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

Oct 2022

Project Reference Number

NIA_WWU_2_12

Project Registration

Project Title

EUSE - Ventilation Within Buildings

Project Reference Number

NIA_WWU_2_12

Project Licensee(s)

Wales & West Utilities

Project Start

November 2022

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Darren Cushen

Project Budget

£216,733.00

Summary

There is a need to understand the implications associated with the conversion to hydrogen and effectiveness of existing ventilation in the home, so a literature review of the current ventilation requirements will be required to understand any ongoing or completed project work being undertaken on ventilation requirements associated with hydrogen.

Whole building ventilation interaction, extensive scenario modelling as well as the effects of mechanical ventilation will need to be completed to understand how a whole building performs, e.g., the interaction of ventilation between rooms/storeys/cupboards.

Third Party Collaborators

Kiwa

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. Significant decisions on the future of UK heat policy are expected from the UK government in 2026 so the need for further evidence to influence these decisions is of critical importance.

As part of the BEIS and Ofgem Hydrogen Village Trial, a number of projects have been identified through the End User Safety Evidence (EUSE) working group. The projects have been split between the four Gas Distribution Networks (GDN) with WWU taking lead on two projects, one of which is the ventilation project.

Method(s)

There is a need to understand the implications associated with the conversion to hydrogen and effectiveness of existing ventilation in the home, so a literature review of the current ventilation requirements will be required to understand any ongoing or completed project work being undertaken on ventilation requirements associated with hydrogen.

Whole building ventilation interaction, extensive scenario modelling as well as the effects of mechanical ventilation will need to be completed to understand how a whole building performs, e.g., the interaction of ventilation between rooms/storeys/cupboards.

A baseline for natural gas will be modelled followed by development of a hydrogen model in order to compare differing ventilation scenarios.

KIWA will provide evidence and learnings in the following areas:

1. Review of existing work and requirements: Review of work undertaken across several projects (e.g. Hy4Heat and HyHouse) to understand the work that has been done to on the effects of ventilation, changes in ventilation requirements for hydrogen as opposed to natural gas and minimum required ventilation.
2. Whole building ventilation interaction modelling: How the whole building performs, e.g., the interaction of ventilation between rooms/storeys/cupboards and leakage paths by elevation, dispersion and the potential for diffusive loss.
3. Mechanical ventilation: As a common form of ventilation, so its presence will be included and effects understood.
4. Minimum ventilation requirements: 10,000mm2 additional ventilation has been suggested as an output of Hy4Heat. Further work is needed to be undertaken to determine if this is suitable across different circumstances and room types in addition to any minimum ventilation requirements

Measurement and data quality statement:

We will achieve by creating and applying a Quality Assurance (QA) plan including a QA log. These will be based on templates from the Department for Business, Energy & Industrial Strategy (BEIS) (for whom we are undertaking similar activities) and our experience of producing high quality research reports for clients.

The key aspects that will be quality assured are:
1. Literature review execution where the methodology will be defined to ensure that the quality and reliability of the sources is assessed correctly so that appropriate emphasis can be placed on the information that they yield. Checks will be made to ensure that it is consistently applied.
2. Literature review output where the output will be checked to ensure that the questions are answered, that where possible evidence gaps have been filled and if not have been defined such as to inform the modelling activities. A formal record of each source reviewed and the findings with regards to its value and reliability will be made. This will be reflected in the reporting of the project.
3. Models and modelling outputs for basic modelling (using a two-vent model) to be undertaken regarding the implications for building ventilation. Although, these models will be relatively simple it will still be necessary to ensure that they are of a good quality. The general principles of the BEIS QA Guidance for Models will be applied. Particular focus will be on the calculations applied and the input data.

Reports will be subject to a formal Technical Quality Review to ensure their quality prior to release. Reports will be assessed against quality criteria which will include:
1. Accuracy (including correct reporting of modelling results)
2. Clarity (including spelling, grammar)
3. Graphics (including correct communication of information)
4. Appropriate referencing (mainly for the sources identified in the desk study and literature review),
5. Data and calculations,
6. Timeliness of delivery,
7. Stakeholder engagement.

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

Review of existing work: Review of existing legislation such as BS 5925:1991 Code of practice for Ventilation principles and designing for natural ventilation. As well as a review of work that has been undertaken in other projects.

Modelling: The project will construct a two vent model of buoyancy and wind driven ventilation of dispersion of hydrogen in Excel or Python. This assumes that the leakage is represented by a low level and a high level vent above and below the neutral buoyancy plane. In principle this treats the situation as having only one of each vent type, however more than two vents may be used in practice.

Accounting for mechanical ventilation: Mechanical ventilation changes the pressure drop across one or more vents from an enclosed space. This will affect the flows of gases and the local and overall dispersion rates. There are three general types of mechanical ventilation; Positive input ventilation (PIV), Mechanical extract ventilation (MEV) and Balanced whole house ventilation.

Adjustment to minimum ventilation requirements: All pipework for 2nd and 3rd family gases, installed in buildings, including in voids should conform to BS6891. This standard doesn't apply for 1st family gases, the closest to hydrogen of the existing gas families. Currently work is underway to develop the standards and guidance for installation of systems for carrying gas which is mainly hydrogen. Learnings from this work will be applied to this project.

Final Report: All of the above will be compiled into a formal report, with an exec summary.
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 investigate if the conversion from natural gas to hydrogen creates new issues with regards to the existing ventilation within properties

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 on the implications associated with the conversion to hydrogen and effectiveness of existing ventilation in the home

Project Partners and External Funding

Project Partners: KIWA. The project will be fully funded via NIA

Potential for New Learning

The outputs of the project will help understand the impact that ventilation has on hydrogen within domestic properties. The learnings give a better understanding the potential to use additional ventilation as a risk mitigation. The learnings will be shared with the other networks, HSE, BEIS and Ofgem through the End User Safety Evidence working group as well as through the usual route of the Smarter Networks Portal.

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 is applicable to the entire GB network.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External: £163,400 Internal: £53,333 Total: £216,733

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 to a natural gas transmission and distribution system to a network transporting 100% hydrogen. Conversion to hydrogen within domestic properties will need to be assessed from a ventilation perspective. The current ventilation requirements within domestic properties is deemed sufficient risk mitigation for natural gas. Work has been done through a number of different projects to look at the changes required in ventilation associated with conversion to hydrogen. This work will need to be incorporated into modelling of the effects of ventilation on hydrogen within a domestic premises being undertaken as part of the project. Whole building interaction and mechanical ventilation will be considered as part of the modelling. This will give a better understanding to the changes required if any to the minimum ventilation within domestic premises

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

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

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

As part of the BEIS and Ofgem Hydrogen Village Trial, a number of projects have been identified through the End User Safety Evidence (EUSE) working group. The projects have been split between the four Gas Distribution Networks with WWU taking lead on two projects, one of which is this 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?

☑ 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.

As part of the BEIS and Ofgem Hydrogen Village Trial, a number of projects have been identified through the End User Safety Evidence (EUSE) working group. The projects have been split between the four Gas Distribution Networks with WWU taking lead on two projects, one of which is this project.

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

Modelling of the effect of ventilation on hydrogen has not yet been completed. Ventilation is a key risk mitigation against the build-up of flammable gasses within a property. The modelling will firstly be carried out for releases of methane for which current ventilation requirements are acceptable. The equivalent release of hydrogen will then be calculated and modelled giving a direct comparison. The results from releases of methane and releases of hydrogen will be compared under the different scenarios. The impact of different types of ventilation on flammable gas concentrations will be assessed and compared

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 https://www.wwutilities.co.uk/about-us/our-responsibilities/innovation/
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" https://www.wwutilities.co.uk/about-us/our-responsibilities/innovation/

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