

## NIA Project Registration and PEA Document

### Date of Submission

Mar 2023

### Project Reference Number

NIA\_WWU\_2\_19

## Project Registration

### Project Title

Integrated Hydrogen Transport Hubs

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NIA\_WWU\_2\_19

### Project Licensee(s)

Wales & West Utilities

### Project Start

March 2023

### Project Duration

0 years and 2 months

### Nominated Project Contact(s)

Henry James

### Project Budget

£66,667.00

## Summary

Green hydrogen fuel-cell vehicle technology is a credible option to decarbonise vehicles, however the production and distribution of hydrogen is currently high cost. Additionally, the heat produced during electrolysis is in theory high enough to support the decarbonisation of district heating but is typically wasted. Addressing both needs in an uncoordinated manner would likely lead to inefficient investment in networked infrastructure. Taking an integrated approach to decarbonising heat and transport provides an opportunity to improve network usage and lower the cost of hydrogen production.

In order to evaluate the potential benefits of waste heat from electrolyzers and the integration of this with other applications, a detailed desktop analysis will be conducted to understand and articulate the work already done in this regard.

## Preceding Projects

SIF\_WWU\_2\_2 - Integrated Hydrogen Transport Hubs

## Third Party Collaborators

Guidehouse

## Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

## Problem Being Solved

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. 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.

Energy companies need to determine how and where whole systems solutions, such as a hybrid hydrogen hub, that use electrolysis to provide hydrogen for transport hubs and hydrogen boilers for district heat networks, can provide a cost-effective solution that achieves customer needs.

To deliver a cost-effective solution, network operators need to consider all aspects of the value chain. Specifically, the value of waste heat produced from electrolysis needs to be considered. Innovative solutions to incorporate waste heat from electrolysis in decarbonising heat for district heating need to be assessed, and if plausible, trialled in suitable regions. Initial pilots in the Netherlands, Port of Rotterdam, have demonstrated the use of waste heat from electrolysis in district heat networks. Further work is required in the UK to understand the technical, commercial, and regulatory barriers to deploying whole systems solutions that leverage waste heat from electrolysis in home heating network solutions.

## Method(s)

In order to evaluate the potential benefits of waste heat from electrolyzers and integrating this with other applications, a detailed desktop analysis will be conducted to understand and articulate the work already done in this regard particularly across Europe, but also conducting a scan of similar initiatives globally.

A detailed case study on the Port of Rotterdam trial will be conducted via primary research (interviews with the relevant stakeholders from that project). This project will compliment a SIF discovery phase project, which is developing the concept of an integrated hydrogen transport hub in the WWU region, this NIA work will evaluate the benefits streams from such a concept.

Coordinated planning of hydrogen transport hubs will enable optimal infrastructure deployment and efficient energy use. Using waste heat from the electrolysis process, enables homes, businesses and industry to be heated efficiently through district heating, rather than relying on new gas and electricity infrastructure required to facilitate heat pumps or hydrogen boilers. Ultimately, this leads to a reduction in the cost to operate the gas and electricity networks, thus achieving a direct cost saving to energy bills for consumers.

## Data and measurement quality

Guidehouse will apply their best practice research techniques, including using known sources of insight, cross checking information and applying QA review before finalising conclusions. For this phase of work, a mix of primary and secondary research will be conducted. Where appropriate, primary sources such as interviews with the port of Rotterdam project team will be conducted, interview notes documented and minutes shared for validation, before utilisation of primary data for the purposes of the project.

Secondary research will be conducted through well-tested and robust methods, including desktop research of existing academic and non-academic studies to corroborate and enhance findings from primary methods. In future phases of this work, additional technical data may be sought from project partners to develop and refine the concept of a hydrogen hub. Similar primary and secondary methods shall be deployed for these purposes as appropriate.

Guidehouse will also test conclusions with SMEs based in Europe and working with gas network clients there to validate claims and explore interpretation of results.

For the purposes of traceability and reliability of results, data and methods employed will be based on established best practice regarding data sources and methodologies/tools, which are expected to meet the Data Quality objectives without the need for additional audits. This is particularly applicable given the expected level of detail of the study (high level / conceptual) and associated accuracy of results (low-moderate), which will be used to support early conceptual planning, for which a degree of uncertainty is acceptable.

For the purposes of comparability of results, the study will validate input data and output results against published reports and sources to demonstrate compatibility and validity of assumptions and results, clearly identifying the potential reasons for discrepancies or deviation from the assumptions or results, the conditions for which the results are valid and the sensitivity to assumptions.

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

### Identification of high-level technical barriers and opportunities

- Overview of how hybrid hydrogen systems function from a technical perspective
- Summary of technical challenges and assessment of how these may be influenced by UK conditions (climate etc)
- Summary of the opportunities associated with deploying hybrid hydrogen hubs in the UK

### Map and characterise waste heat and oxygen valuation opportunities for WWU region

- Overview of how hybrid hydrogen systems function from a technical perspective
- Summary of technical challenges and assessment of how these may be influenced by UK conditions (climate etc)
- Summary of the opportunities associated with deploying hybrid hydrogen hubs in the UK

### Conduct detailed desktop study of international case studies

- Conduct a case study of the Port of Rotterdam project through stakeholder interviews and desk-based research
- Identify other relevant global projects to draw learnings from

### Produce report with learnings from research

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)

Evaluate how waste heat from electrolyzers can support district heating schemes, and other integrated hydrogen use cases.

### 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.

## Success Criteria

A consolidated report with produced detailing international and local academic research of the topic, that will inform the development of an operating model and business case that will help determine the applicability of the solution for future demonstration in a trial project.

## Project Partners and External Funding

The project partners for the project will be Guidehouse; the project will be fully funded via NIA.

Potential for New Learning

The project will generate a range of learning about the deployment and benefits of hybrid hydrogen and large-scale electrolyzers. The project will focus on the operating model and value streams to the networks and its customers.

Scale of Project

This project is a desktop study, which is the appropriate level for this project.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

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

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External Cost: £50k  
Internal Cost: £16,667  
Total Cost: £66,667

## 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 will provide valuable learning to inform whether waste heat from electrolyzers can be utilised and valued to reduce the levelised cost of hydrogen for customers.

#### 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 learnings from the project will be applicable to the entire GB network.

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

There will be no direct roll out costs associated with the 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

The report will be applicable to all networks via the SNP. The use of waste heat from electrolysis is an issue that all networks will face.

### 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 the project and no concerns of duplication were 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

This is a first of a kind study on the value of hybrid hydrogen in the UK. The learning from this project will inform the need for future demonstration projects.

### Relevant Foreground IPR

The report will form the basis of 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](mailto: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