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

Jun 2021

Project Reference Number

NIA_CAD0072

Project Registration

Project Title

FI-0001 HyNet Homes – Understand Phase (technical)

Project Reference Number

NIA_CAD0072

Project Licensee(s)

Cadent

Project Start

July 2021

Project Duration

1 year and 0 months

Nominated Project Contact(s)

Damien.hawke@cadentgas.com, Henry.james@wwutilities.co.uk, Lucy.mason@WWU.com

Project Budget

£916,830.00

Summary

This project is a collaborative project between WWU and Cadent, which looks at the early technical development of a hydrogen village in the North West of England. The hydrogen production is being made available from the HyNet's hydrogen production units within the Stanlow oil refinery, making this area potentially ideal to develop a hydrogen village trial.

This project looks at hydrogen production and resilience options, network configuration, end user appliances, commercial and regulatory implications of developing a hydrogen project in this the North West. This project will act as the forerunner to more in depth engineering studies should the decision to progress the project be taken.

This project sits alongside NIA FI-0002 HyNet Understand Phase (consumer).

Third Party Collaborators

Kiwa

Element Energy

GL Industrial Services Ltd

Progressive Energy Limited

WSP UK Limited

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

This should outline the Problem(s) which is/are being addressed by the Project. This cannot be changed once registered.
The UK has mandated that it shall reach Net Zero emissions no later than 2050. The UK was the first major world economy to set this target and it shows the UK's commitment to tackling climate change for future generations. This mandate has put the UK on an accelerated programme to reduce emissions across our entire society whether this is industry, transport, agriculture or the way we create our power and heat our homes. To achieve Net Zero by 2050 will require a co-ordinated effort across the whole of the economy and by individuals who will be required to make technology choices and potentially change habits and behaviours to live more sustainable lives.

The Climate Change Committee (CCC) have looked into the pathway to reach Net Zero with a series of carbon budgets the most recent of which is the 6th carbon budget. This carbon budget stipulates that there will need to be a 68% reduction in carbon emissions compared to 1900 by 2030 and then up to 75% reduction by 2035, this will require significant actions and decisions to be made in the early years of the 2020s. To reach these targets the Government is looking at a range of technology options in order to decarbonise and how policies can be implemented to create the conditions for these technologies to be successful deployed. A recent example of this success is the deployment of off-shore wind which has enabled widespread emissions reductions in the power sector. The UK is currently positioning itself at forefront and world leader in investigating the use of hydrogen for heating. This has been partly achieved through the emergence of projects such as HyDeploy, H100 and H21 that have evolved during RIIO-GD1 period. During RIIO GD2 the next step is to demonstrate the use of hydrogen on a large scale to enable policy decisions to be made in the 2020s.

In-order to further accelerate the emergence of hydrogen in the UK economy the Government's 10 Point Plan made some clear policy impact, which includes;
a. Aiming for 5GW Hydrogen production capacity by 2030 in partnership with industry
b. Lower carbon heating and cooking with no change in experience for domestic consumers through hydrogen blends and reducing the emissions of natural gas by up to 7%.
The 10-Point Plan also published some targeted milestones which included the prospect to begin a large village hydrogen heating trial by 2025 and set out the plans for a possible hydrogen heating trial by the end of the decade. To reach the target of a hydrogen village being demonstrated in 2025 will require early work to be undertaken and this project signifies the first stage of this early work. This NIA project is the Pre- Front End Engineering Design (FEED) for the hydrogen village and will be the initial piece of work to scope a hydrogen village trial to be delivered alongside Government's directed timelines.

The trial is to be developed in the North West of England and is centred around the potential HyNet hydrogen production facility located on the Stanlow oil refinery in Runcorn. There are a number of possible trial locations around the towns and villages surrounding the refinery and this piece of work will further develop the concept of a hydrogen village. Further work will be required if a hydrogen suitable hydrogen village location is firstly identified and then worked up to produce the outline characteristics of a credible project.

Method(s)

This section should set out the Method or Methods that will be used in order to provide a Solution to the Problem. The type of Method should be identified where possible, eg technical or commercial.
For RIIO-2 projects, apart from projects involving specific novel commercial arrangement(s), this section should also include a Measurement Quality Statement and Data Quality Statement.

This project will be led by Cadent and principally by Cadent's Future Networks team in conjunction with Wales & West Utilities (WWU). Cadent have accumulated experience on hydrogen projects such as HyDeploy and HyDeploy2. Experienced contractors will be hired into the project, under the management of Cadent and WWU.

The project has been designed into 6 work packages. This is to ensure that work is suitably broken down across all the different areas.
WP0 – Project Management and Integration: This work-package is required to ensure that the project remains on track, its outputs are of a sufficient standard, the material and planning for the project next stage is undertaken and is fully aligned with RIIO GD2 funding mechanisms.
WP1 – Hydrogen production and resilience: The hydrogen production is predicated on the HyNet NW facility within the Stanlow oil refinery in Runcorn. This WP looks at the characteristics of the hydrogen production, how resilience can best be enabled and any further considerations that need to be undertaken to ensure that suitable hydrogen is available to undertake the trial. A key determinate of the project will be ensuring that consumers are reliably supplied with hydrogen throughout the duration of the trial.
WP2 – Network Infrastructure: This WP looks at the network characteristics, whether the network is suitable for hydrogen conversion or what actions need to be taken to ensure that it is, how hydrogen is networked to the injection point, how the sectoral conversion of the network will occur and what network control measures, including pressure management, which needs to be put in place to ensure that the network can adequately function with hydrogen.
WP3 – End User applications: Technical: Hydrogen will require new appliances to be adopted by the consumer to ensure that they are safe to be used on hydrogen.

WP4 – Commercial: The cost of the hydrogen will have to be understood and the impact that this has on consumer bills, what are the liabilities of the trial and what modifications/requirements need to be made to the Uniform Network Code (UNC).
WP5 – Safety Case: HyNet Homes will be the first at-scale safety case for the transportation and utilisation of 100% hydrogen within the gas distribution system. The enabling safety case for the trial will likely form the regulatory and procedural precedents and conversion of the current gas distribution network to operating on 100% hydrogen.

Measurement Quality statement includes the fact there are a variety of specialist consultancies and two network licensees involved in the project who will constantly measure the quality output of the project. This will also be reinforced and further scrutinised by the project steering committee, which will compromise of a number of experienced gas industry professionals who will regularly monitor the output of the project. There is also expected to be a regular interface with the BEIS hydrogen trials team, who will have full access to the documents available and will be able to provide comment.

This project is not expected to be particularly data heavy. There is no modelling being done as such but instead some high-level design and engineering work as required. Any data can be made available for review upon request.

Scope

The scope and objectives of the Project should be clearly defined including the net benefits for consumers (eg financial, environmental, etc). This section should also detail the financial benefits which would directly accrue to the GB Gas Transportation System and/or electricity transmission or distribution.

The scope can be broken down into the individual work packages. Each work package has an associated scope

WP 0: Project management and integration
- The creation of a scope of works for FEED
- Project execution plan for FEED including any bid documentation required
- High level Basis of Design
- Work package reports

WP1: Production and resilience
- Functional specification. Functional specification for the resilient supply solution is appropriately defined. This includes assessment of meter point data and annual demand. The functional specification will be developed by looking at a number of different characteristics including safety, customer requirements, trial efficacy, timescales and cost-effectiveness.
- Options assessment. A screening assessment of options will be included, which are to be assessed against the functional specification. There will be a strategic assessment of options including single hydrogen production plus storage, diverse hydrogen sources with no storage and feasibility of non-hydrogen forms of resilience.
- Costs and deliverability of selected approaches. At least one, possibly two solutions are taken forward into a more detailed feasibility stage.
- Identification of supply chain to deliver. Engagement with supply chain, including development of shortlist for FEED package and potential delivery partners.

WP2: Network Infrastructure
- Current network. Build a picture of demand for both annual and peak. This will include identification of users, Independent Gas Transporters (IGT). Understanding the current network assets with some asset surveys.
- The network readiness for H2. Reuse of existing pipes or laying of new, pressure reduction station (PRS) next to a hydrogen production facility, budgetary implications for differing options, feasibility on credible options is undertaken.
- Network Investment. Acceleration of IMR, understand timing and cost implications of this, identify the new investments required and implications of this within the business.
- Early view of sectorisation of the network to carry out the conversion of the network.

WP3: End User Applications
- Technical feasibility: This will include assessment of appliance user types, level of supply chain readiness, counter factual to a hydrogen use-case, including the identification of alternative solutions to hydrogen.
- Economic feasibility and perspective: This will include market assessment and evaluation, high level business case, what level of compensation/incentives are required, economics of the alternative solution (including cost estimate, counterfactual performance)
- Hydrogen conversion approach and roll-out strategy: Surveys being undertaken, approach to pre-conversion of properties, including planning/schedule and work force requirements.

WP4: Commercial
- Commercial market operations. This includes identifying the market mechanisms that the trial will exist within. Hydrogen subsidy options will be considered, commercial impacts for IGTs, Cadent's commercial services (including meter installation and potential

boiler installation)
- Uniform Network Code modifications/requirements. Look at the trial implications with regards to UNC and understand what modifications need to be made.
- Billing of hydrogen. Understand the commodity balancing mechanism
- Liability of Cadent. Assess and understand Cadent's liability under the trial. Both from a regulatory and commercial stand point but also create an over-all risk profile document.

WP5: Safety case
- Understanding the regulatory approval mechanism. The regulatory approach for 100% H2 conversion is not well understood although is expected to be worked through by H21 and H100.
- Quantitative Risk Assessment (QRA) selection and definition. At the moment there is no QRA that has been proved to form the basis of a gas distribution safety case for 100% hydrogen. An assessment will need to be undertaken to understand the success criteria for a 100% hydrogen safety case.
- Evidence base. The necessary areas of evidence will need to be reviewed relative to the existing/forecasted evidence from existing programmes. Areas of evidence that will need to be looked at include gas characteristics, network materials and assets, downstream appliances and operational procedures. Gaps will be identified, and measures put in place during the FEED.
- External Dependencies. The scope of this phase of work is to scope out the evidence requirements necessary to be able to put forward a safety case for HyNet Homes and take stock of the available evidence either created or in train through other programmes.

Objective(s)

This cannot be changed once registered.

The objective of this project is to enable further work and engagement to be undertaken with key stakeholders once the initial outline scope and project plan has been developed. This will include the use of an additional SME to further bolster the project team and input their specialism to ensure successful project development and eventual delivery.

- The objective of this project is to look at the high-level risks and opportunities to develop a hydrogen village trial by 2025, in line with the UK Government's 10 Point Plan.
- There will be a number of outputs to this project, which will initially be viewed at a suitably high level. A number of technical, economic and social factors will be investigated to create a feasible hydrogen village trial in the North West of England.
- The outputs of this work will be further developed by undergoing a FEED if it is deemed necessary at the end of this first stage.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Details of the expected effects of the Method(s) and Solution(s) upon consumers in vulnerable situations. This must include an assessment of distributional impacts (technical, financial and wellbeing-related). For RIIO-1 projects please add "Not Applicable"
This is a low impact project because it will assess the technical risks and opportunities of hydrogen town conversion. When looking at decarbonisation options it is important that this is done not only with a technical focus but also with a focus on the consumer and the potential impact of change upon them. This work primarily concentrates on the technical aspects of hydrogen production, transportation and usage but has the ability to unlock decarbonisation at a low cost compared to alternative solutions, which will benefit customers in vulnerable situations.

The sister project to this project, FI-0002 HyNet Homes Understand Phase (consumer research) will look more thoroughly into consumer impacts and consider vulnerability.

Success Criteria

Details of how the Funding Licensee will evaluate whether the Project has been successful. This cannot be changed once registered.

The success criteria of the project are as follows:
- Development of WP reports for WP 0 to 5.
- Understanding the optimum network configuration for a hydrogen village. This will include what network modifications will need to be undertaken and the time/cost involved in doing this.
- Undertaken a feasibility study on hydrogen production, identified the preferred method and undertaken an assessment with regards to resilience and next steps.
- Understand the regulatory context with regards to UNC modifications, limitations of liability and cost of hydrogen to the consumer.
- Undertake a consumer susceptibility assessment for the trial, which will underpin which technology we offer and consumer benefits that are offered.
- Understand the appliance technology in the chosen area including appliance roll-out and alternative technologies available.
- Understand the safety case assumptions, approach and technical gaps from other projects and how these will be fed into the

hydrogen village project.
- Have a project scope and associated costs for next steps, which is likely to be FEED.
- Understand the shape of the project team and what external skills are required.

Project Partners and External Funding

Details of actual or potential Project Partners and external funding support as appropriate.

The project partners are:
Cadent Gas Ltd (lead GDN) external funding: £550.10k
internal funding: 183.37
WWU external funding: £137.53k
Internal funding: £45.84k
TOTAL: **£916.83K**

Other organisations involved in the project include: Kiwa, Progressive Energy, Element Energy and WSP UK.

External funding: N/A

Potential for New Learning

Details of what the parties expect to learn and how the learning will be disseminated.
This project is unique in that it is the first time that a hydrogen village has been considered. To date no other project has considered network conversion to hydrogen at a village scale and what the practical implications of what this are. This will therefore create new learning that can be tailored for other projects looking at hydrogen conversion and also any consideration given to a hydrogen town.

Scale of Project

The Funding Licensee should justify the scale of the Project – including the scale of the investment relative to the potential benefits. In particular, it should explain why there would be less potential for new learning if the Project were of a smaller scale.

This project will be focused on converting c.2000 homes to hydrogen. The networks believe this is the scale that represents a hydrogen village.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

Details of where the Project will take place. If the Project is a collaboration, the Funding Licensee area(s) in which the Project will take place should be identified.

This study is predicated on looking at the opportunities afforded by hydrogen production in the North West of England. Currently there is a consortium of partners undergoing a FEED on the hydrogen production in the vicinity of the Stanlow Oil Refinery, this FEED is due to finish in the summer of 2021 and the next phase will be a final investment decision (FID). With this in mind this project will consider options for a hydrogen village in the local area surrounding the Stanlow Oil Refinery.

Revenue Allowed for the RIIO Settlement

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’. 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

Indicative Total NIA Project Expenditure

Not applicable

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 will facilitate the energy system transition by eventually enabling a hydrogen village to be trialled, as described in the UK Government's 10 Point Plan.

In a net zero society, natural gas will no longer be combusted for heat as it emits CO2, which can accelerate climate change, as a result alternatives must be found to natural gas and one of these options could be hydrogen subject to its safe transportation and utilisation being adequately demonstrated. This project looks at a high-level options for the hydrogen trial in a domestic setting. This is a necessary demonstration which aims to show hydrogen as a leading technology to decarbonise heat.

How the Project has potential to benefit consumer in vulnerable situations:

Not applicable

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)

Not applicable

Please provide a calculation of the expected benefits the Solution

Not applicable (this is a research project)

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

This work will potentially be replicable to the whole of GB's gas distribution network as the whole network could potentially undergo a conversion to hydrogen in the future. Although this project is predicated on HyNet and the NW industrial cluster the output could relate to any at scale conversion project throughout the GB.

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

The cost of hydrogen conversion will be clearer at the end of this project although the actual network conversion to hydrogen will not be done as part of this project, it will be done in subsequent projects. This project instead will be looking at technical evidence and the practicalities of hydrogen conversion to identify suitable locations and next stage investigation.

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

All network licensees will potentially be converting their networks to hydrogen, possibly as soon as the mid-2020s in the UK's industrial clusters. If this is the case this then means that the work that is produced from this project can be used by all Network Licensees, this is because industrial clusters are located in all Network Licensees operational areas. The projects aim is to facilitate the initial research into the first at-scale conversion of a network and the QRA will underpin all of this work. It is that QRA that can then be built upon in 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)

Not applicable

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 is a pioneering project for Network Licensees' with regards to developing a hydrogen village.

Cadent has discussed the project with other Network Licensees and can confirm that there is no duplication with either other historic projects or those currently being considered. This is particularly the case with H100 Fife, which both Cadent and WWU are project partners on. H100 looks at designing and building a purpose-built hydrogen pipeline to convey hydrogen to peoples homes, whereas HyNet Homes looks to repurpose an existing low pressure gas network that is currently in operation today with natural gas. This means that there is clear deconfliction between H100 and HyNet Homes.

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

Not applicable

Additional Governance And Document Upload

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

As part of the Government's 10 Point Plan this has given the need to develop a hydrogen village and hydrogen town. The technology development curve for hydrogen is now at the point where a hydrogen village is required to demonstrate hydrogen at scale, this can then inform subsequent policy decisions which must be taken on heat in the mid-2020s. As a hydrogen village has not been developed to date this means that the project is innovative and should not be viewed as BAU. This project should be viewed as the first step in developing a suitable hydrogen village proposition, therefore is entirely innovative

Relevant Foreground IPR

This project and the resultant outcomes/ deliverables will conform to the default treatment of IPR as set out under the agreed NIA Governance (where the default requirements address two types of IPR: Background IPR and Foreground IPR).

Data Access Details

Not applicable

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

This project will provide detailed option analysis and risk identification to allow a hydrogen village project to be developed by 2025, as per Government directive. If achieved this will provide a quantum leap for the UK gas industry and thus cannot be regarded as business as usual.

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 conforms to NIA requirements. Commercial risks to be overcome, which require NIA support include the current absence of a relevant support mechanism for CCS and hydrogen as a fuel. A mechanism is currently under consideration by Government, but in the meantime, any network licensee would struggle to justify investment of this nature. However, support in the short-term for this project under the NIA, will allow all licensees to manage commercial risk and then move quickly at the relevant time to deliver maximum benefits to customers in the form of lower costs of network deployment.

This project has been approved by a senior member of staff

☑ Yes