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NIA Project Registration and PEA Document

Date of Submission

Dec 2022

Project Reference Number

NIA_CAD0087

Project Registration

Project Title

HyLights: Hydrogen Gas Lamp Feasibility

Project Reference Number

NIA_CAD0087

Project Licensee(s)

Cadent

Project Start

December 2022

Project Duration

0 years and 4 months

Nominated Project Contact(s)

Brad Bannerman

Project Budget

£20,000.00

Summary

This project looks to conduct a practical feasibility study to determine whether existing heritage lamps fuelled by natural gas can be repurposed to operate with a hydrogen supply. If the gas lamps, the majority of which are located in London and provide a certain historic value, could be converted to hydrogen and operated on a local gas network, it would give these appliances a route to net zero along with other appliances and use cases being investigated across the domestic and non-domestic sectors.

If successful, the idea is to produce a promotional video of the work, which can help engage the gas industry and wider public on the opportunity for hydrogen conversion of the gas grid in meeting GB's net zero targets.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

The UK Government'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. Connected to the gas network today are a series of heritage gas lamps that have been used to illuminate parts of London, and other areas across Great Britain, since 1807. These unique lamps provide a certain historic value and are a point of interest for many locals and tourists alike. Their future is the subject of great debate given the recent decision to postpone the further rollout of electric, LED replacements.

The objective of this Project then is to bring the remaining 19th century lamps into the 21st century with zero carbon emissions, and to prove that the gas industry can deliver advanced technology into a historical environment. The Project will therefore provide the first

steps to determining whether hydrogen gas lamps are a deployable, commercially viable, and sustainable solution to replace existing natural gas heritage lighting.

Method(s)

This Project is all about understanding current natural gas lamp design before carrying out the relevant testing to investigate the suitability of existing lamps to be placed under hydrogen service as part of a wider network conversion.

The Project will commence with an analysis of existing gas lamp designs, technology, operation, and gas consumption before the appropriate testing and development work is undertaken to determine whether it is possible to produce a safe and reliable product. The services of the industry's leading gas lamp specialist will be enlisted to supply samples of existing lamps and components, along with explanation of the main function, parameters and history of the components used.

With a suitable representative gas lamp identified for experimentation and initial development for use with hydrogen, initial tests will take place using an existing mantle to determine the heat input needed to acquire sufficient luminosity and prove the concept of a hydrogen gas light.

The sample gas light with multiple mantles will then be converted for use with hydrogen. Development work will be carried out as required to produce a proof-of-concept solution for demonstration purposes.

The operational controls and built-in safety devices will also be assessed, both for the reference natural gas lamps and the new proposed hydrogen versions before certification requirements and appropriate BS/EN standards are identified. Consideration will be given to the appropriate technical challenges that must be overcome to achieve UKCA certification of any new hydrogen gas lamps and enable them to be placed on the market.

Finally, a feasibility report will be produced to identify what has been achieved to date, what needs to be done to produce a reliable and commercially viable product, whether this is deemed possible, and if so an estimate of the costs and timescales involved.

A promotional video of the work will also be produced to help engage the gas industry and wider public on the opportunity for hydrogen conversion of the gas network in meeting the UK's net zero targets.

Project delivery will be supported by hiring professional organisation(s) to support Cadent on the project. Much of the work will involve physical testing in a laboratory environment, so it is important that any organisation involved has experience in executing technical test programmes within the appliance development sector of the gas industry.

Scope

This Project is undertaken in 6 technical phases, which are:

Phase 1: Initial project scoping phase with the assistance of the industry's leading gas lamp specialist. This phase will involve the following activities:

- Agree scope and terms of reference for the project.
- Analyse existing gas lamp designs, technology, operation and gas consumption.
- Select a sample gas lamp for conversion to hydrogen.

Phase 2: Initial hydrogen luminosity tests to assess the suitability of conversion. This phase will involve the following activities:

- Fire a hydrogen flame into an existing gas mantle and measure the heat input needed to produce an acceptable amount of light.
- Prove the concept of a hydrogen fired mantle.

Phase 3: The focus here will be on the development of a single hydrogen gas lamp. This phase will involve the following activities:

- Convert the sample gas lamp (from Phase 1) for use with hydrogen.
- To measure and document key performance criteria including heat input and appropriate component temperatures.
- To conduct development work as required.

Phase 4: Once developed, gas lamp controls will need to be properly evaluated. This phase will involve the following activities:

- Evaluate operational and safety controls on the sample natural gas lamp.
- Determine whether these can be made suitable for hydrogen, or what alternative/additional controls will be required.

Phase 5: This phase will be designed to evaluate the appropriate BS/EN Standards and Certification Requirements. Key activities will include:

- Determine appropriate BS/EN Standards to apply.
- Consider additional requirements for hydrogen.
- Advise certification requirements likely to be required to facilitate commercialisation of hydrogen gas lamps.

Phase 6: This phase will involve the preparation and publication of the feasibility report, including information on the following:

- What has been achieved to date.
- What needs to be done to produce a reliable and commercially viable product.
- Whether this is deemed possible.
- If possible, an estimation of the costs and timescales required for a full development programme

On completion of the feasibility study, if proven to be feasible, a promotional video of the work will be produced to engage wider industry and the general public.

Objective(s)

The objectives of the project are as follows:

- Provide an opportunity for these unique historic lamps to be retained and begin to understand if they can be adapted to be hydrogen-ready ahead of conversion as part of a wider hydrogen conversion programme.
- Identify a route for further phases of development work and high profile PR opportunities.

Bring forward an opportunity to win the hearts and minds of the public with a visual presentation of hydrogen use which can also be used to decarbonise their homes.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This project focuses on the conversion of heritage gas lamps to work under hydrogen service. As such, it cannot be reasonably expected to have any effect upon consumers in vulnerable situations.

Success Criteria

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

- Feasibility study into the potential for conversion of the UK's heritage gas lamps to work with hydrogen, including a layout of the future work required to develop a fully accredited product.

If proven feasible, a video will be produced to extract the significant PR value associated with the work.

Project Partners and External Funding

The project partners are:

Cadent Gas Ltd, Institution of Gas Engineers and Managers (IGEM), Energy and Utilities Alliance (EUA)

IGEM and EUA to contribute an additional £800 each of funding to supplement NIA contribution.

Potential for New Learning

Currently there is lots of interest around the continued use of heritage gas lamps and whether or not these should be replaced with LED alternatives in support of the UK's net-zero targets. This project will give the opportunity to understand whether existing gas lamps can be repurposed to work with hydrogen, therefore allowing the UK's gas industry to future-proof some of its earliest assets with a non-carbon emitting fuel.

Learning will be disseminated to other UK GDNs (all of whom have existing gas lamps within their network areas), and other key stakeholders through the feasibility report and promotional video produced as part of the work.

Scale of Project

There are currently 300 heritage gas lamps still in operation in the Westminster City Council region alone, with many more lamps located at historic sites across Great Britain.

This project represents a small investment into an initial feasibility study to investigate whether the lamps can be repurposed for hydrogen use. Conversion of the lamps themselves will be dependent on any future gas network conversion to hydrogen and so there will be no immediate benefit of the work to reduction of GB's carbon emissions. The work does provide a good foundation to build on however and presents an opportunity to generate positive PR around the use of hydrogen as a means of providing clean energy in the future.

If the project was to be of a smaller scale, there simply wouldn't be any potential to generate new learning.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

The project will take place within the test facilities of the technical organisation hired to lead the work. Future rollout of hydrogen gas lamps could be realised across the whole of GB.

Revenue Allowed for the RIIO Settlement

Not applicable to this R&D project.

Indicative Total NIA Project Expenditure

The project is broken down into the technical feasibility study, plus the production of a promotional video.

The agreed fixed cost for the feasibility study is £9,980, with the remainder of the funding to be used to produce the promotional video.

This gives a Total NIA Expenditure to reclaim of £20,000 split as £16000 external costs and £4000 internal costs.

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 future conversion of gas lamps in GB to run on hydrogen, thus playing a part in the wider net-zero ambitions of the country.

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

The intention is for this project to be relevant and therefore replicable to hydrogen gas lamps located anywhere across GB.

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

Not applicable

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 has existing gas lamps in operation within its geographical boundaries.

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.

A large number of heritage gas lamps have already been replaced with electric alternatives in the name of reducing carbon emissions. This work is first-of-a-kind and would allow the remaining gas lamps to stay in place, only to be powered by a cleaner fuel should wider gas network conversion to hydrogen go ahead in the future.

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

There are no projects similar to this. This project seeks to assess the feasibility of converting existing natural gas lamps to run on hydrogen.

Additional Governance And Document Upload

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

This first of a kind project seeks to provide the technical foundations to support future conversion of existing gas lamps to be powered by hydrogen.

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 conversion of GB's heritage gas lamps to run on hydrogen, and any of the associated projects which will enable hydrogen conversion 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 uncover technical, operational and regulatory considerations when determining the suitability of existing gas lamps to be repurposed for hydrogen service.

This project has been approved by a senior member of staff

Yes