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

Jul 2023

Project Reference Number

NIA_CAD0093

Project Registration

Project Title

Low Power Heat

Project Reference Number

NIA_CAD0093

Project Licensee(s)

Cadent

Project Start

August 2023

Project Duration

2 years and 8 months

Nominated Project Contact(s)

innovation@cadentgas.com

Project Budget

£466,666.00

Summary

GDNs currently have a licence condition and GSOP requirements to provide fan heaters or oil filled radiators to PSR customers and those in vulnerable situations during a gas outage to stay warm. In addition to the current alternative heat solutions, Cadent are looking to provide an additional alternative heat source for customers in vulnerable situations, that will be easy to manage, ensure that the customer has no or minimal disruption to their normal day to day life, make them feel safer in an off-gas situation and be able to still live independently in their home.

Third Party Collaborators

Haydale Composite Solutions

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

GDNs currently have a licence condition to provide fan heaters & oil filled radiators to the most vulnerable households during a gas outage to help customers stay warm. Additional cost to the customer to use alternative power to heat their home has also been considered.

Haydale's graphene ink-based heaters offer a potential low power usage solution to heat domestic premises when the gas supply is interrupted and so is of interest to Cadent and their challenge of providing heating to their PSR customers or those in a vulnerable situations when their gas supply is interrupted.

Haydale's graphene inks can be printed onto a variety of substrates, either rigid or flexible, they are conformable and flexible. They can be tailored for bespoke solutions to operate at a variety of resistivities and powers and so offer a wide range of options to deliver

solutions across a variety of different and varying use case scenarios. This development will be for a low power alternative radiator heating solution, it will resemble the look of a standard radiator, so it aesthetically fits in to the home environment.

Method(s)

We will take a novel technical approach to this problem by using Haydale's graphene inks. Haydale's graphene inks can be printed onto a variety of substrates, either rigid or flexible, they are conformable and flexible. They can be tailored for bespoke solutions to operate at a variety of resistivities and powers, and in different design configurations, so offer a wide range of options to deliver solutions across a variety of different and varying use case scenarios.

Haydale's graphene ink based radiator heaters offer a potential low power usage solution to heat domestic premises when the gas supply is interrupted and can be easily adapted into different designs to deliver bespoke solutions for a wide range of customer requirements, so is of interest to Cadent and their challenge of providing heat to their PSR customers & those in a vulnerable situation when their gas supply is interrupted.

Data Quality Statement

The project will ensure that necessary data is of sufficient quality and readily available to meet the objectives of the project. This will be achieved by capturing output that will have derived from the research phase of the project. As the project moves along its lifecycle, further data will be captured and analysed, to ensure that the end product is of benefit to customers who are in vulnerable situations.

Measurement Quality Statement

The project will collect data during the research and development phases. This data will determine what internal procedures will need to be updated as well as considering any standards that need to be followed or updated. Based on the accuracy of the data will also allow the project to have informed information before progressing into testing and delivery phase.

Scope

This project will be split into 3 phases, with the final objective of having a solution that can go to market which will provide an alternative heat source, in off gas situations, for customers who are in vulnerable situations. The 3 phases are as follows:

· Phase 1 - A report outlining the requirements for the manufacture of a graphene based printed heating solution, the outcomes from the laboratory trials and thermal modelling, the design ideas and recommendations.

· Phase 2 - A working proof of concept demonstrator, validated at the laboratory-scale along with a detailed report.

· Phase 3 - A working pre-product prototype that can be trialled and validated in an operational environment along with a detailed report of all work undertaken and any test results, modelling, and designs.

Objective(s)

The objectives of this project are:

Phase 1

- Technical requirements for developing low power graphene radiator heating solution will include:
- Must heat for a minimum of 6 hours/day.
- Heat up faster than traditional radiators.
- Must be powered by a rechargeable battery.
- Societal requirements in terms of size, form, weight, usability etc.
- Will be sustainable and recyclable.
- Economic requirements in terms of cost, durability, and "leave or return"

Stage 1 will allow Haydale and Cadent to agree on a most suitable design which shows the most promise for further development in Stage 2.

Phase 2

Phase 2 will use the information from the scope of work, technical requirements, and societal requirements from Stage 1 to develop proof of concept demonstrator graphene ink- based radiator, this will include:

- Substrate material selection
- Ink development
- Printing development
- Testing and analysis of the heaters
- Size of product (large and small)
- How the heater will fit onto existing radiators and look.
- Easy to use for all customers.

Phase 3

From Phase 2, one proof of concept demonstrator system will be taken forward for development into a pre-product prototype.

Phase 3 will focus on scaling up the proof-of-concept demonstrator into an operational pre-product prototype in line with the requirements (technical, societal, and economic) identified in the previous stages and in line with Cadent's requirements.

This work package may require additional support from selected supply chain partners who can assist in the development of the prototype and who would work with Haydale to commercialise the product for Cadent.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This project has been input into the Consumer Vulnerability Impact Assessment Tool and there are no negative impacts on consumers in vulnerable situations therefore there is no need to take mitigation measures.

Success Criteria

- The graphene ink-based heaters developed can safely and efficiently deliver enough heat for domestic properties.
- The graphene ink-based heaters are economically and commercially viable.
- The heater should be safely fixed to the radiator
- The heater should not be intrusive to the customer, so it doesn't look out of place
- The heater should work at optimum temperature, so it does not burn the customer
- The rechargeable battery should be within the device
- A minimum of 2 sizes should be produced

Project Partners and External Funding

The project partner for this project is Haydale Limited and the project will be wholly funded via NIA.

Potential for New Learning

This will be a new, innovative, and challenging application for Haydale's graphene-based heater ink technology and the project will generate several opportunities for Haydale to learn. Once the technology is proven, the use of the graphene ink-based heaters in this application will be a new product and improved method for ensuring the comfort and safety of Cadent's customers.

Scale of Project

The project will be delivered as detailed and will bring significant advances relating to alternative heat sources in Off Gas situations and their effect / impact on consumers in vulnerable situations. If the scale was lessened, it would significantly reduce the benefits customers could receive from the project.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project is applicable to Cadent's four Networks.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total external costs: £350,000

Total internal costs: £116,666

Total NIA expenditure: £466,666

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:

N/A

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

The aim of this project is to deliver an alternative heat source for customers who are in vulnerable situations when there is no gas, either planned or unplanned. The product will provide a safe method of heating homes, will be easy to manoeuvre, and have the look and feel of a radiator, so not disrupting their daily life and provide the optimum heat required to keep them warm. The potential solution will enable many customers in vulnerable situations to be able to heat a room to an optimum temperature to allow them to stay warm and live independently, whereas current alternative solutions are not fit for purpose in many cases.

Other considerations include the impacts of our works on Fuel Poor households & low income – by reducing the cost of alternative ways of heating. Considerations where alternative accommodation process are not suitable and we should be providing ways to allow people to stay at home. LSx research carried out for Cadent – concluded that in terms of alterative temporary accommodation, being in new surroundings /away from home can be destabilising for families, especially those where disabled relatives or young children are concerned and for people with anxiety.

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

The aim of the project is not necessarily to see financial benefits but to improve the experience of vulnerable customers and potentially the wider public when they are in an off-gas situation. In addition, the project could provide the below benefits:

· Financial - Printed heaters could be mass manufactured using reel to reel production method and thoroughly encapsulated for longer service life.

· Health and Safety - Smart control system will ensure safer operation of each unit.

· Customers - Heaters can be custom built for domestic installations.

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

The roll out of his product will have the potential to be nation wide and available for all GDN's. Whilst the project is looking to benefit Customers who are in Vulnerable Situations, it is by no means exclusive to these customers.

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

Roll out costs are not yet defined within the project due to the project starting at TRL2. These will be discussed in Phase 1 of the

project and monitored throughout its lifecycle.

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 learnings from this project could be adopted by other Network licenses.

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 thorough check has been completed and no similar projects have been identified. All networks were informed of the project via a project notification form on huddle and no issues of duplication have arisen.

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

This method of Low Power Heat has not been identified previously across all GDNs and thus makes this project innovative.

Relevant Foreground IPR

The 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

Any consumer data gathered throughout this project will be anonymised and will be compliant with General Data Protection Regulations (GDPR) and the UK Data Protection Act. Any compliant data can be made available for review upon request.

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

The scale of the issues at hand is unknown and therefore there is a high level of uncertainty associated with the project which would be beyond the network licensees' risk appetites. This piece of work is to better understand the opportunities for alternative heating methods when customers are off-gas.

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 high-level risk associated with the low TRL project is beyond the current risk appetites of networks. NIA will allow us to complete this project to better inform future decisions and opportunities.

This project has been approved by a senior member of staff

☑ Yes