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

May 2025

Project Reference Number

NIA_ENWL_038

Project Registration

Project Title

Net Zero Terrace

Project Reference Number

NIA_ENWL_038

Project Licensee(s)

Electricity North West

Project Start

May 2025

Project Duration

1 year and 2 months

Nominated Project Contact(s)

Innovation@enwl.co.uk

Project Budget

£680,616.00

Summary

The overarching Net Zero Terrace (NZT) concept uses the DNO network to decarbonise terraced housing by producing a community-led Smart Local Energy System (SLES) appropriate for those that might otherwise be left behind. NZT enables terraced communities across GB to decarbonise by increasing up-take of heat pumps, reducing costs to customers and deferring network reinforcement.

This NIA project represents a key step in the demonstration of the NZT overarching solution by developing the Minimum Viable Product (MVP) for the Home Energy Management System (HEMS) and testing interoperability, creating the specification for the Community Energy Management System (CEMS) and further developing the tools for the customer journey as well as improving understanding of data flows and building data governance strategy.

Preceding Projects

10055259 - Net Zero Terrace

10085870 - Net Zero Terrace Alpha

Third Party Collaborators

Buro Happold

Looped Energy Communities

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

There are approximately 10 million terraced houses in the UK and due to space and noise constraints, these communities are difficult to decarbonise meaning the consumers are at risk of being left behind during the energy system transition.

The current solution for terraced properties is a standalone electric boiler which is up to four times less efficient than a heat pump, resulting in increased costs for consumers and higher demand on the network. A large scale rollout of electric boilers will cause constraints on the Low Voltage (LV) network and require large amounts of reinforcement.

Recent Strategic Innovation Fund (SIF) Discovery and Alpha projects began the development of the NZT solution including the technical model, architecture model, deployment model and planning model.

Whilst the SIF projects went a long way towards developing the NZT solution there is further development required to de-risk the solution before it is scaled out to communities. This NIA project will understand, develop and test the MVP for the HEMS, create the specification for the CEMS and further develop the tools for the customer journey as well as improve understanding of data flows and build data governance strategy to enable communities of terraced houses to adopt low carbon affordable heating, reduce bills and increase the provision of network flexibility.

Method(s)

The project will demonstrate, on a laboratory test rig, the minimum viable product of the NZT HEMS using the architecture model developed during the previous SIF projects, enabling the integration of the components to be proven.

The system models and functional requirements for the CEMS will be developed further ensuring there is adequate control to maintain network stability, e.g. when a constraint signal is sent, assets will be curtailed to ensure thermal or voltage limits are not exceeded.

The planning model will be developed further to understand the locations where the solution could be deployed.

Additionally, the digital customer journey will be further explored and recommended enhancements will be made to the customer interface using the Fairer Warmth system.

Measurement Quality Statement:

Measurement quality is a key part of this project, and steps will be taken to assure an appropriate standard is achieved. A test specification will determine the test criteria and inform the test schedule. Testing will be witnessed, and the outputs and documentation will be reviewed against the agreed test schedule. This process will provide assurance and report on compliance with the data quality objectives.

Testing undertaken during this project will follow best practise, ensuring that measurements are subject to validation and verification.

Data Quality Statement:

Data generated and/or processed in the course of this project will be reviewed to provide assurance that outputs meet the required standards. Data will be managed in line with the RIIO ED2 Data Best Practice Guidance and Data Assurance Guidance.

This project does not plan to undertake any processing of personal data.

Scope

The project will establish and test a MVP of the NZT HEMS solution including defining the key elements of the MVP, producing the specification for the HEMS, testing it in a laboratory environment and developing the functional requirements for the CEMS.

The project will also appraise options for future deployment of NZT by assessing areas of the network where the solution could be deployed.

Additionally, the project will develop the digital solutions required to improve the customer journey including data management governance.

Benefits of NZT

The counterfactual to NZT is the disparate, uncoordinated replacement of gas boilers with electric boilers, adding an estimated 12kW per property which is a significant increase in the local network demand.

The CBA, based on 5 substations, shows that benefits of up to £16.95m can be realised based on a 20 year NPV and a penetration rate of 80-100%.

Extrapolating this estimated NPV for all of ENWL area, and assuming ENWL's spread of terraced homes is reasonably typical of other DNO areas, a 20 year NPV of up to £189,508m is estimated across GB.

Objective(s)

The objectives are:

- Demonstrate, in a laboratory environment, the HEMS MVP
- Develop the system models and functional requirements enabling integration of the components.
- Develop the planning model to understand the locations where the solution could be deployed.
- Develop the digital customer journey.

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 an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to reduce the costs for households, improve the exchange of information between networks and customers. Other considerations including the projects impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Success Criteria

The project will deliver the following outputs:

- Functional specification of the HEMS.
- Functional specification for the CEMS.
- Report detailing the outcome of the laboratory testing.
- Report detailing the digital customer journey
- Report detailing the planning model including recommendations for future deployment.

Project Partners and External Funding

Buro Happold

Looped Energy Communities

There is no external funding support.

Potential for New Learning

The project will provide the specification for the HEMS MVP which can be scaled up and deployed. The MVP will be demonstrated in a safe environment, testing integration of the components and providing confidence in the solution. It will also provide the functional specification for the CEMS which together with the HEMS can be deployed to terraced communities enabling them to decarbonise.

Data from the Electricity North West network will be combined with community data and analysed enabling the approach to selecting the communities that will benefit most from NZT to be documented.

The Fairer Warmth app will be enhanced to provide the customer journey for the NZT solution.

Project outputs will be shared publicly on the Smarter Networks Portal, the Electricity North West website and at dissemination events such as the Energy Innovation Summit.

Scale of Project

The HEMS MVP will be demonstrated in a laboratory environment where testing can be carried out in a controlled environment.

Testing the integrated MVP in this setting will provide assurance that the NZT concept is sufficiently developed for a real life demonstration in a future project phase.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

Electricity North West's distribution network.

Revenue Allowed for the RIIO Settlement

£0

Indicative Total NIA Project Expenditure

£612,554

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:

Communities of many millions of terraced homes in the UK are difficult to decarbonise due to space and noise constraints associated with installation individual heat pumps. The current solution for terraced properties is a standalone electric boiler which is up to four times less efficient than a heat pump, resulting in increased costs for consumers and higher demand on the network.

The planned approach proposed by NZT will make decarbonising terraced homes achievable and, offering a solution to these communities who would otherwise be left behind in the energy transition.

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

Base Cost – reinforcement and connections associated with the installation of electric boilers to replace gas boilers consisting of overlaying LV cables, increasing and/or developing local transformer capacity to address increased demand.

Method Cost – reinforcement and connections costs associated with the NZT solution consisting of:

- overlaying LV cables, increasing and/or developing local transformer capacity to address increased demand.
- installing an on-load tap changer (OLTC) transformer (i.e. Smart Street design) to mitigate voltage excursions to address increased generation.

The scale of the impact and the extent of the cost varies due to the volume of terraced houses converted to NZT instead of electric boilers, the more properties converted to NZT solution, the less impact from the demand. Analysis indicates that NZT would reduce peak network capacity by up to 80% compared to the base cost counterfactual of direct electric heating in individual homes.

For the Base Cost the amount of reinforcement required is greater leading to higher costs. The method can reduce losses and has the potential to deliver significant environmental benefits. The recipients of the benefits are

- Societal - savings in carbon
- Customers - lower energy costs, warmer homes, lower reinforcement cost
- DNO - minimum reinforcement, minimum disruption

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

There are nearly 10 million terrace homes in the UK. The NZT concept could be applied to all terraced homes across the UK.

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

The capex cost for each substation is estimated at £288,000.

Rolled out across GB, the estimated capex (allowing an average of 3993 substations for 14 DNO areas) is £16,099m.

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 overarching aim of NZT is to produce a replicable model that can be applied in communities of terraced streets throughout Great Britian.

This project will add to the body of learning generated by NZT by:

- Demonstrating the HEMS MVP in a laboratory environment, thereby derisking deployment in a live network trial
- Developing the system models and functional requirements enabling integration of the components.
- Developing the planning model to understand the locations where the solution could be deployed.
- Developing the digital customer journey.

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 review of the Smarter Networks Portal and conversations with other networks has not revealed any other project like NZT, exploring low carbon heat via an integrated SLES combining ambient loop heat technologies with community renewables, home energy management and integration of the DNO.

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

Preparatory work and market testing by the NZT partners has identified NZT as a viable solution to the challenges faced delivering low carbon affordable heat and that all the required subsystems exist. However, integration of these sub-systems into a SLES is a new development, which requires development of the CEMS and testing of the HEMS MVP in a safe lab environment to demonstrate the system and prove the sub-systems can effectively be integrated with each other and the DNO network.

Relevant Foreground IPR

Expected Relevant foreground IPR to be generated is

- Further development of NZT Smart Local Energy System architecture and use case
- HEMS MVP definition and functional requirements, component integrations requirements
- HEMS product specification and integration strategy
- CEMS functional specification
- Further development of the planning model, assessing areas of the network where the solution could be deployed
- Further development of the Fairer Warmth app for integration with the NZT SLES including data flow mapping and communication strategy, definition of digital planning requirements and interfaces

Background IPR, developed in the SIF NZT Discovery and Alpha projects, will be utilised in this project including:

- NZT system architecture, use cases, technoeconomic and spatial planning methodology and solution design
- Test specification for evaluation of HEMS component integrating with wider system options and operating model

Data Access Details

Data generated can be requested by interested third parties by contacting the innovation team in accordance with our data sharing policy which is available on our website.

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

The TRL (4 moving up to 6) of this project means the NZT business case is not yet sufficiently developed for Business as Usual. In this project, technology and commercial risks will be addressed, preparing for roll outs across Great Britian in future.

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 uncertainty in the outcomes of these research and development activities and relatively low TRL of the project present commercial and technical risks. By testing NZT product in a safe environment, this project will de-risk NZT enabling real world trials in a future phase. Therefore, this activity could only be performed with NIA funding.

This project has been approved by a senior member of staff

☑ Yes