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

Nov 2024

Project Reference Number

NIA_WWU_02_66

Project Registration

Project Title

Project GaIN

Project Reference Number

NIA_WWU_02_66

Project Licensee(s)

Wales & West Utilities

Project Start

November 2024

Project Duration

0 years and 6 months

Nominated Project Contact(s)

Eileen Russell

Project Budget

£240,000.00

Summary

As the UK attempts to decarbonise residential heat to meet net zero by 2050, electric heat pumps along with heat networks are expected to play a key role. However, it is generally accepted that no one technology will be able to meet the needs of all households. If we are to deliver affordable low- carbon heating in the residential sector, we shall need as wide a range of technology options as possible to overcome the economic and technical challenges facing every customer.

Project GaIN (Gathering Insights) will explore alternatives to heat pumps and heat networks which can utilise the robust gas network and benefit from its current upgrade programme, supporting the aims of DESNZ's decarbonisation of heat roadmap. The project will discover and assess additional technology options where alternative solutions might be more costly or difficult to deliver; this will include LAEP system benefits as well as localised CAPEX and OPEX costs.

Third Party Collaborators

LCP Delta

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

In our attempts to decarbonise residential heat, electric heat pumps along with heat networks are expected to play a key role. However, it is generally accepted that no one technology will be able to meet the needs of all households. If we are to deliver affordable low-carbon heating in the residential sector, we shall need as wide a range of technology options as possible to overcome the economic and technical challenges facing every customer.

Recent studies have shown that electric heat pumps will only be suitable for around 10% of homes without significant additional

remedial measures. Even high-temperature heat pumps required additional radiators, hot water cylinder replacement and other disruptive interventions.

In addition, householders have expressed dissatisfaction with the disruption and practical constraints in terms of available space, noise to neighbours and end user economics in terms of either CAPEX or running costs.

Furthermore, even when heat pump technology can meet the needs of the household there remain challenges facing the capacity of the electricity distribution network to deliver the required power and of course the availability of generation particularly at times of peak demand.

Whilst some would argue that electric heat pumps should be the focus of residential heating, even if only 10% of homes were unsuitable, we will still need a solution for those homes.

Today, gas boilers provide reliable, affordable heat to most homes and whilst we recognise the need to decarbonise our homes, this can be immediately addressed to some degree by replacing older, less efficient gas boilers with more efficient alternatives such as thermally driven (gas-fired) heat pumps. This would provide a options for today's consumers to effectively replace older, less efficient gas boilers with a lower carbon, hybridised solution, that would meet the needs of 90% of homes that are currently unsuitable for a traditional heat pump, facilitating the transition to net zero.

Alternatively, there may be other options where fuel cells might substitute heat-only appliances, simultaneously producing space and water heating whilst generating electricity more efficiently than central generating plant in support of nearby electrical heating solutions.

Indeed, as the gas grid decarbonises, advanced gas solutions operating in a whole system environment would offer low carbon heat both now and in the longer term, with a trajectory that leads to zero carbon heating with a more effective overall energy system that utilises the existing gas and electricity distribution infrastructure to maximum impact at least cost. This provides immediate decarbonised solutions to consumers that not only would reduce carbon emissions, but could also save substantial sums required to upgrade electricity infrastructure, whilst addressing the challenge of stranded gas assets which is emerging as a major challenge to the energy transition.

Method(s)

Project GaIN (Gathering Insights) will explore alternatives to heat pumps and heat networks which can utilise the robust gas network and benefit from its current upgrade programme, supporting the aims of DESNZ's decarbonisation of heat roadmap. The project will discover and assess additional technology options where alternative solutions might be more costly or difficult to deliver; this will include LAEP system benefits as well as localised CAPEX and OPEX costs.

LCP-Delta will undertake comprehensive research on the current market trends and technological advancements to understand the state-of-the-art in high-efficiency gas heating appliances and their potential applications. They will then evaluate the suitability of UK homes and their surrounding environments for the installation of advanced gas boilers in order to understand the specific needs and constraints of different types of homes and neighbourhoods.

LCP-Delta will review selected LAEPs to identify any gaps in the current technologies used for residential heating, with a view to identifying areas where advanced gas boilers could provide a more efficient or more cost-effective solution. An assessment of the performance, applicability and carbon profiles of different heating technologies will enable LCP-Delta to understand the environmental impact of these technologies and how they can contribute to carbon reduction goals.

LCP-Delta will conduct interviews with up to five key stakeholders to clearly understand the performance of the technologies and qualify any assumptions. Interactive stakeholder engagement sessions will supplement these formal interviews and will be informed by the market and technological research previously undertaken.

LCP-Delta will next develop carbon models to predict the carbon emissions of different assets and buildings based on their heating systems, helping to inform decisions about which technologies to implement for maximum carbon reduction.

The final deliverable of the project will see LCP-Delta compile the findings from the project into a comprehensive report.

Upon review of this project's method and scope, it has been concluded that data will not be used to inform any of the project's outputs. As such, the brevity of the following data quality statement has been deemed adequately proportionate to the risk (or lack thereof) associated with the measurement and quality control of data that this project requires.

Data Quality

All sources of data used will be assessed for reliability of the data acquisition method used, and bias of the data source to the extent

practical. Sources of data that do not meet high standards of reliability and impartiality will be excluded from usage. The data provider, original sourced data location and details about the data acquisition method will be recorded for all data used in an MS Excel spreadsheet. Any outstanding concerns regarding the quality of data sources will additionally be recorded in an MS Excel spreadsheet. All such records will be discussed with WWU during the project with complete documents provided alongside the final deliverables of the project.

Measurement Quality

The quality of our outputs is at the heart of LCP Delta's corporate ethos. This is reflected in more than 75% repeat business in the last year as well as all client feedback being rated an average of 4.4 out of 5 for consultancy work. We have a comprehensive internal QA process shown below used on all projects. For this project specifically we will appoint Head of Consulting, Andrew Turton as the internal QA lead. At the kick off stage, we will discuss and agree on relevant KPIs with WWU which are likely to include:

- Compliance with programme
- Response time and turnaround to WWU requests
- Success rate in conducting external engagement – number of people, organisations, etc.

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

Technology Review

- Review of existing technology undertaken
- Desktop research exercise to assess state-of-the-art technology options, including product readiness and performance
- Delivery of interim report with results of desktop research exercise
- Presentation of results to steering group

Industry Engagement

- Interviews with up to five key stakeholders to clearly understand the performance of technologies and qualify earlier assumptions
- Define and agree on benchmark/base case heat pump (air/ground source) with WWU
- Interim report with results of stakeholder engagement and industry interviews

Stakeholder Workshops/webinars

- Interactive stakeholder engagement sessions to supplement formal interviews
- Sessions will be informed by earlier project work
- Delivery and hosting of industry webinar and workshops by LCP-Delta
- Interim report produced with outcomes of these workshops
- Presentation to steering group with the results of the stakeholder engagement activities

Network Impact

- Assessment on overall network if key assumed solutions are adopted and deployed (this will be high-level, indicative modelling, including cost-benefit analysis of the in-scope options)
- Interim report with results of the assessment of impact of changes on the network
- Output of modelling on system impacts of these changes
- Presentation to steering group with results of modelling of network impact and LAEP system impacts

Final Reporting/Dissemination

- Delivery of final project report encompassing all project learnings
- Final presentation of findings to the steering group
- OFGEM closedown report produced

Objective(s)

The overall objective of this project is to explore the potential role for high-efficiency gas appliances to support the transition and to

provide an evidence base to support the case for a better-integrated energy system, providing cost and deliverability benefits to individual households and to the wider energy system. This will be achieved by undertaking studies including technical and economic modelling with the intention of gaining a better understanding of the following areas:

1. The current status of high-efficiency gas heating appliances including heat only (primarily heat pumps) and combined heat and power technologies (primarily fuel cell-based). This will cover both the technical maturity, current and projected installed costs and performance and other characteristics limiting or facilitating their deployment.
2. The applications for the respective technologies and where this will make them more suitable for homes where other solutions (such as electric heat pumps) face significant cost or deliverability challenges. Particular consideration will be given to homes where fabric or other measures are unacceptably onerous, such as listed buildings or where space constraints make some products impractical to install.
3. The energy system impacts at low voltage electricity level and how the respective technologies might mitigate impacts and associated costs and timings for connection of electrical solutions.
4. The potential for optimising implementation costs for the UK energy system of the various solutions compared with the most commonly assumed technologies in current policy.
5. The overall carbon burden of alternative deployment rates for electric heat pumps compared with lower carbon gas technologies in the short term and overall, to 2050. That is, whether installing higher efficiency gas appliances now (which will immediately reduce carbon emissions) has merit compared with waiting for the low carbon electricity system to be built out to accommodate electric heat pumps over a longer timescale.

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

The criteria which would demonstrate a successful project are:

1. Understanding of the advanced gas heating technologies, their current and projected performance, costs and other characteristics
2. Using air/ground source heat pumps as the base case (benchmark and comparator), the project will confirm that the technologies provide a deliverable solution which addresses the challenges of low-carbon residential heating systems in terms of customer acceptance (including disruption, space, noise, heating regimes etc.), operating costs and sustainability.
3. Confirm or otherwise that the technology categories identified in this proposal are at a TRL which would allow them to be deployed at a relevant scale within the time period to 2050.
4. Identification of achievable value for the networks and establishing a credible baseline to enable others to demonstrate the case for retention of a gas distribution network within the strategic framework of UK net zero policy

Project Partners and External Funding

The supplier for this project is LCP-Delta. The project will be wholly funded via NIA, with WWU as lead network.

Potential for New Learning

It is anticipated that learnings from this project will be widely applicable across all networks. The challenges of finding a technology solution capable of fulfilling the requirement to replace gas boilers which currently provide over 80% of all household heating systems inevitably means that any learnings will be replicable to a large extent elsewhere.

Although arguably areas with lower penetration of mains gas will be relatively less able to exploit learnings, there is no franchise area where gas-connected homes are absent.

In terms of the specific learning opportunity, the review of relevant technologies, their potential applications and limitations will all be key points which will support understanding of advanced technologies gas networks and across the whole energy system.

The majority of the heating industry, policymakers and even gas networks themselves have little understanding or even awareness of the various advanced technologies we intend to explore in this project. If we are to develop relevant residential heating policy and make the necessary investments to deliver on those policies, it is essential that the learnings around the technologies become more widely available and understood as proposed in this project.

At the same time, the modelling of performance and network impacts will be crucial to building the case for the future role of gas networks within an integrated energy system which is affordable, secure and sustainable.

Scale of Project

This is a desktop research and modelling with analysis project that has been costed to deliver studies (including technical and economic modelling) with supporting evidence to gain a better understanding of the following areas:

1. Need to review technologies whatever scale is considered
2. Initial scope is for a generic study from which learnings will be scaled
3. Subsequent stages (not in this project) may involve trials of relevant technologies at which point there will be a need to determine the minimum viable project scale

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project will cover the entire GB network.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

- External: £180,000
- Internal: £60,000
- Total: £240,000

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:

The project will facilitate the energy transition for residential heat, providing an additional technology option where alternative solutions might be more costly or difficult to deliver. By making use of the existing heat distribution installation within the home and the existing gas supply the selected technologies deliver OPEX and CAPEX savings to householders. At the same time it will deliver overall system benefits for all connected customers, both gas and electric by both reducing the demand and increasing the generation of low-carbon electricity in support of electrification of heat.

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

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 which will assist in this area. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save millions of pounds with minimal gas customer disruption verses alternative decarbonisation solutions. The use of high-efficiency gas appliances (thermally driven heat pumps) uses a low-cost fuel supply to deliver significant cost (and carbon) savings compared with existing heat installations; as the gas grid is itself decarbonised, it is logical to utilise this higher cost fuel as efficiently as possible. In the case of fuel cells, additional value is created by the generation of low-carbon electricity within the low-voltage electricity distribution network thus reducing socialised network DUoS costs.

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

The learnings will be applicable to all networks.

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

There are no rollout costs 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

It is anticipated that learnings from this project will be widely applicable across all networks. The challenges of finding a technology solution capable of fulfilling the requirement to replace gas boilers which currently provide over 80% of all household heating systems inevitably means that any learnings will be replicable to a large extent elsewhere.

Although arguably areas with lower penetration of mains gas will be relatively less able to exploit learnings, there is no franchise area where gas-connected homes are absent.

In terms of the specific learning opportunity, the review of relevant technologies, their potential applications and limitations will all be key points which will support each of the GDN understanding of advanced technologies.

The majority of the heating industry, policymakers and even GDN themselves have little understanding or even awareness of the various advanced technologies we intend to explore in this project. If we are to develop relevant residential heating policy and make the necessary investments to deliver on those policies, it is essential that the learnings around the technologies become more widely available and understood as proposed in this project.

At the same time, the modelling of performance and network impacts will be crucial to building the case for the future role of gas networks within an integrated energy system which is affordable, secure and sustainable.

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.

All networks have been made aware of this project and no concerns of duplication have been raised.

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

During the course of this project, performance data of the relevant technologies will be collated together with anticipated costs from other studies. This will be used to model the proposed innovation with regard to the application of thermally driven heat pumps and fuel cell CHP technologies and identify economic benefits to individual consumers as well as the overall energy system. If sufficient value is identified within the proposed CBA, a subsequent stage will be used to demonstrate the deliverability of a relevant technology mix in a simulated residential heating environment leading to a full-scale demonstration in due course.

Relevant Foreground IPR

The project report and other deliverables will form 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 here
- 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" here

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

The initial study proposed here will be a generic model based on the performance of commercially available (or near commercial) technologies which it is expected will be available across the entirety of the UK. The modelling of performance and economic benefits to the individual consumer will likewise be fully transferrable across all customers. Subsequent studies will also be transferrable as concepts although there may be minor variations in the way in which the respective electrical and gas distribution networks can benefit from synergies in the applied technologies. This not a BAU activity for networks.

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 for transport in 2050 that this work is no longer valid.

This project has been approved by a senior member of staff

☑ Yes