study to be completed as part of phase 1. The study will use the two aforementioned sites as case studies:

- Understand the high-level network/infrastructure design
- Explore connection sizing
- Analysis of solution against regulatory regime and business model for connections
- Final report detailing all findings
- A tool to allow learning to be applied of the preferred future business model to other industrial sites.

If successful a follow-on demonstrator project will be scoped.

The scope for phase 1 will be broken down into the following key tasks:

1. Assessment of current connection design to natural gas for both industries and its design basis. This will cover the potential for multiple natural gas connections for different applications.
2. Assessment of existing operating business model for natural gas
    1. This task will require information on existing design (high level), as-built drawings, and existing natural gas tariffs and consumption with annual profile (daily reports and hourly reports for some available period to estimate a peak). In lieu of actual data, estimated tariffs and demands based on Xoserve data will be used. This data, together with any forward energy usage requirements of the industrial sites will allow for an understanding of the design required.
3. Estimation of required hydrogen demand and peak load based on existing natural gas data and at future expansions for industries.
4. High level design of new hydrogen distribution facilities including pipeline extension and service lies from existing tie-in point, including hydraulic analysis by Synergi gas to estimate pipeline diameter, material, pressure etc. This will be a basic analysis based on demand, pressures and an initial high-level hand calc for initial pipe size. The analysis will be based on a single tie into the HP hydrogen pipeline together with a pipe route to the industrial users with several branches off.
5. Concepts for connection will include high pressure (HyNet hydrogen source) intermediate and medium pressure (Alternative hydrogen supply potentials). This will broaden the study to a wider application.
6. High level design of primary meter sets (dual fuel) with pressure regulating facility for each industry for hydrogen supply.
7. Estimation of high-level construction works and estimated schedule
8. CAPEX and OPEX estimation based on engineering estimate (through Bill of Quantities) and actual rates obtaining with accuracy 20%- 25% and operations and maintenance modelling.
9. Preparation of operating business model and comparison to new connection. Cross-check with alternate connection Liquefied petroleum gas (LPG) and/or power station where NG is not 100% utilised.
10. Optimization of the business model for each of the two industries and study of 2-3 various scenarios according to their operating profiles (estimated where data not available).
11. Conclusions, preparation of recommendations, risks, barriers and mitigation
12. Future business model tool to apply to other industrial sites
13. Technical and financial feasibility study report

Typical information request for sites under study:

- Current NG pipeline layouts
- Meter location and types,
- Entry Pressure
- Actual load demands, peak, seasonal etc. (estimated where data not available).
- Future site plans for any additional NG requirements
- Existing Natural Gas Tariffs

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 of pounds with minimal gas customer disruption verses alternative decarbonisation solutions. Due to the low level TRL of the project, it is not possible to provide a more detailed CBA.

Objective(s)

Identify barriers and solutions to allow industrial users, within the GDN and new connections, to accelerate their decarbonisation and identify how a dual fuel network will function and how the business model for new connections will work.

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 can be broken down into the following main metrics:

- Identification of the physical make-up of the network
- Details on how a business model including funding, regulation and operation would function
- Ability to allow learning to be translated to multiple sites across the UK with similar needs

Project Partners and External Funding

The project partners for this project are Apollo Engineering. It will be wholly funded via NIA.

Potential for New Learning

The new learnings that this project will bring are the practicality, cost, and business model required to bring alternative gaseous fuel (hydrogen) to industrial users from an NTS/LTS hydrogen supply.

Further to this, it will establish how to define a dual fuel business model for connections to support the energy transition while infrastructure is still in its infancy in regards to resilience.

Initially the project will be in phase 1 which is to understand the feasibility of a fuel switching project at the chosen sites. The potential next phase of the project looks at establishing a demonstration at one or more of the chosen sites. This will cement the learnings of the initial phase and start to understand any practical barriers, hurdles and further evidence gained during the detailed engineering, implement (build) and operate (go live) stages.

All outcomes of the project will be uploaded to the ENA Smarter Networks Portal.

Scale of Project

This initial phase of the project is a feasibility study to understand the potential of the project to address the key objectives. . At scale for this phase is to review two industrial sites and these would provide the basis for the next phase which would be to provide a demonstrator as part of the HyNet project.

Smaller scale would not allow for the complexities of a dual fuel arrangement to be understood in enough granularity to apply the same approaches to other industrial sites. Also, by reviewing two different industrial sites, it will support understanding on commonalities between industrial users and those that might be site-specific.

The potential benefits of understanding the feasibility of a switch to 100% hydrogen via an initial dual fuel arrangement are significant. The ability to accelerate the decarbonisation in the UK would support the pathway to NetZero by 2050, provided great learning from the early adopters to ensure a successful transition and allow UK businesses to have a competitive advantage in the marketplace due to low carbon industrial goods, products and services.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This project is focusing on an area in North Wales, however learning will be applicable to all GDN's.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External Cost: £46,480

Internal Cost: £15,493

Total Cost: £61,973

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 directly explores the transition from a carbon-based gas system to a low carbon-based energy system specific for industrial users. It will create significant learnings to be disseminated among the GDNs.

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 outcomes of the project would be relevant to all networks across GB

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

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 of pounds with minimal gas customer disruption verses alternative decarbonisation solutions

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

☐ 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 learning from this project will help to advise Network Licence holders on a practical means for supplying a “dual fuel” gas supply to an industrial customer who requires a supply of both clean hydrogen, and resilient natural gas whilst both gases are available from a pre-2050 gas network.

Along with a suggested business model, a tool will be generated to allow the learning from this project to be applied to any industrial site in the UK. This will help foster growth within industrial clusters and enable the rollout of early dual fuel supplies. It is intended that this early work will help form the basis and evidence for recommendations made to policy consultations set out by BEIS.

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 over 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

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 the feasibility of hydrogen as an energy solution for the UK as part of the net zero targets for 2050.

Currently, for the selected industries within this project, a fuel-switching project has not been explored and specifically, a dual fuel project so it will be a “first of its kind”. This will unlock the next phase of the project which is a demonstrator of the solution in action

Relevant Foreground IPR

No background IPR is needed within the project, the foreground IPR that will be generated will be a report detailing the findings of the study.

Data Access Details

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