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

Jan 2023

Project Reference Number

NIA_WWU_02_14

Project Registration

Project Title

Hydrogen for Aviation

Project Reference Number

NIA_WWU_02_14

Project Licensee(s)

Wales & West Utilities

Project Start

January 2023

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Henry James

Project Budget

£161,304.00

Summary

The aviation sector has a significant challenge to help achieve net zero, as it currently contributes 2.5% of global CO2 emissions and 7% of UK greenhouse gas emissions. Hydrogen could play a role in decarbonising the sector, not only as a direct fuel source for future aircraft, but also for the production of Sustainable Aviation Fuel (SAF) and in the aerospace supply chain.

WWU need to understand the potential scale and timing of requirements for hydrogen for aviation, alongside potential barriers and challenges, as they explore the role their infrastructure may be able to play in delivering blended and 100% hydrogen in a decarbonised energy system.

Preceding Projects

NIA_WWU_2_03 - SWIC Market-Accelerating Hydrogen Distribution and Storage

NIA_WWU_2_01 - SWIC Hydrogen Supply Pipeline Infrastructure

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

NIA_WWU_2_08 - SWIC - Hydrogen Peaking Plant Feasibility Study

NIA_WWU_2_02 - Regional Decarbonisation Pathways

Third Party Collaborators

Arup

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

The aviation sector has a significant challenge to help achieve net zero, as it currently contributes 2.5% of global CO2 emissions and 7% of UK greenhouse gas emissions. Hydrogen could play a role in decarbonising the sector, not only as a direct fuel source for future aircraft, but also for the production of Sustainable Aviation Fuel (SAF) and in the aerospace supply chain. The government's Jet Zero policy includes a SAF mandate to ensure at least 10% of jet fuel is SAF by 2030, with the government's ambition to have at least five commercial-scale SAF plants under construction in the UK by 2025.

Within WWU's network footprint, there are organisations with a rich engineering and energy history. The newly formed Hydrogen South West (HSW) consortium is home to a powerful cluster of leading aerospace and transport businesses such as GKN, Airbus, Easyjet and Bristol Airport. This makes it ideal to explore decarbonising the aviation sector, and this work needs to be a fundamental part of HSW's vision for a hydrogen ecosystem.

The potential of this work is also being realised elsewhere within WWU's network through the South Wales Industrial Cluster (SWIC) with the planning and consultation of a new SAF production facility in Port Talbot – creating a new demand for hydrogen in the process.

WWU need to understand the potential scale and timing of requirements for hydrogen for aviation, alongside potential barriers and challenges, as they explore the role their infrastructure may be able to play in delivering blended and 100% hydrogen in a decarbonised energy system.

Method(s)

This project will conduct a literature review of hydrogen developments in the UK aviation industry to understand current ambitions, barriers to deployment, and the geographical implications of using existing gas network infrastructure to supply hydrogen to points of demand (notably airports, and locations for Sustainable Aviation Fuel (SAF) production).

The project will undertake a demand assessment from aviation across the Hydrogen South West (HSW) and the South Wales Industrial Clusters (SWIC) footprints, focussing on Bristol and Cardiff as case studies, to gain a deeper understanding of opportunities and barriers. In turn this will inform the infrastructure requirements and any repurposing of assets for hydrogen around them, with recommendations for further steps to fill evidence gaps.

This project is a follow on project from Regional Decarbonisation Pathways, and will help develop near and long term planning for the future of the network, informing early thinking around the development of the Hydrogen South West cluster, and setting direction for further work in Wales and southwest England. Learning from the project is expected to be applicable across GB.

The project will follow the below structure:

1. Baseline review of current literature and Technology Readiness Level (TRL) for hydrogen use in UK aviation (mapped) including SAF, hydrogen for fuel cell and combustion for aircraft, ground operations and supply chain.
2. Case studies for potential hydrogen requirements (demand, quality/purity and other considerations) for Cardiff and Bristol airports and aerospace sectors, and how this may evolve in different phases between 2022-2050 in the following areas:
    a. Ground operations
    b. SAF (including production locations)
    c. Short haul aircraft
    d. Long haul aircraft
    e. Aerospace supply chain
3. Final report (public-facing)

Scope

Literature Review and Background Study: Work has already been carried out in the UK on this topic, providing wide-ranging studies which ARUP will build on in this review of current literature such as those conducted for Aerospace Technology Institute via the FlyZero programme. These included TRL assessments and road maps covering key technologies, including, for instance, cryogenic fuel systems and storage, hydrogen gas turbines, hydrogen fuel cells and electrical propulsion systems and advanced manufacturing

Stakeholder Engagement: An online stakeholder mapping workshop will take place. This will be used to produce an engagement plan for gathering the required demand scenario data for the case studies. This will detail the project's stakeholders, the strategy for how stakeholder engagement will be carried out and how the findings will be processed and shared.

Case Studies:

1. Demand Scenarios: The project will start the case studies by looking at possible demand scenarios and how these may evolve

between 2022 and 2050
2. Hydrogen Production, Storage and Distribution for Demand Scenarios: The case studies will consider the hydrogen eco-system needed to support the demand scenarios

Final Report: A final report which will bring together the findings from the case studies to provide WWU with comprehensive information to support their objective to explore the potential hydrogen requirements for Cardiff and Bristol airports and aerospace sectors out to 2050, helping to develop both near and long term strategic project direction.

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

Objective(s)

To assist networks in understanding the potential scale and timing of requirements for hydrogen for aviation, alongside potential barriers and challenges.

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

A successful project will produce a report which details the strategic and technical evidence base for the potential role of hydrogen in aviation for utilisation across all Gas Distribution Networks (GDN) interactions, and future development opportunities within the aviation sector and wider aerospace supply chain.

Project Partners and External Funding

Project Partners: ARUP. This project will be wholly funded via NIA.

Potential for New Learning

This work will ensure all parties develop a strong understanding of how the gas network can support the future operations of an aviation supply chain where hydrogen plays a key role. In particular, the work will explore how hydrogen can be delivered to airports and their supply chains in order to decarbonise sectors relating to manufacturing, operation, and maintenance.

Project partners were chosen for their broad experience in the UK aviation sector, and as such, will ensure that the outputs of the work can be applied to airports across the UK. Work will be disseminated through existing working groups, such as those associated with the ENA's Gas Goes Green programme, as well as consortia such as Hydrogen South West.

Scale of Project

This will be a desktop study, which is the appropriate scale for this project. This allows networks to assess the impacts of the findings before deciding if further work is needed in this area.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project will produce case studies relating to the WWU network, however the learning will be applicable to similar sites throughout the GB network.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

An indication of the total Allowable NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO1).
An indication of the Total NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO2).

External: £121,000

Internal: £40,304

Total: £161304

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 aviation and aerospace industries have long been the source of innovation breakthroughs. From the Concorde era until now, this has transformed into a sector with a growing focus on decarbonisation. This project facilitates the energy transition by exploring the role that the current and future gas network can play within the aerospace/aviation sector. Hydrogen in particular has the potential to revolutionise the way in which airports are operated, as well critical supply chain elements such as component manufacturing and fuel production. The gas network can play a substantial role in this by developing hydrogen transportation infrastructure.

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

Research Project

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

This will be fully replicable across all networks.

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

There are no roll out costs at present, as 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

☐ 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 outputs of this work will enable each gas network to understand the potential hydrogen demand associated with airports within their region. By having this understanding, networks will have greater certainty when making investment decisions to develop their future hydrogen network.

The project will also open opportunities for new consortia, potentially between airports but also networks, to help drive a whole-systems approach to developing robust and low-risk hydrogen supply-chains.

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.

This project was circulated to all networks and no concerns were raised with duplication.

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

Whilst many supply/demand assessments have been undertaken for cases of hydrogen, this work will focus on supply and demand within the domestic aviation sector and supporting supply chain – a newly emerging hydrogen market. The majority of airports are already connected by discrete fuel supply networks, but this work will quantify the magnitude of the opportunity around the use of existing gas networks to satisfy future hydrogen demands for both transitionary and fully developed use cases.

Relevant Foreground IPR

The project will produce a report which will form part of 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 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