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

Dec 2023

Project Reference Number

NIA_WWU_02_58

Project Registration

Project Title

Biomethane and Hydrogen Interactions

Project Reference Number

NIA_WWU_02_58

Project Licensee(s)

Wales & West Utilities

Project Start

December 2023

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Matt Hindle

Project Budget

£141,827.00

Summary

This project will explore how biomethane can be managed and used in areas of the gas network which will be converted to 100% hydrogen. A report will be produced detailing whether there could be a role for blending a small proportion of biomethane in dedicated hydrogen networks; what options exist for biomethane sites to produce hydrogen in place of methane and what options exist to move biomethane to non-hydrogen areas either in transition or in the longer term.

Third Party Collaborators

Arup

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

Today, over 100 biomethane plants across the UK have the capacity to meet the annual heat demand of over 750,000 homes. New plants are continuing to connect to the gas network, supported by the Government's Green Gas Support Scheme (GGSS).

The location of biomethane plants tends to be based on a combination of available 'feedstocks' for the anaerobic digestion process (typically food waste, animal slurry, other farm material or sewage sludge) and capacity for injection to the gas networks. Biomethane is anticipated to play an important role in the delivery of Net Zero, with the potential to generate negative emissions where production from waste material is combined with carbon capture and utilisation or storage.

However, the potential scale of biomethane production is inherently limited by the availability of feedstock to generate the gas. In some areas, available capacity for grid injection also presents a constraint, particularly during summer months when gas demand is lower. To reach Net Zero, Britain's Gas Networks therefore expect that current and future biomethane production will need to work alongside

hydrogen to deliver a fully decarbonised gas system. The Gas Networks' ambitions for hydrogen have been set out in A Hydrogen Vision for the UK. Delivering these plans supports the government's strategy to develop "Regional or national [hydrogen] networks & large-scale storage integrated with CCUS, gas & electricity networks" by the mid-2030s.

As hydrogen networks develop in line with the Hydrogen vision for the UK, and demand for gasses changes, it is likely that some biomethane production will be in areas with blended hydrogen, and in parts of the country where gas networks are converting to 100% hydrogen. To inform hydrogen rollout plans, the Gas Networks therefore need to understand the challenges and opportunities for biomethane production in these areas, and what this will mean for network development, technology requirements and investment in the future.

Method(s)

The project aims to explore how biomethane can be managed and used in areas of the gas network which are converted to dedicated hydrogen in the future. This will include whether there could be a role for blending a small proportion of biomethane in those networks; what options exist for biomethane sites to produce hydrogen in place of methane; what options exist to move biomethane to non-hydrogen areas either in transition or in the longer term.

It will explore and present conclusions on:

- The best long-term use for biomethane in a gas system, including if that system is substantially converted to hydrogen
- How hydrogen and biomethane could interact in the future system, and through the transition
  - What options exist to manage these interactions, either
  - At production sites, or
  - As part of the gas network
- Likely decision points required, including responsibilities and criteria
- Policy and regulatory implications and requirements
- Recommendations for further Research & Development

Measurement Quality Statement and Data Quality Statement

ARUP will review the data and information requirements as part of the inception and kick off procedures. As part of the plan, they will identify milestones in the project for where data will need to be obtained, created, associated, merged or consumed. As part of the project inception, they will discuss with the networks the best approach for how to define, format, structure, and associate all project information and data so that it is easily accessed, consumed and usable (interoperable).

All incoming information and data is registered, checked and reviewed for completeness, accuracyand integrity and communicated to the project team as appropriate minimising the risk of non-conformance throughout the project. The team will also look at how the data aligns with competing datasets, and any security and privacy implications and licence restrictions. ARUP will provide recommendations on the datasets received, and work with the networks to develop data management scenarios where required. Thyey will use data prioritization when they are given competing datasets , to decide which data to use for which application, and may seek to agree these with networks during the process. When using the data as part of our analyses, ARUP will document any transformation processes used via workflow diagrams for all datasets which will allow anyone accessing the data to understand how it has been processed and manipulated. They will work with the networks to understand if there are existing data standards and formats to align with in addition to following government standards.

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 medium level of data assumptions. No additional peer review is required for this project.

Scope

WP 1 - Inception and baseline review

As part of the baseline review ARUP will consider existing knowledge, people, and projects, as well as complete a literature review to understand the current role of hydrogen and biomethane, biogas utilisation, and the future requirements of both gases for the demand sectors. The baseline review will then use a framework, which ARUP will create, to produce a relative score for the gas networks key priorities.

As well as the desk study, virtual 1:1 interviews with key stakeholders will allow ARUP to gain an understanding of their current and future positions in the biomethane space, and their specific blockers and enablers. ARUP will present the baseline to the stakeholders to get their feedback and update to incorporate this.

WP 2 - Stakeholder engagement

Conduct 1:1 interviews with a maximum of 15 key stakeholders to understand their objectives, constraints and concerns in relation to biomethane and its utilisation.

Wider stakeholder engagement will be delivered through three stakeholder engagement workshops throughout the project, where ARUP will gather their knowledge, understanding, and test our analysis. These will consist of:

1. Baseline understanding: gather views, objectives, concerns and opportunities
2. Technical, economic and regulations analysis: to understand opportunities for adapting new technologies, where R&D is focused, integration with LAEPs, and direction of future regulation.
3. Scenarios and recommendations: Present suggested scenarios and recommendations to the key stakeholders and gather feedback on them. This may involve suggestions for collaboration between different groups, piloting new technology or identifying limitations in current regulations. Work with the stakeholders to agree on scenario refinements as well as understand the impacts of the scenarios on the stakeholders.

Stakeholder input and outputs from the workshops will be used to inform each stage of the project.

WP 3 - Technical and economic analysis of options

Evaluation of biomethane demand

ARUP will analyse the market for biomethane, including specific areas for biomethane demand, and will consider which industries would suit biogas vs biomethane vs hydrogen.. We need to consider on a priority assessment where biomethane is required over biogas, and the rationale for conversion to hydrogen. Likewise, we need to consider how feedstock locations influence supply locations, the requirement for digestate, and how close supply is to demand locations.

Establish an initial technology list

ARUP will use their baseline engagement with stakeholders to define the criteria and assumptions which they will then use to generate a long list of potential technology options to manage the interactions between hydrogen, biomethane, and gas networks. ARUP will examine technical readiness levels, industry best practise and innovative solutions, including options for alternative green gas generation. They will consider conventional biomethane with different substrates, but also options around gasification of waste streams.

They also look at converting biomethane to hydrogen, whether through SMR turquoise hydrogen or another method, with or without bioCO2/carbon capture.

Shortlisting and applying to scenarios

ARUP will assess a long list of technology options against the framework of key objectives for each scenario. They will use this framework to undertake a multi-criteria analysis to establish a shortlist of options which are feasible for implementation in each scenario i.e. what are the technical differences in a 100% biomethane network vs a blended hydrogen and biomethane network.

Techno-economic modelling

ARUP will create a techno-economic model, considering the end-to-end process from production, network management and system operation, storage and any development of new infrastructure. They will examine how blends of gases can be managed (both technically and economically for the elements to combine), stored and transported. They will consider the transition between different scenarios, and what the barriers to this could be. Technical analysis will consider what is feasible, what sizes do different technologies need to be and how the energy flows within the system to optimise for cost and carbon.

Economic analysis will be based on a whole life cost built up from CAPEX and OPEX. This will include a comparison with a counterfactual for the end use of biogas, this could be in a CHP for heat and power or as currently injected into the gas grid.

WP 4 – Analysis of regulatory implications

Review and analysis of existing regulations

As part of this workstream, ARUP will review the relevant regulations related to gas which exist in the UK currently, from both a commercial and technical perspective. This will include, but is not limited to, the following documents:

- Economic regulation: Gas licencing, Gas (calculation of thermal energy) Regulations 1996, Uniform Network Code including billing

and settlement, Network Entry Agreements

- Technical regulation: GS(M)R1996, Pipeline Safety Regulations 1996, Pressure Systems Safety Regulations 2000, SR2021 No 7: generic risk assessment anaerobic digestion facility, including use of the resultant biogas – waste recovery operation, T/PM/GQ/8 management procedure, Radioactive substances act., COSHH, Health and Safety at Work Act

Generic risk assessment - biomethane entry to grid (qualitative)

Various parameters will be considered as part of this assessment. These will include Wobbe Number, oxygen content, incomplete combustion factor, soot index, gross calorific value, delivery temperature, odorant, hydrogen sulphide, water dew temperature, organohalide content, bio-hazards, carbon dioxide, contaminants, pressure, odour, total sulphur, and inerts.

The parameter network entry requirements and requirement sources (such as GS(M)R) will be provided. The 'expected value' of the parameters will be compared with the network entry requirement and deviations of each parameter from these requirements will be stated. Plausible explanations for these deviations will be provided, where available and feasible.

Each scenario will be scored for both impact and likelihood of deviation or non-compliance, to create a risk score for each parameter. These will be used within the overarching framework to compare the scenarios.

Recommendations and control measures based on the risk assessment

Based on the analysis and risk assessment, ARUP will provide recommendations and control measures which would be required to enable biomethane rollout. The recommendations and control measures will cover, where applicable, both regulatory change and technical recommendations to mitigate individual risks.

WP 5 - Scenario Development

To develop a roadmap demonstrating how biomethane takes part in a hydrogen transition, ARUP will use their framework for decisions which will have been populated through the project to allow the team, guided by the stakeholders, to understand which scenarios are the most likely at which timescales, and how the gas networks might transition to a net zero future.

ARUP will make use of the data and information gathered on biomethane resources by location (feedstock supply, hydrogen networks, the distribution of processing plants, and the volume of biogas potential), to look at what is appropriate for different geographic archetypes, based on the mapping undertaken in the baseline to provide more in-depth case study examples for each scenario. They will map spatially and numerically the potential deployment of any viable options, considering relevant regional factors such as rural vs urban, and supply vs demand

ARUP will make recommendations based on the scenario development to unlock the potential of biomethane, for example, if bottlenecks are identified they will recommend how these could be overcome, whether this be through technical, economic, regulatory, or other factors.

ARUP will test their scenarios and recommendations as part of the stakeholder engagement and final stakeholder workshop.

WP 6 - Recommendations and Report

Based on the outcome of ARUP's analysis, they will develop a roadmap of recommendations from 2023 to 2050 across three areas:

1. Policy & regulatory requirements- what industry regulations and internal standards need updating or modifying.
2. Technical research and development to be conducted.
3. Further work required by the gas networks

Objective(s)

Explore how biomethane can be managed and used in areas of the gas network which could be converted to dedicated hydrogen

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

Success will see a report produced which will assist networks in understanding how Biomethane can work with Hydrogen to decarbonise the gas network.

Project Partners and External Funding

ARUP have recently completed a market study of biogas and biomethane in Europe and is involved in several projects analysing the potential of hydrogen gas to be used in the UK gas networks, so are perfectly placed to complete this work.

Potential for New Learning

The project will inform networks on how biomethane can be managed and used in areas of the gas network which are due to be converted to dedicated hydrogen. Project reports will be uploaded to the ENA portal, to ensure dissemination of the project findings

Scale of Project

This will be a desktop study, which is the appropriate scale at this stage due to the low TRL of the problem at the current time.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This will cover the whole of the GB Network.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Cadent External: £47,275.69

SGN External: £23,637.85

WWU External: £11,818.93

NG External: £11,818.93

NGN External: £11,818.93

Total External: £106,370.33

Cadent Internal: £15,758.67

SGN Internal: £7,879.28

WWU Internal: £3,939.64

NG Internal: £3,939.64

NGN Internal : £3,939.64

Total Internal: £35,456.87

Total: £141,827.20

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:

This project is necessary to facilitate the transition from a natural gas transmission and distribution system to a network transporting hydrogen & biomethane. By allowing different net-zero gases into the network, networks can make informed decisions on investment and what the future of the network will look like.

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 which will assist in this area. 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

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

The outputs of the project will be relevent to all gas networks across GB.

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

This is a research project, so these figures are not available at the current time.

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
- [x] 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

All gas networks are part of this project ensuring value for money for the consumer. Reports will also be published on the Smarter Networks Project.

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?

- [x] 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 gas networks are a part of the 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 interaction between Biomethane and Hydrogen in the network has never been assessed, it is important this is looked into as it could provide a strategically significant solution which, when adopted alongside other low carbon technologies, will help to deliver net zero by 2050

Relevant Foreground IPR

The foreground IPR will be the report produced as part of the project.

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 several 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