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

Sep 2022

Project Reference Number

NIA_CAD0083

Project Registration

Project Title

End User Behaviour – Impact on Safety

Project Reference Number

NIA_CAD0083

Project Licensee(s)

Cadent

Project Start

August 2022

Project Duration

0 years and 11 months

Nominated Project Contact(s)

David Jones

Project Budget

£285,303.00

Summary

The purpose of the project is to better understand public attitudes towards new technology and in particular the 'safe first use of hydrogen in the home', with recommendations of any appropriate measures to mitigate behavioural risks and negative responses where identified. A combined method approach will be used to gain insight into consumers' understanding of and attitudes towards 100% hydrogen in the home. This will include an initial literature review to inform a series of focus groups/interviews and a final survey. The work will take place on the two nominated Village Trial locations in order to obtain a wider range of data.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

The Prime Minister's Ten Point Plan for a Green Industrial Revolution set out the government's intent to explore the option of hydrogen to be used within the current gas network infrastructure. It specifically mentioned that a Hydrogen Village Trial should be underway no later than 2025 to enable an important policy decision to be made in 2026 on the options for heating homes in a net zero future.

End User Safety Evidence group (EUSE) is a group within the End User sub programme of the BEIS Hydrogen Grid R&D Programme. EUSE will facilitate the gathering of safety evidence downstream of the emergency control valve (ECV) to support delivery of the Village Trial.

Public behaviour and attitudes towards new technology can have a significant impact on safety. The purpose of this project is to understand the impact of consumer attitudes and behaviour in respect to the safe first use of hydrogen in the home, recommending

appropriate measures to mitigate behavioural risks/negative responses where identified. It is anticipated that overcoming such barriers will increase the attractiveness of the hydrogen trial proposition thereby increasing willingness to participate.

There are several evidence lines to be answered by this Project, however, broadly, the aim will be to understand the likely consumer attitudes/response to additional safety mitigation measures required when using 100% hydrogen in the home. It will also be important to have a view as to the baseline level of understanding about existing natural gas safety measures and any prior knowledge of the use of hydrogen in homes.

Consideration will have to be given to the factors which may affect public behaviour and safety. An understanding into how factors such as appliance design, consumer awareness, and social demographics influence safety behaviour when using 100% hydrogen in the home will be required. Equally important is the determination of consumer attitudes to potential safety mitigation measures introduced with the introduction of hydrogen in the home – the behavioural safety risk must be balanced against the risk of trial rejection. In other words, proposed safety measures will not be effective if they create excessive barriers to trial participation.

Consistency in the approach to communication with consumers in the trial areas will be key and the outcomes of the Project will determine if the explanation of the necessity of safety measures needs to be modified to decrease consumer opposition. Learnings from the project should be used to inform a future communication plan for various audiences.

This project is one of the GDNs collaborative projects, led by Cadent, undertaken as part of the End User Safety Evidence working group.

Method(s)

A combined method approach will be used to gain insight into consumers' understanding of and attitudes towards 100% hydrogen in the home. The work will take place on the two nominated Village Trial locations in order to obtain a wider range of data.

An advisory stakeholder group will be formed consisting of technical subject matter experts as appropriate to ensure the potential of each phase of the Project is maximised. This will involve discussing each phase before it begins and then reviewing the findings. The advisory group will also enable Cadent and NGN village communication teams to draw on the Project when developing their communication with the village trial residents.

An initial understanding of domestic consumers' attitudes towards and possibly behaviours associated with deployment of new gas technology in the home will be important. There is a need to ensure that this Project delivers new insight on consumer attitudes to hydrogen that has not been delivered by the pre-existing range of studies that have been carried out in the UK and abroad.

Building on the understanding of previous work, a series of focus groups and/or interviews will be carried out with residents from the two nominated Village Trial locations. The advisory stakeholder group will develop a sampling strategy to determine who is invited. A semi-structured question set will also be developed in consultation with the advisory group – this will give structure to the discussions to ensure topics of interest to the Project are covered, whilst also allowing participants to raise relevant topics that are important to them. In this way, the focus groups will allow researchers to explore participants' views on given topics in detail.

Where consumer uptake is not sufficient to form multiple focus groups, one-to-one interviews will be used to supplement the data.

With the focus group and interview data analysed, key themes will be used to develop a survey to be sent to all households in the two nominated Village Trial locations (either paper survey or e-survey). The survey will be released in line with Cadent and NGN village communication teams' survey schedule to avoid survey fatigue/overloading of trial residents.

The survey and focus groups/interviews form a critical part of this Project and all data analysis will be included in a final report. In addition to the report, key findings from the Project will be incorporated into DNV's Village Trial Quantitative Risk Assessment (QRA). This will ensure a more powerful output from the Project, working to focus on improving safety performance of the first of a kind hydrogen trial at approximately 2000 homes scale.

Project delivery will be supported by hiring professional organisations to support Cadent on the project. Much of the work will involve consumer engagement across the two potential trial premises, so it is important that any organisation involved has experience in executing human factors/behavioural research programmes across any range of industries – not necessarily gas industry specific.

Scope

As mentioned in Section 2.2 above, a combined method approach will be adopted, dictated by the outcome of engagements with consumers, rather than a strict work package breakdown more suited to purely technical work.

The advisory stakeholder group will play a key part in the successful delivery of the project, meeting on a regular basis to plan the upcoming stages of work and analysing the outputs from any work that has been completed. The advisory group will be formed with a series of technical subject matter experts, as well as experts in the communications and behavioural fields.

Literature Review

The first stage of the project will be to undertake a review of the literature on domestic consumers' attitudes towards and possibly behaviours associated with deployment of new gas technology in the home. Search terms will be developed in consultation with the advisory group members – grey and peer-reviewed literature will be considered and a set of criteria for selecting papers will be developed. Papers about other UK hydrogen projects known by the study team will also be considered as part of the review including Hy4Heat, H21, H100, HyDeploy etc and the IGEM Hydrogen Knowledge Centre.

Focus Groups and/or Interviews

The project will then move on to the hosting of focus groups in each village location. The advisory group will develop a sampling strategy to determine who is invited, however, recruitment of participants for focus groups (and interviews) will be undertaken by Cadent and NGN. Focus groups are likely to be face-to-face and usually consist of 10-12 participants, if there is a need for virtual focus groups to be held, these can be done with slightly less participants. The focus groups will generally last an hour and will be used to explore participants' views on given topics. A semi-structured question set is used as this gives structure to discussions to ensure topics of interest to the researchers are covered, yet also allowing participants to raise relevant topics that are important to them. The question set will be in developed in consultation with the advisory group and it is anticipated questions could cover factors such as:

- Appliance/equipment design
- Risk perception
- Awareness/affordability etc.

The discussions at each focus group will be captured by a note-taker, with potential for audio/video recordings with the consent of the participants. It is anticipated that the focus groups will be held in a community space such as a community hall or a school, virtual focus groups will most likely be held on MS Teams.

It may not be possible to organise five separate focus groups, so one-to-one interviews may be used to supplement the data. The same semi-structured question set will be used and a note-taker will again attend to capture the discussion. It is anticipated that most interviews will be conducted by MS Teams or telephone where this is not possible, but the researchers will also agree to face-to-face interviews if this can be arranged and is better for the interviewee. Face-to-face interviews will only be conducted in a community space for ethical reasons.

The focus group and interview data will be analysed to identify key themes which will then be summarised in the final report and used to develop the survey.

Survey

The survey items will be developed based on the findings of the focus groups and interviews and in consultation with the advisory group. Both an e-survey and paper survey will be made available. It is anticipated that the survey will be sent to all households participating in the village trial (in both potential locations). A drop off point for the paper surveys will be set up in the community or they can be returned by post. Both electronic and paper surveys will be completed anonymously. It is anticipated that the survey will largely consist of fixed response questions, either yes/no or a short rating scale. Some open response questions may also be included to allow greater commentary and depth of information. Basic statistical analysis will be undertaken with the data and will be included in the final report.

Quantitative Risk Assessment

It is expected that the quantitative risk assessment (QRA) team at DNV will be represented on the project advisory group; this will enable them to influence each phase of the study to maximise its potential for incorporation into the QRA.

The above scope lends itself to the following five key deliverables:

1. Excel spreadsheet summarising the literature review.

2. A semi-structured question set for the focus groups and interviews.

3. A survey (electronic and paper) for distribution to the village trial consumers.

4. A report providing a top-level summary of the key messages, methodology, literature review, focus groups and interviews, survey analysis, discussion (including any limitations of the approach), and recommendations which may include further work.

5. Human factors input into the Hydrogen Village QRA as appropriate.

Objective(s)

The objectives of the project are as follows:

- Establish a baseline of the level of understanding amongst householders of the potential safety measures associated with using 100% hydrogen in the home

- Establish a baseline of the attitudes of householders to these potential safety measures, both positive and negative.

- Explore potential behaviours, both safe and unsafe, with respect to potential 100% hydrogen safety measures through self-report.

- Explore how negative attitudes and reported unsafe behaviours may be mitigated.

- Use the findings to help shape industry communication with householders.

- Use the findings to encourage 80-90% uptake of the trial within the village in order to provide sounder evidence on which to base decisions.

Explore whether the findings can be used as part of a quantitative risk assessment.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This project focuses on consumer behaviour and how that behaviour might impact on consumer safety when replacing natural gas with hydrogen in the home. Due to the nature of the project, consumer engagement will play a massive part. The project team will work together with Cadent and NGN village communications teams to ensure that recruitment for focus groups/interviews is carried out in an ethical manner. The definition of “vulnerable” has been discussed at length and in this case will cover any individual who is not able to give informed consent to take part in focus group/interview/survey on their own behalf – “vulnerable” consumers will not be asked to take part in any of the work done as part of this project.

The project aims to understand the attitude consumers have towards the introduction of hydrogen in the home, particularly with regards to additional safety measures that may be introduced as a result. Those safety measures that consumers flag as the type of measure they are unlikely to comply with (for example, technically, the introduction of increased ventilation; financially, the need to purchase new appliances) will have to be reconsidered as without consumer buy in, the conversion of the UK gas network to hydrogen will be a non-starter.

Consumer participation in all aspects of this project will be voluntary.

Success Criteria

The success criteria for the project is the delivery of the following:

- Recruitment of a sufficient number of participants from each of the two village trial locations to enable the series of focus groups/interviews and survey to deliver meaningful conclusions.

- Feedback of any proposed consumer rejection to new proposed safety measures into the relevant workstreams – particularly

for technical safety measures so that alternative options can be investigated.

- Ensure findings are used to shape future industry communication with consumers regarding the replacement of natural gas with hydrogen in the home.

- Agreement from GDNs, industry, and regulatory bodies that evidence gaps associated with the impact on safety of end user behaviour with hydrogen in the home at the beginning of the project have been suitably covered.

Project Partners and External Funding

Cadent, WWU,SGN, NGN.

Potential for New Learning

Currently there are lots of questions around the suitability of existing gas installations to be safely repurposed for hydrogen service. In addition to this, any changes required to be made to existing installations/domestic property layout will need to have consumer acceptance to be a success.

This project will give the opportunity to assess consumer attitudes towards potential new safety measures with hydrogen, giving an insight into which proposed new measures will be effective and which ones will need to be reassessed to ensure any future Hydrogen Village Trial can be carried out to an equivalent level of safety of the current natural gas picture.

Learning will be disseminated to GDNs, HSE and key stakeholders through a series of informal discussions/presentations as required, culminating in a final report summarising all learning at the end of the project.

Scale of Project

Consumer acceptance associated with the safe repurposing of the internal gas installation is critical to enabling the Hydrogen Village Trial potentially located in the North West or North East of England in 2025.

The project is required to cover key evidence gaps ahead of any potential Hydrogen Village Trial. The Village Trial itself is required to inform a UK government policy decision on hydrogen for home heating in 2026, and the work done in this project will not only be relevant to a village-sized trial, but to future larger trials and potential national roll out of hydrogen for home heating.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The focus groups/interviews and survey work will take place at the proposed Hydrogen Village Trial locations in the North West and North East of England. All other aspects of the project, i.e., literature review, data analysis etc., will be desktop based.

Revenue Allowed for the RIIO Settlement

Not applicable to this R&D project.

Indicative Total NIA Project Expenditure

The project is broken down on a time and materials basis. An estimated mid-range cost of £179,244 to deliver the work based on resource and cost effort has been agreed. To acknowledge the natural uncertainty of the work, an additional 10% contingency may be implemented, subject to Cadent’s prior written approval.

This gives a Total NIA Expenditure to reclaim of £179,244.

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 a vital enabler to the Hydrogen Village, which has a considerable benefit in facilitating the energy system transition.

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

N/A

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

The intention is for this project to be relevant and therefore replicable to hydrogen trials of any size/any future national rollout.

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

N/A

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

The learning can be used by any network that intends to do a hydrogen village trial or built upon by any network that intends to do any subsequent trials.

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.

The technical suitability of existing gas installations to be repurposed for hydrogen gas service is currently a subject lacking any substantial evidence. Any extra safety mitigation measures that have to be introduced to ensure hydrogen is as technically safe as natural gas, will only be effective if consumers are accepting of the new measures and allow them to work as designed. This project is the first of its kind in that it will be aiming to understand the attitudes to gas safety of the actual consumers that will be involved in a world first Hydrogen Village Trial. There have been research and development projects looking at different aspects of consumer attitudes towards hydrogen which this project will combine with to deliver a more powerful result.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

There are no projects like this. This project seeks to cover key evidence gaps, that without full coverage, would prevent the delivery of a Hydrogen Village Trial.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

This project is a vital enabler for the Hydrogen Village trials which is a highly innovative programme that has not been replicated anywhere else in the world to date. This project has been initiated as part of the collaborative projects agreed by BEIS and HSE ahead of the trial commencing.

Relevant Foreground IPR

All relevant foreground IP created as part of the project will follow NIA governance.

Data Access Details

Current expectation is that all data used in this project will be sourced from published documentation, the test cases will be available

upon request.

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'. Cadent 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 at https://cadentgas.com/future-of-gas

· Via our managed mailbox futureofgas@cadent.com

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The hydrogen village projects and any of the associated enabling projects, cannot be considered as BAU due to their first of a kind nature and risks which go beyond BAU.

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

This project has inherent risks due to its first of a kind nature so it is right it should be supported using NIA funding.

This project looks to understand consumer attitudes towards potential technical, operational and regulatory changes to ensure an equivalent level of risk is achieved when repurposing existing gas installations for hydrogen service.

This project has been approved by a senior member of staff

☑ Yes