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

Aug 2022

Project Reference Number

NIA_UKPN0083

Project Registration

Project Title

NeatHeat

Project Reference Number

NIA_UKPN0083

Project Licensee(s)

UK Power Networks

Project Start

September 2022

Project Duration

1 year and 10 months

Nominated Project Contact(s)

Rona Mitchell

Project Budget

£473,000.00

Summary

A project with the objective to investigate the use of smart electrical storage heating systems in housing archetypes with spatial constraints or limited access to external wall space. The solution will be installed, trialled, and monitored within customer homes in order to understand the practicality of this low-carbon heating technology as well as the impact of such a solution on the network. The findings of this project will ensure that the distribution network operators obtain insight into such technology. Therefore, not form an obstacle in allowing customers to participate in the decarbonisation journey.

Third Party Collaborators

OVO Energy

Tepeo

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

Heating is responsible for 37% of the UK's carbon emissions. In order to meet the Net Zero targets, this sector must be decarbonised – primarily through electrification.

While heat pumps are expected to be a core part of the 'electrification of heat', we understand that one size fits all does not work for heat, and it is a challenge to install these in homes with no outside space or limited internal space – specifically terraced housing archetypes. Even in units where external wall space is available, there is a significant disruption associated with heat pump installation, e.g. radiator replacements and pipework upgrades that may make this solution an unattractive proposition for customers in such housing archetypes. According to a study implemented by Barrat Homes*, approximately 26% of UK homes do not have a viable

alternative to act on decarbonising their heating today in a cost-effective and least disruptive manner. To date, about 500 customers have registered their interest in installing a heat battery** with OVO Energy (Energy Retailer) for these reasons and without any form of advertisement for the project. Additionally, Tepeo (Solution Suppler) is identifying more than 200 potential customers every month who are interested in this product.

Besides the challenge associated with size and space, heat pumps and their associated installations can be costly and in some cases in excess of £12,000. Even with the newly launched Green Heat Network grant scheme, this results in an end cost of about £7,000 per home. This subsidy makes heat pumps more affordable yet still expensive compared to typical boilers. Furthermore, given the budget size of the Green Heat Network Fund of £338m, this would only allow less than 67k customers to benefit from this subsidy as it stands.

Accordingly these challenges require an alternative low carbon technology (LCT) solution for locations where heat pump installations are either impractical, non-desirable, or less cost-effective. This project will be using Tepeo's Zero Emission Boiler (ZEB) which is a low carbon alternative to a gas or oil boiler. It is powered by electricity and works like a battery to store heat very efficiently until it is needed.

* https://www.barratthomes.co.uk/uk-in-a-street

** https://www.ovoenergy.com/guides/top-7-eco-alternatives-to-gas-boilers

*** https://es.catapult.org.uk/news/electrification-of-heat-trial-finds-heat-pumps-suitable-for-all-housing-types/

Method(s)

The Aim:

This project aims to investigate the potential of Zero Emission Boilers (ZEB) as an alternative LCT solution to the carbon intensive gas boilers and in areas where a heat pump may present an unreasonable fit. It will use a combination of qualitative customer research, quantitative analysis on monitoring data (supply point half-hourly consumption and dedicated asset monitoring), analysis of installations (time, disruption, upgrades required, etc.) and industry subject matter expert interviews to determine the applicability and implications of using ZEBs at scale.

Project Partners:

OVO Energy – an energy retailer providing customers with smart (time-of-use) tariffs and will lead the analysis of data collected from the project.

Tepeo – manufacturer of the ZEB and will lead the installation process and all matters related to the product.

The trial:

The participating customers in the trial will be chosen based on specific selection criteria developed as part of this project. The data collected from this trial will include electrical consumption and heating supply as well as the reliability of the product. After the trial is completed, participants would be able to keep the product for their personal use at no cost to them unless otherwise requested by them. Should the latter occur, details of the planned procedure will be defined as part of the project planning and setup phase.

Impact on Network:

The ultimate aim of the ZEB is to allow customers to decarbonise their heating system without causing electricity network reinforcement. Based on findings from Tepeo's research, installation of a ZEB would not trigger a requirement for a fuse upgrade within homes fitted with a 100A fuse. Since the ZEB draws 40A, this assumption still stands even if the house is also fitted with an electric vehicle charger which typically draws 30A. The ZEB can be smart controlled to only operate at night (off-peak) as this is when it charges the internal storage system which will then be used to heat the space if and when required. This will be proved during the project trials.

Impact on Customer:

The ZEB is aimed to be a like-for-like replacement for a gas or oil boiler. Therefore, limited impact or disruption is anticipated from the customer side during installation. However, the ZEB would require four hours to charge from empty and the standard flushing procedure would still have to take place. The participating customers shall be supported throughout the journey and the associated partners' representatives will be identified as part of the end-to-end customer journey plan.

The assurances:

In order to reassure the participating customers and in an attempt to eliminate any potential concerns, disturbances, or incurred costs, actions have been put in place so that all participants do not face any negative impact due to this trial. Specifically, bill credit has been agreed to be provided to customers by the energy retail project partner, OVO Energy. However, such payments will be planned in a way that does not create any impact on the accuracy of the project findings.

All data used within this project is for the purposes described above, and therefore quality will be measured on this basis. The project will follow all data quality rules, logging, and prioritising issues as they arise in line with the approved methodology set out in our Enterprise Data Management Policy, which forms part of the UK Power Networks Integrated Management System.

Data quality will be measured across five dimensions where applicable:

- Accuracy
- Completeness
- Consistency
- Validity
- Uniqueness

Data quality rules for each of the appropriate data quality dimensions above will be set by the project, measuring them closely on a regular basis to identify quality issues.

Data quality issues will be logged in a central location and prioritised using an approved matrix which combines the importance of the issue, and the amount of data affected, this gives an indication of the issue's impact on the project and wider business, considering factors such as:

- The impact on the health and safety of the public and employees
- Whether it may result in a breach of our licence conditions or relevant regulations
- The impact on UK Power Networks' reputation
- The impact on our operations and efficiency
- The financial impact, including project delays and charges from external service providers

The project will then seek support for resolving the issues in priority order. All data and background information will be stored centrally and securely in a project specific Sharepoint folder or in our Enterprise Data Store if required by the wider business in accordance with data protection requirements.

Scope

The development of this project will be divided into six work packages which are set out as follows:

1) Project planning and setup:

The initial project setup will be conducted as part of this work package. This includes preparation and signature of terms and conditions as well as agreements with all parties. It will also include the identification of installers and providing all necessary training.

2) Customer recruitment:

As part of this work package, a customer research plan will be implemented. A marketing strategy will be executed, and eligible participating customers will be onboarded. Terms and conditions and a list of FAQs will also be put in place to aid with the process.

3) Product installation:

The installation phase is aimed to be quick to allow for more monitoring time. All installations and the activities associated with it are to be carried out by Tepeo and its sub-contracted installers. Any required domestic fuse upgrades would be part of this work package as well as all the necessary testing of the complete heating system.

4) Product monitoring:

All installed systems will be monitored for the duration of the project. The process is not intended to provide a live feed. The exact specification of collected data would be based on the outcome of work package 1. This is envisioned to indicate the power draw, heat output and reliability of the product.

5) Customer research:

This work package will focus on the customer experience and their satisfaction with the product. Surveys are intended to be carried out as part of this activity. The methods planned to be used are Customer Satisfaction Score (CSAT) vs Net Promoter Score (NPS).

6) End of project analysis and reporting:

The work package marks the last phase of the project where all the findings would be collated, summarised and made available/uploaded to the relevant portals. The roll-out of findings to Business as Usual (BAU) will be delivered as part of this work package.

Objective(s)

The objectives of the project are to:

- Understand customer attitudes to low carbon heating options and perceptions of ZEBs.
- Understand the practicalities for installation – property suitability, logistics, duration etc.
- Evaluate the potential network impacts – fuse upgrades, service cable suitability, peak load, and wider network impacts.
- Explore what the implications are if customers have both an EV and a ZEB.
- Understand running costs and how time-of-use tariffs can deliver competitive heating costs vs fossil fuels

The outcomes of the project are:

- Inform policy decisions by supporting Local Authorities and the Department for Business, Energy and Industrial Strategy (BEIS) with data and evidence
- Understand the impact of ZEBs on the network and ensure readiness
- Understand customer perception and experience with regards to this technology as an alternative to heat pumps
- Understand the operational cost of ZEBs to the customers
- Validate the benefits from smart operating the ZEB's charging patterns

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

There are two types of consumer vulnerability impacted by this project:

Home Size – Risk at being left behind:

For a variety of reasons, smaller homes (including flats), are less suited to heat pump installations. Customers who live in these types of homes are therefore at risk of being left behind in the transition to Net Zero. This is a type of vulnerability that has not previously received much attention in previous years. This project is trialling a solution to ensure that we do not leave anyone behind in the journey to low carbon heating.

Financial Vulnerability

As part of the project recruitment drive, tepeo are contacting individuals who has previously considered purchasing a ZEB but decided not to proceed due to upfront cost.

Project Approach to Vulnerability:

Consumers in vulnerable circumstances are not specifically being targeted in this project. For the duration of the trial, a special tariff will be offered to customers to reduce the cost of running the ZEB. The tariff is subsidised by the project budget. It will allow the project to collect data on how people wish to heat their homes without taking into account the high cost of electricity. However, after the trial concludes, it is unlikely that Ovo Energy will choose to prolong the offer of this tariff. The cost of running the ZEB will therefore likely increase for customers after the project concludes. For this reason, it is not proposed to specifically target consumers in vulnerable circumstances.

Success Criteria

The project will be deemed successful when we have:

- Demonstrated the successful installation and operation of the smart storage heater in the designated housing archetypes
- Gained insights into the impact of such low carbon solution on the network operation
- Understood how the load profiles of customers within various housing archetypes would look like under smart operation of the unit
- Understood the operational costs of this solution and the impact of that on customers
- Understood the overall customer journey and the areas where DNOs, and others, can play a key role in the decarbonisation journey

Project Partners and External Funding

The partners for the project including their contributions are as follows:

OVO Energy: energy retailer, project contribution is £30,000

Tepeo: ZEB supplier, project contribution is £75,265

Potential for New Learning

The project will deliver key internal and external learnings in light of this innovative solution and how it will impact both the network as well as customers.

From a network perspective, understanding the installation requirements of this solution will allow all participating parties to proactively support the customer during their decarbonisation journey. Additionally, the smart operation of the storage heating system can provide additional tools to the system operator to ensure that the network operation is optimised at all times. Last but not least, understanding the impact of this LCT on the network will ensure that the DNOs do not become a blocker for this transition and enhance the network readiness for the future.

The customers, on the other hand, especially those in spatially limited housing archetypes, will benefit from having a clear decarbonisation journey and an understanding of how this solution can ensure they are not left behind in this journey. Additionally, having an understanding of the operational cost of the unit will provide added certainty to the users. Furthermore, this collaboration will shed more light on alternative heating solutions and both, directly and indirectly, support the growth of this industry in a way that suits all customer types and requirements.

The dissemination activities for this project will be defined as part of work package one in order to maximise the reach and benefits obtained from this project. This shall include internal project meetings, workshops, as well as continuous stakeholder engagement. Externally, this can be in the form of press releases, presentations, as well as reports which are to be issued as part of the project deliverables.

Scale of Project

The scale of the project is to install smart electrical storage heaters in customer homes. This number of homes will be selected in a way that is representative enough of the housing archetypes this project is targeting. The project's aim is to gather real-life data combined with an operational assessment of this solution. It will also provide a greater understanding of the suitability of this solution in the designated housing archetypes and provide insights into the impact of such solutions on the network.

If the project were of a smaller scale, then there would be less potential for key learnings including the suitability for such a solution to be widely used in customer homes across Great Britain.

A time extension of four months was progressed in June 2023. This was because of delays in customer recruitment and product installation compared to the baseline plan.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

Trial homes will be located within the UK Power Networks' licence areas. Exact locations are to be defined during the project planning and setup stage.

Revenue Allowed for the RIIO Settlement

No funding was provided within the current RIIO settlement that will become surplus to requirements as a result of this project.

Indicative Total NIA Project Expenditure

We estimate the UK Power Networks' NIA expenditure to be £473,000, of which £425,700 (90%) will be recovered from NIA.

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 aims to prove that the smart operation of electrical storage heating systems, in conjunction with other LCTs, is capable of facilitating the overall energy system transition. Such smart operation can be done both on a local level in the customer home as well as across the whole distribution system. This facilitation can be in the form of releasing more capacity into the network or providing additional flexibility services to the operator, especially if paired with EV smart charging for example.

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

The operational cost of the ZEB is being investigated and will be compared to that of a gas boiler or heat pump, the latter will be used for benchmark purposes. Should ZEB be found to be cheaper to operate, this would reduce the bills of customers in general, especially those in fuel poverty or at risk of fuel poverty.

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)

The high-level network benefits from this project come from the potentially deferred reinforcement costs. We anticipate that the customer uptake of heating technologies similar to the ZEB will start increasing as we approach the 2035 mark (ban on boiler installation). Therefore, no direct benefits or savings are estimated to be realised throughout the duration of RIIO-1 and RIIO-2.

Please provide a calculation of the expected benefits the Solution

OVO Energy estimates that there are 10m houses in the UK this solution would be able to serve. From this, it can be estimated that 3.33m (33%) falls within our network. It is anticipated that 40% of those would agree to utilise this solution according to OVO energy's market research. Therefore, ~1.3m homes are used in these calculations.

Network Benefit:

Should these customers in consideration install a heat pump in order to comply with the low carbon regulations, this is estimated to impose an additional 1.7kW peak load per customer. Due to these being peak loads, network reinforcement would have to take place to meet the increased demand. With smart charging of ZEB, the heat demand would be shifted to times of low demand and therefore would delay the requirement of such upgrades. With the consideration of the ban of gas boilers installations taking effect from 2035, we can estimate that those ~1.3m customer homes would revert to a solution to what is being trialled in this project. Based on this, the network benefits can be calculated as follows:

- Number of 500 KVA sites required to cover 1.3m homes: 3,627 sites (assuming that 20% of the load can be absorbed by current substations)
- Cost per MVA Site Upgrade (net basis): £72,500 (unit cost across the three licence areas) calculated by = £145,000 per MVA site upgrade x 0.5 MVA
- Method cost (base cost deferred four years): £63,424
- Benefit per site: £9,076

- Estimated total benefit: 3,627 sites * £9,076= £32.9m (Estimated to be exponentially distributed between 2035–2050)

There are also wider social benefits in the form of:

- Social Benefit:

o OVO currently estimates that 40% of customers living within limited space homes in the UK would not be able to upgrade to a heat pump.

o By utilising cheaper tariffs to charge, the ZEB would reduce the overall utility bill of the customer when compared to using a heat pump since it is commonly advised to be on for the majority of the time.

o The cost of a ZEB is estimated to be £7K at the pre-commercial stage. The average cost of a heat pump is £12K. Both of these figures include any fees associated with the installation. Without including the current subsidy in place, this would bring a total benefit of £5k per customer.

- An additional benefit resulting from utilising this unit would be the reduction in CO2 emissions compared to the continued use of gas boilers within these hard-to-reach homes.

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

OVO Energy estimates that there are currently >10m homes across the UK that would not be physically suitable for a heat pump upgrade (such as flats and terraced houses). As the UK Power Networks region covers approximately a third of the GB, this solution can be made available to ~3.3m homes within our network which would have not been able to efficiently decarbonise otherwise.

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

The current estimated cost of installing this solution is £7,000. This includes the cost of the unit itself, installation costs as well as the cost of adding a thermal control system to the customer's home. Given that this solution is still in the pre-commercial stage, the roll-out cost is estimated to drop down as the technology matures. All costs associated with this product will be investigated and revalidated as part of the project delivery.

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 project will gather in-home performance and operational data on the smart electrical storage heating system. This will inform our whole system modelling and future forecasting from a network demand perspective. An understanding on the flexible nature of this solution will help networks overcome the operability challenges faced due to the uncertain nature of Net Zero transition and support deferral of network reinforcement.

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.

A check has been completed on the smarter networks portal and no similar projects addressing the use of smart electrical energy storage heating systems for the designated housing archetypes were identified.

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

This project will be the first attempt to understand the impact of using a smart electrical energy storage heating system on the network as well as on the customer decarbonisation journey. Additionally, the solution being investigated is in a pre-commercial stage and had limited deployment as part of its proof of concept stage.

The project will assess this solution based on the criteria mentioned above and identify the role it will play in the low carbon transition as well as how it can support the system operator in optimising the network performance.

Relevant Foreground IPR

The data created, outputs and deliverables produced as part of the project will conform to the default treatment of IPR.

Data Access Details

To view the full Innovation Data Sharing Policy, please visit UK Power Networks' website here:

http://innovation.ukpowernetworks.co.uk/innovation/en/contact-us/InnovationDataSharingPolicy.pdf

UK Power Networks recognise that Innovation projects may produce network and consumption data, and that this data may be useful to others. This data may be shared with interested parties, whenever it is practicable and legal to do so, and it is in the interest of GB electricity customers. In accordance with the Innovation Data Sharing Policy, UK Power Networks aim to make available all non-personal, non-confidential/non-sensitive data on request, so that interested parties can benefit from this data.

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

This project involves the deployment and trial of a low carbon technology within customers' homes which is an activity not completed as

part of the electricity networks' business as usual activities.

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 solution that is being trialled as part of this project is innovative and is going to provide a strong insight into the decarbonisation of heat. The nature of the project scope and the solution it is trying to deliver, especially the benefit to the customers, make it a strong candidate to benefit from the network innovation allowance. Such activities, including the collaboration with suppliers and energy retailers, are not currently completed as part of the business as usual activities of the electricity networks.

This project has been approved by a senior member of staff

☑ Yes