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

Mar 2026

Project Reference Number

NIA_UKPN0119

Project Registration

Project Title

Therma-stats

Project Reference Number

NIA_UKPN0119

Project Licensee(s)

UK Power Networks

Project Start

May 2026

Project Duration

1 year and 3 months

Nominated Project Contact(s)

Sarah.Golobish@ukpowernetworks.co.uk

Project Budget

£512,137.00

Summary

Therma-stats is a research project which tackles the lack of visibility of domestic heating flexibility in network planning, which is a growing uncertainty as heat pump uptake is expected to be the main driver of load related reinforcement after 2035. The project will develop an understanding of household-level energy flexibility by combining EPC data, housing archetypes, and insights into heat pump operation to enable forecasting that incorporates flexibility insights to support efficient investment planning and support decarbonisation.

Preceding Projects

NIA_UKPN0076 - Neighbourhood Green

10061354 - KnowMyFlex

Third Party Collaborators

University of Reading

Environmental Resources Management (ERM)

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

Thermal**s**tats addresses the limited visibility of the flexibility available from domestic heating systems, particularly heat pumps, within electricity network planning. This limits the ability of Distribution System Operators (DSOs) to test and plan for a range of future

scenarios where heat pump demand is lower than currently projected due to their flexible operation.
Heat pump uptake is expected to dramatically increase from 2035, becoming the dominant driver of load related reinforcement. This brings challenges, but also significant opportunities to leverage the flexibility that could be harnessed from domestic and commercial heating systems to reduce, defer, or even eliminate the need for network reinforcement.
Electricity networks are limited in their ability to reliably consider this during network planning by a lack of visibility of the available heat flexibility. While some heat pumps participate in flexibility today, the volumes are too small to reliably use them in forecasting.
To fully realise the value of flexibility and optimise investment in the network, we need a better understanding of the existing flexibility potential of heat pumps. This is essential to future-proof the network, as this will enable smarter, more efficient network planning that reflects real world usage and demand side potential. We anticipate that failing to model flexibility for heat pumps may contribute to a range of problems that include the potential for excessive and oversized forecast network reinforcement (particularly once heat pumps become the key driver of reinforcement) and limited ability to plan and prioritise investment without visibility of the flexibility available from domestic heating. More generally, without these insights we are missing opportunities for utilising existing network capacity in the most effective way.

Method(s)

This is a research project to develop Meter Point Administration Number (MPAN) level Energy Flexibility Certificates (EFCs) for our network, quantifying the potential heat flexibility available at a household level. This flexibility is expected to predominately come from pre-heating homes and the use of thermal storage. Adding this understanding of flexibility and building on Energy Performance Certificate (EPCs) to EFCs will improve and inform our strategic network modelling and planning.

To do this, the project will conduct a literature review to collate existing housing archetypes, flexibility profiles and baseline profiles from existing innovation projects and industry data. These will be evaluated for completeness and validated for our network. Any missing archetypes and profiles will then be created.

Address-level EPC datasets will be used to develop a detailed database of domestic stock, and the distribution substations to which they are connected. These will be combined with the flexibility profiles to create an estimate of flexibility in the form of an EFC at MPAN level.

This MPAN-level flexibility modelling will be integrated with aggregated electricity demand profiles at asset level based on the Strategic Forecasting System (SFS) outputs. Detailed analysis will be carried out across the portfolio of substations to determine the impact of both heat pump flexibility, as well as total EFC flexibility and its impact on forecasted heat pump load growth on our network.

We expect to use the following methods throughout this research project:
Literature review of existing housing archetypes and flexibility profiles
Validation and creation of missing archetypes and flexibility data specific to UK Power Networks
Mapping of domestic stock using EPC data
Development of MPAN-level flexibility models for heating and other LCTs (e.g. electric vehicles, batteries)
Integration with the SFS to assess network impact
Scenario-based analysis of flexibility's effect on peak demand
Reporting and benefit quantification, including a roadmap for future work
Measurement Quality Statement

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 Statement:

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 project outcomes and the performance evaluation of the solution
The impact on the health and safety of the public and employees
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

This research project aims to develop novel flexible profiles at MPAN level to quantify heating system flexibility. A better understanding of this flexibility will enhance network planning and forecasting, allowing networks to make informed decisions about investments.

This will involve the following activities:

Work Package 1 – Horizon scanning and literature review
Define the current state of the art, covering:
Archetyping of GB housing stock
Heat pump load profiles and the potential for heat pump flexibility
Heat pump uptake, particularly how future uptake can be mapped onto housing archetypes and geography
Work Package 2 – Archetyping and EFC creation
Validate and share archetyping of domestic stock by LSOA, associated demand profiles. Develop extensions of this stock to incorporate data relevant to an EFC.

Work Package 3 – Archetype parameterisation
Parameterise the heat pump flexibility potential for each archetype and calculate MPAN level flexible heat pump profiles based on passive profile and flexibility parameters developed earlier.

Work Package 4 – Baselining
Calculate baseline network impacts and create heat pump and other load baseline profiles building on insights from Neighbourhood Green. Calculate baseline network impacts to 2050 under NESO's Future Energy Scenarios pathways, and other relevant scenarios, producing the load breakdown at a range of network asset classes (primaries, secondaries).

Work Package 5 – Flexibility modelling
Calculate baseline network impacts and combine MPAN level heat pump flexibility model with SFS demand profiles at asset level, to determine site-specific impact under a range of Demand Side Response (DSR) implementation options. Simulate impact of aggregated MPANs in as above, quantify the potential of heating flexibility to reduce peak demand and delay infrastructure upgrades. Conduct a sensitivity analysis of additional behind the meter intervention e.g. energy efficiency, thermal/battery storage.

Work Package 6 – Reporting and benefits assessment
Consolidate and quantify network benefits of an EFC based approach to flexibility. Develop roadmap for further improving EFC data inputs and accuracy and identify barriers to flexibility benefits and their mitigations.

Objective(s)

Create a standardised methodology for domestic flexibility potential quantification across the network
Collate and validate housing archetypes and flexibility profiles from existing research and innovation projects, filling gaps where necessary
Map domestic stock using EPC data and link it to distribution substations to enable spatially resolved flexibility modelling
Develop a theoretical model to quantify domestic DSR for heat, and determine its network benefit

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This is a deskIbased research project and will not involve customer interaction or any activities that directly affect consumers, including those in vulnerable circumstances.

Improving understanding of heat pump flexibility will support more efficient network planning and could indirectly benefit vulnerable

customers by helping reduce long‐term energy system costs, minimising unnecessary reinforcement, and enabling better‐heated homes through increased uptake of flexible, low‐carbon heating technologies.

Success Criteria

Flexibility quantifications methodology developed, tested, and documented
Database of domestic archetypes and flexibility profiles validated and supplemented where gaps exist
EPC-based domestic stock mapping successfully linked to substations
Impact analysis completed showing the volume of flexibility potential and the resulting reduction peak demand under a range of scenarios

Project Partners and External Funding

The project partners are the University of Reading and Environmental Resources Management (ERM). The costs for this project will be funded through the NIA without external funding from other project partners or any other sources

Potential for New Learning

We expect the project to provide the following learnings:
Develop a clear relationship between building characteristics (e.g., insulation, thermal mass, storage capacity) and the technical potential for heat pump demand management at MPAN level
An understanding of how flexibility varies across different housing archetypes and geographic areas within UK Power Networks' area
Use bottom-up modelling to understand the extent to which heat pump flexibility can reduce peak demand at a household-level
Build on Neighbourhood Green and PeakHeat projects by increasing granularity, expanding coverage to all three of the UK Power Networks licence areas, and connecting EFCs to long-term heat pump uptake modelling through 2050
Understand how EFC-based flexibility assessment aligns with or challenges current regulatory methodologies (e.g., RESP) and what changes might be needed for adoption

Scale of Project

The scale is appropriate for a research project focused on leveraging insights from a range of previous studies into a clear and useable picture of the potential range of heat pump demand. By analysing flexibility across all three licence areas, the project will deliver representative findings and enable meaningful improvements to forecasting accuracy. A smaller scope would reduce the applicability of results and limit the ability to generate insights across our network.

Technology Readiness at Start

TRL1 Basic Principles

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The modelling for this project will be carried out across all three of UK Power Networks' licence areas. No physical fieldwork or customer engagement is required.

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

The total expenditure that UK Power Networks expects to incur for this project is £512,137. 90% of this (£460,923) will be recovered from NIA expenditure.

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:

ThermalIstats supports the energy transition by enhancing network operators' ability to accurately model future heatingIrelated load. By incorporating granular flexibility data into forecasting processes, the project will provide insights into how domestic heat pumps can reduce peak demand and support headroom management. This will help optimise longIterm network investment and enable the efficient 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

As this is a research project it does not require benefit calculation. However, improved visibility of heating flexibility has the potential to:
Reduce unnecessary reinforcement, lowering longterm system costs for consumers
Enable more efficient planning that accelerates lowcarbon heat deployment
Help facilitate a fair, costefficient transition to electric heating

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

The method is expected to be generally replicable across GB, as other DNOs can adopt the EFC methodology and integrate it with their own forecasting. The housing stock across other areas of GB is likely to differ in terms of its insulation and qualities which will in turn impact the anticipated flexibility potential across GB. To capture this variation, additional work may be required to ensure that the archetypes studied are suitable across GB.

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

The costs of rolling out the method nationally will depend on the forecasting system used by other networks who intend to use the methodology.

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 generate new insights into the flexibility potential of domestic heat pumps and how this can support DNO forecasting and planning. These insights will be valuable to other network operators and can be replicated or scaled across GB to support wholesystem decarbonisation planning.

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.

Thermalstats builds on previous work such as Neighbourhood Green, PeakHeat, and KnowMyFlex, and extends these approaches by creating householdlevel flexibility estimates and integrating them into a networkwide modelling framework. The literature review and horizon scanning activities included at the start of this project ensure no unnecessary duplication with similar projects.

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

PeakHeat generated valuable insights into the flexibility potential of heat pumps and provided an important foundation for understanding how heating demand may vary under different conditions. Thermalstats builds directly on this work by taking the next logical step: increasing the granularity, spatial resolution, and modelling depth so that flexibility can be assessed across an entire network and using a household-level bottom-up assessment of flexibility.

Additional Governance And Document Upload

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

The project is innovative because EFCs have not previously been integrated into forecasting at an MPAN/household level. The methodology, linking EPC data, archetypes, and flexibility modelling into forecasting at this level of granularity, is novel and has not been trialled before within GB distribution network planning.

Relevant Foreground IPR

The outputs and deliverables produced as part of the project will conform to the default treatment of IPR. The relevant foreground IPR will be comprised of the following:
Learnings from development of a new methodology that quantifies domestic heating flexibility using EPC data, building archetypes and heat pump modelling
Learnings from development of a novel dataset of MPAN level flexible load profiles linking EPC based building attributes to parameterised heating flexibility
Project documentation including modelling assumptions, technical methodology, analytical outputs and the roadmap for future refinement of the flexibility modelling approach

Data Access Details

Where appropriate, de-sensitised data and non-confidential findings will be made available to interested parties in alignment with our Data Sharing Policy. UK Power Networks recognises that Innovation projects may produce network and consumption data, and that this data may be useful to others. This 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 aims to make available all non-personal, non-confidential-sensitive data on request, so that interested parties can benefit from this data.

To view UK Power Networks' Innovation Data Sharing Policy, please access it through our innovation microsite: https://innovation.ukpowernetworks.co.uk/

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

The project cannot be funded through business as usual (BAU) activities because it involves research with uncertain outcomes and methodologies that are not yet established or validated for operational use. The development of EFCs at a property level, and their integration into the Strategic Forecasting System, carries technical and analytical risks, including uncertainty around data completeness, modelling accuracy, and the extent to which flexibility can be reliably estimated.

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

Support from the Network Innovation Allowance (NIA) is required because the project carries commercial, technical, and operational risk.
The project depends on developing an untested methodology, which may or may not yield sufficiently accurate outputs for network planning. NIA funding is designed specifically to enable this kind of exploratory research where outcomes are uncertain but potentially transformative. The project aligns with NIA guidance for early TRL innovation, enabling the consortium (UK Power Networks, ERM, University of Reading) to trial and validate new methods before considering wider adoption. This project therefore requires NIA support to mitigate risk and demonstrate value before any future implementation.

This project has been approved by a senior member of staff

☑ Yes