SIF Alpha Round 3 Project Registration

Date of Submission

Oct 2024

Project Reference Number

10132187

Initial Project Details

Project Title

HeatNet

Project Contact

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Challenge Area

Whole system network planning and utilisation to facilitate faster and cheaper network transformation and asset rollout

Strategy Theme

Optimised assets and practices

Lead Sector

Electricity Distribution

Project Start Date

01/10/2024

Project Duration (Months)

6

Lead Funding Licensee

UKPN - South Eastern Power Networks Plc

Funding Licensee(s)

UKPN - South Eastern Power Networks Plc

Funding Mechanism

SIF Alpha - Round 3

Collaborating Networks

UK Power Networks

Technology Areas

Active Network Management

Voltage Control

Project Summary

Heat pumps are essential for reducing the UK's building emissions, but their widespread use could strain local electricity networks. HeatNet will demonstrate how coordinating heat pump operations with advanced algorithms can address these challenges.

HeatNet will develop innovative machine-learning tools to manage heat pump power loads to help regulate voltage drops at the grid edge and ensure customer warmth. Our aim is to develop an independent service to accelerate the electrification of heat with new strategies that improve voltage quality and network reliability.

Add Preceding Project(s)

10061352 - HeatNet

Add Third Party Collaborator(s)

I C Consultants

Project Budget

£519,057.00

SIF Funding

£467,057.00

Project Approaches and Desired Outcomes

Animal testing (not scored)

- ○ Yes
- ◉ No

Problem statement

The core problem that HeatNet addresses remains the same since Discovery. The growing use of heat pumps, driven by government and policies, increases electrical loads on the network. This necessitates new digital tools and commercial arrangements to manage voltage drop and reduce the need for reinforcement. During Discovery, we improved our understanding of advanced coordination algorithms and demonstrated their potential to support almost 30% more heat pumps within a sample low voltage (LV) subnetwork. We now have a clearer plan to replicate and validate this level of improvement in broader use cases and to integrate this technology into existing network management processes.

Predicting electrical load growth from heat pumps in network planning and operations is challenging due to limited data on how demand diversities from high concentrations of installations on single or a few LV feeders will manifest in practice. Residential demand characteristics from heat pumps can vary significantly throughout the year due to weather, house types and consumer segment. Current network planning tools use static demand curves and diversity assumptions, which, while ensuring safety, can lead to over-engineering the network and hence cost inefficiencies. DNOs face uncertainties about where heat pumps will be installed across the network and how to best plan for and manage these new loads.

Maintaining correct voltage levels is critical for network stability and DNOs must ensure homes remain within statutory limits (216V to 253V). During peak heating times, increased current flow can cause higher voltage drops, impacting the quality of the electricity supply. If voltage drops below the statutory limits, it can reduce performance and may damage appliances. Heat pump demand closer to a distribution substation is less problematic, but clustered demand at the end of a feeder causes greater voltage drop and may trigger earlier reinforcement than planned.

DNOs already use smart services to actively manage their networks. However, coordinating home heating systems presents a step change in complexity and DNO's do not intend to directly control these assets, now or in the future. While it is already feasible to incentivise households to switch off electric heating or even remotely manage smart systems using randomised load limits at connection points during times of network stress, these actions can have negative consumer outcomes. Households could be left cold and uncomfortable, and vulnerable consumers or those in fuel poverty may be exposed to health risks.

The primary users of HeatNet are DNOs who would use the service to help manage voltage on their networks. In Alpha, we intend to address challenges related to maintaining consumer protection standards, system interoperability and regulatory compliance. There is a need for DNO's to enable coordinated smart home heating solutions that can help manage local LV-issues without sacrificing thermal comfort.

HeatNet aligns with Challenge 1, Theme 2 and continues to build on over a decade of R&D in smart heat-pump control optimisation and high-resolution data collection by Passiv UK (Passiv), leveraging the capabilities of digital network planning tools and maximising existing capacity. Related innovation projects include:

NEDO Smart Communities (2016) – Heat pump demand side response (DSR)

FREEDOM (2018) – Aggregated heat pump DSR and demand forecasting

Bridgend LEM (2020) – Proof-of-concept, optimised heat pump coordination

EQUINOX (Present) - Testing commercial methods for heat pump control

Heat Pump Ready (Present) – Smart meter integrated and broadband independent heat pump control

Innovation justification

HeatNet is a highly innovative solution designed to increase the number of heat pumps connected to the network without requiring additional reinforcement. While smart control systems can remotely manage distributed energy resources to reduce network stress and enhance grid stability, our unique approach uses machine learning to optimise the interdependence between localised groups of heat pumps to minimise voltage drop. We believe this technique is unprecedented globally.

Managing domestic heat pumps presents unique challenges compared to electrical loads like EVs or batteries. HeatNet controls must minimise consumer discomfort and meet pre-agreed service levels by balancing heat pump performance factors, external weather conditions, and thermal inertia, all while supporting grid stability. HeatNet uses network modelling and machine learning control algorithms, to improve the management of clusters of heat pumps on LV subnetworks. We aim to develop a market-led service that uses innovative optimisation tools to coordinate localised groups of heat pumps to regulate voltage and minimise the need for reinforcement. Alpha will help us develop our innovation in two key areas:

Technical: processes for integrating voltage drop data with heat pump optimisation and coordination algorithms to improve network management
Commercial: understanding the overall value proposition, regulatory considerations, and mechanisms to maintain consumer protection and DNO oversight

Despite the complexity and early conceptual state of HeatNet, we have already started to engage with two innovation projects tackling similar themes: Market Signals for the Electrification of Heating and Demand Diversification Service for LMAs. We anticipate that these early connections will help pave the way for shared learning and collaboration during Alpha. Passiv also bring insights from UKPN's projects Watt Heat and Heatropolis. The positive feedback from our Show & Tell webinar underscores interest and potential for HeatNet and we plan significantly wider stakeholder engagement during Alpha.

Currently, network reinforcement is the counterfactual alternative for addressing load growth and voltage drop issues caused by localised concentrations of heat pumps. Coordinating electrical loads from large numbers of heat pumps on a single subnetwork to ensure diversity and stability remains largely theoretical due to limited real-world data. HeatNet aims to address these challenges using advanced modelling tools in Alpha, and plans to test these outcomes through a large-scale demonstration trial during Beta.

Due to the technical complexity of HeatNet, it is well-suited to the phased nature of the SIF to de-risk the project, as demonstrated by early success during Discovery. There is a level of high commercial potential and the project is now ready for more technical development during Alpha, ahead of further trial or deployment in Beta. The network innovation process is a critical catalyst for technology-led innovations such as HeatNet, which would not otherwise be realised through more incremental, business-as-usual, commercial activities.

The six-month scale of Alpha will enable HeatNet to rapidly progress in tackling Challenge 1, Theme 2, by testing data integrations and optimisation scenarios, engaging widely with stakeholders to identify barriers and enablers, and developing suitable business models. This approach allows for engagement with relevant stakeholders, including network designers, heat pump manufacturers, and regulators, to address the technical barriers relating to interoperability and uncertainties associated with consumer protection identified during the Discovery.

Readiness levels have been summarised as follows:

Technology readiness: Alpha will enable progression from (TRL4-5) to (TRL5-6)

· Integration readiness: Initial levels are low (1), but with scope to transpose existing specifications (e.g. smart heat mandate, PAS1879 (5)

· Commercial readiness: Alpha will support initial market understanding (CRL 2-3)

Impact and benefits (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Environmental - carbon reduction – indirect CO2 savings per annum

New to market – products

Impacts and benefits description

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HeatNet delivers consumer benefits by optimising load shifting between clusters of heat pumps on a local LV network. Using smart controls can help to reduce seasonal network stress and voltage drop challenges.

During Discovery, Imperial College London completed a cost-benefit analysis (CBA) using their Integrated Whole Energy System model (IWES). This model quantifies the impact of future demand growth and calculates thermal and voltage-driven asset upgrades, reinforcement costs and the impact of demand diversity effects in LV networks. The CBA used growth rates in heat pumps UKPN's 2023 Consumer Transformation DFES and assumed full participation of HeatNet residential smart heat pump control in network management to help regulate network voltages and flows. Imperial College estimated that the 30-year NPV of benefits from the HeatNet approach across UKPN's licence regions could be about £541m from avoided distribution network reinforcement. When including the potential benefits of transmission and generation systems this value proposition increases to £3,048m. The corresponding whole-life NPV values were £832m and £5,030m, respectively.

Financial - Future reduction in the cost of operating the network.

Average avoided cost to the DNO due to the HeatNet solution, compared to uncoordinated and unmanaged heat pump installations requiring conventional reinforcement (M/£).

Discovery validated a high-level proof of concept of using advanced heat pump controls and machine-learning coordination algorithms to increase heat pump uptake within the same network infrastructure by almost 30%.

Better-informed voltage management will lead to a reduction in cost from reduced voltage issues, associated site visits, and

obtaining a more resilient network.

Early modelling during Discovery achieved a 15% reduction in peak voltage drop and a 14% reduction in peak demand.

Analysis by Imperial College during Discovery identified that distribution level savings of £7,179 of MW per year are achievable.

Financial - cost savings per annum on energy bills for consumers

Long-term savings by reduced distribution use of system (DUoS) costs from reduced socialised costs for network upgrades.

Environmental - carbon reduction -- indirect CO2 savings

HeatNet can help accelerate the adoption of higher -volume heat pump installations compared to traditional reinforcement-led approaches. This will contribute to broader societal benefits by reducing reliance on gas-heating boilers and their associated emissions.

Although CO2 savings from avoided infrastructure has not yet been quantified, initial analysis by Imperial College using IWES suggests carbon storage could be reduced by 0.7 MtCO2/year using HeatNet.

Metric: Number of HeatNet-optimised homes adopted over time (number of households).

New to market – services

The business models and opportunities for commercialising the HeatNet service will be explored in detail during Alpha. We intend to evaluate the key value drivers and regulatory barriers for this new type of service as well as, the roles of service providers (suppliers, aggregators), end users (DNO/DSO) any emerging consumer protection issues.

In addition to distribution level savings highlighted above, HeatNet could result in transmission level savings and wider energy system benefits including a reduced need for low carbon power generation, smaller heating appliances, and a lower reliance on other flexibility technologies such as battery storage systems. Early analysis suggests that by 2050, this technology could result in a net value of £2.46 billion per year across the whole GB energy system compared to the counterfactual Consumer Transformation National Grid FES projection.

The details of potential cost savings to the network, consumer savings, environmental benefits, and opportunities for realising the value form a HeatNet service will be explored further and quantified during Alpha and Beta. All benefits are linked to the deployment of the HeatNet solution as a commercial proposition following Beta.

Teams and resources

Moving into Alpha, HeatNet will be delivered by the same project partners as Discovery – UKPN, Passiv, and Imperial College Consultants. This team builds on established working relationships developed through several previous projects together, such as the pioneering FREEDOM project (a large-scale field trial demonstrating multi-vector heat pump demand-side response and demand forecasting) and more recently, Watt Heat and Heatropolis. Each partner has a proven track record in delivering high-quality applied research and demonstration projects.

UK Power Networks

UKPN is responsible for ensuring their network can support the increasing number of residential heat pumps, which will play a central role in the decarbonisation of heat. Their Innovation Team has led multiple large-scale projects including those addressing the challenges of electrifying heat. HeatNet will be supported by their network planning, DSO, and connections teams, who are responsible for designing and delivering electricity connections, and managing operation on the network.

Role: UKPN will identify three LV networks representing different network topologies for HeatNet scenario modelling. They will engage as a subcontractors at AmberTREE, developers of the DPlan network planning software used by UK Power Networks' design engineers, to extract novel voltage drop calculations from their system's backend to support LV subnetwork use case modelling. . The team will develop installation sequences using available data and forecasting tools, conduct counterfactual evaluations of network reinforcement and operational costs for each use case, and create a roadmap for integrating HeatNet during Beta to improve real-world network planning and operations.

Passiv

Passiv has established market leading, machine learning domestic energy modelling and smart heat-pump control capabilities, evidenced in projects such as: SMETER (thermal modelling of homes), 4D Heat (modelling flexibility in residential heat to reduce wind curtailment), NEDO Smart Communities (550 heat pump trial and proof of concept DSR control), EQUINOX (commercialisation of smart heat-pump control), Clean Heat Street (high-density heat pump deployments) and STAT (integration of heat pump DSR with the smart meter system).

Role: Passiv has developed a novel approach to minimise the localised impacts of voltage drop from heat pumps by optimising performance and a process of automated demand management coordination. Building on the Discovery outputs, Passiv will apply their HeatNet coordination algorithms to model scenarios aimed at reducing network reinforcement costs for each use case by incorporating real-world voltage drop data used in network planning and operations. In collaboration with AmberTREE, Passiv will develop data integration requirements that would be needed for Beta, addressing issues such as levels of automation, export frequencies, formats, APIs, and cyber security requirements. At the start of Alpha, Passiv will procure a specialist energy market consultancy to deliver a route-to-market design and regulatory review. Passiv will also manage all stakeholder engagement and dissemination activities, including scheduling workshops, meetings and identifying priority communication channels.

Imperial College Consultants (ICC)

ICC will analyse the technical and economic performance of the HeatNet proposition using sophisticated mathematical models and simulations, , integrating advanced technologies and interdisciplinary approaches.. ICC regularly assesses economic impacts to guide strategic investments and provides insights to organisations such as DESNZ, CCC, Ofgem, and various energy utilities.

Role: ICC will evaluate maximum diversity factors and reductions in voltage-driven reinforcement needs using HeatNet across the use cases, scaling findings for UKPN region and GB scale. The team will assess the whole-system benefits of implementing HeatNet under various future scenarios, comparing it with other flexibility technologies like demand response and battery storage.

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Project Plans and Milestones

Project management and delivery

Six work packages (WP) are proposed for Alpha with clear ownership set out in the accompanying Gantt chart and project management template:

WP1: Project Management (UKPN)

Aims: Ensure successful project mobilisation, delivery and reporting, while adhering to timelines, scope, budget, and SIF governance

Success criteria: Project delivered on time, within budget and to a quality standard. Presentation of an end-of-phase report based on outputs from WP deliverables

WP2: LV network tools and scenario modelling (Passiv)

Aims: Develop new tools and techniques to demonstrate the impact and benefits of novel coordination algorithms in reducing localised voltage drops from a high-density of heat pump clusters on LV subnetworks.

Success criteria: Develop counterfactual reinforcement for each use case network and demonstrate voltage drop optimisation modelling. Improvements to live, cloud-based coordination algorithms and agreement on a roadmap for Beta tools and service provisions to improve real-world network planning, strategies, and data integration.

WP3: Business model design and regulatory assessment (Passiv)

Aims: Evaluate potential business models and commercialisation opportunities, including an assessment of the operational, regulatory, and interoperability requirements and considerations for consumer protection.

Success criteria: Procure an energy market consultancy subcontractor to deliver a summary of regulatory route-to-market barriers and enablers, business model options, customer propositions and recommendations and a Beta CBA.

WP4: Whole system benefits (ICC)

Aims: A comprehensive analysis of the impact of the HeatNet method on UKPN's network areas and across the GB energy system.

Success criteria: Whole system benefits analysis completed and impact assessment of the HeatNet method on the UKPN's distribution network and across the GB energy system

WP5: Stakeholder engagement and dissemination (Passiv)

Aims: Develop stakeholder engagement and dissemination strategy, including setting out a schedule of activities and identifying priority communication channels

Success criteria: Materials created to enable discussions, outputs captured and integrated into broader project design workstreams. Share Alpha knowledge and insight widely through joint PR activities, press releases and Show & Tell webinar.

WP6: Planning for Beta Trial (Passiv)

Aims: Development of Beta trial strategy.

Success criteria: Beta trial strategy, detailed planning, timelines, milestones, specific objectives and identification of potential sites agreed

UKPN will lead project management, supported by Passiv, using standard best practice project management methods and tools, including fortnightly management meetings and status reporting, frequent stand-ups as required for design sprints, a RAID log, and a stakeholder governance schedule aligned with project timelines.

Risks and mitigation strategies are detailed in the accompanying risk register. Key risks include:

1. Voltage drop calculations are too complex: Build on early engagement during Discovery with UKPN network modelling software providers to manually extract data and set out fall-back options and a pathway for use in coordination modelling.

2. Proposed scenario modelling is more challenging than initially perceived: The solution is highly innovative and requires the combined application of novel heat pump optimisation and coordination algorithms in complex scenarios. The project partner has extensive experience in delivering this type of analysis gained through multiple network innovation projects and will ensure that appropriate technical resourcing is in place.

Interdependencies

· WP2: Largely follows a waterfall sequence with a critical initial dependency on extracting voltage drop calculations from UK Power Networks planning tools.

· WP3: The business model design will be informed by outputs from Use Case scenarios in WP2

· WP6: Planning for Beta is dependent on outputs from WP2,3 and 6.

There will be no supply interruptions or engagement with energy consumers during Alpha. We intend to engage with a range of stakeholders including heat pump owners and manufacturers, aggregators and network operators to assess challenges to scalability and replicability.

Key outputs and dissemination

Key outputs

The project aims to understand what the opportunities and challenges are for a service mechanism that can minimise localised voltage drop and network stress through automated coordination of residential heat. The project will also help inform future policy and regulatory decisions and standards relating to the active load management from residential heat.

The HeatNet service mechanism is still at an early development stage but Discovery showed there are opportunities to deliver savings to both distribution networks and the wider energy system. Identifying the drivers and enablers that could unlock this value potential, as well as understanding the limitations for replicability and consumer protection issues will be a key priority for the Alpha.

We will refine the CBA to clearly value the commercial benefits scaled from our network use cases and whole system modelling provided by ICC. Throughout the project, we will focus on ensuring the long-term viability, fostering DNO confidence in the solution

in operational environments, enabling wide-scale adoption and replicability.

The key outputs in Alpha include:

WP1 - Project Management:

- Project plan
- Mid-point and end-of-phase reports
- Show & Tell presentation

WP2 LV network tools and scenario modelling:

- Scenario modelling outputs
- Summary of live digital twin simulation capabilities
- A roadmap for HeatNet tools for Beta

WP3 Business model design and regulatory assessment

- Evaluation of route-to-market barriers and enablers for HeatNet service
- Recommendations of business models for Beta trial

WP4 Whole system benefits

- Summary of approaches to integrating the HeatNet into distribution network planning
- A comprehensive analysis of the whole-system benefits of HeatNet

WP5 Stakeholder engagement and dissemination

- Materials created for stakeholder engagement
- In-person UKPN event and other events where appropriate

WP6 Planning for Beta Trial

- Beta trial strategy

We do not anticipate this would result in the undermining the development of competitive markets.

Dissemination

Our project outputs will be uploaded to the ENA Smarter Networks Portal and feature on the UKPN innovation website. Project learnings will be shared at Innovate UK's Show & Tell events. UKPN will look to share project successes and learnings via its social media channels, and the project will be presented at other UKPN in-person events should the opportunity arise.

As part of our initial project set-up, we will develop a stakeholder engagement and dissemination strategy. This will prioritise communication channels for different audiences, such as heat pump manufacturers, housing developers and social landlords, ensuring relevant information reaches each target group effectively. Our key communication channels will include:

- Dissemination Events: delivering show-and-tell sessions and presentations.
- Working Groups: providing information about the project to relevant industry working groups.
- Industry Events: Energy Innovation Summit, Distributed Energy Show
- Press releases: to increase visibility and grow the profile of the project.

During Alpha, there will be significant stakeholder engagement with electricity licensees, heat pump manufacturers, aggregators, and consumers to understand the perspectives of various stakeholders addressed by HeatNet. This will ensure an effective co-design process in the development of potential business models and service propositions.

Commercials

Intellectual property rights, procurement and contracting (not scored)

We recognise the importance of managing IPR in the delivery of a research and innovation project. All the project partners intend to comply with the default arrangements for IPR and Chapter 9 SIF Governance Document.

Prior to starting the initial Discovery Phase, the project partners made a declaration of background IP for the consortium agreement that will clearly define the background IP they were bringing to the project. The IP Register created at the beginning of Discovery will be updated during the set-up for Alpha and will be developed and maintained throughout the project.

Commercialisation, route to market and business as usual

We anticipate that the primary market for the HeatNet service will be DNOs that want to facilitate more heat pump installations in localised areas without traditional reinforcement. HeatNet is aiming to demonstrate this capability by combining smart control systems, that optimise and flatten heat pump demands, with Passiv's pioneering voltage drop coordination algorithms.

We assume DNOs procure this service, based on the needs and requirements of individual subnetwork needs. The HeatNet service could offer a cost-effective and enduring alternative to network reinforcement at specific locations and may eventually become integrated with other active network management and operational practices.

During Alpha we will develop the value proposition for specific network use cases, business model options, regulatory considerations and consumer-focused considerations. This will be developed, tested and co-designed with a wide range of stakeholders. This will inform our understanding of the limitations for scalability and consumer protection issues.

WP2 will further develop the technical concept of the solution while WP3 will further develop the business and commercial proposition. A main objective during Alpha will be to identify and address technical challenges, regulatory limitations, and consumer protection concerns.

In summary, to ensure that HeatNet can be scaled and replicated by DNOs across GB, we plan to develop a commercialisation, route to market and business-as-usual development process with the following key elements:

· Clearly defined roles, responsibilities and interactions within the service proposition, covering commercial and contractual agreements

· “Provider agnostic” functions that are not tied to proprietary technologies or capabilities

· Well-defined, interoperable system specifications, standards, communication protocols, and interfaces, developed through Alpha and Beta

The development of a roadmap for integrating digital tools and processes needed for the Beta trial will also take place during Alpha.

The HeatNet solution is being developed as a competitive service proposition and we do not anticipate this would result in the undermining of the development of competitive markets.

Facilitation and coordination of the solution for BAU

Several UKPN teams have been involved in Discovery and their continued engagement is paramount in Alpha as the end users of the innovation. Their engagement will facilitate the adoption of solutions into BAU practices. The teams will be involved in the Beta to ensure awareness of project outcomes and prepare for transition to BAU.

No specific investments are required for Alpha. However, some investments may be necessary for BAU depending on the requirements for smart controls and signalling.

UKPN's internal governance processes have engaged senior personnel in the project. Sign-off is at the Executive Management Team (EMT) level, with key requirements for buy-in from the relevant executives, including realising financial benefits to networks users, fair competition in procurement, compliance with network connection obligations, and ensuring the integrity and safety of the network.

Policy, standards and regulations (not scored)

Currently, we believe the existing regulatory framework does not contain any barriers to the completion of the project or BaU application of the solution. We will intend to carry out a thorough review of regulatory barriers, enablers, consumer propositions and interoperability to gain clarity on the areas of uncertainty that we identified in the Discovery project.

Recent policy amendments introduced in Germany for managing residential energy usage (Energy Industry Act section 14a, 2024) could serve as guidance for consideration to future modifications to Customer Export or Import Limitation Schemes (CLS). These regulations mandate the management of energy consumption at grid connection points during peak times without interrupting the energy supply. They specify communication protocols and interfaces with the DNO when consumers install controllable assets, exceeding 3.7 kilowatts, such as heat pumps and require load limitation at the connection point for up to one hour per day.

In the future, adopting a similar approach in the UK, based on an amended G100, could mandate compliance with standard protocols and the implementation of a DNO-led voltage drop optimisation scheme for heat pumps, enabled by a HeatNet service proposition.

Currently our understanding is that derogations will not be required, and existing regulations will not be a barrier to the development of a HeatNet service proposition in the future.

Value for money

The total project cost for Alpha is £544,410and the total SIF-funding requested is £477,680. The project partners are contributing 10% of the total project costs which is more than the minimum 10% compulsory contribution. This demonstrates commitment to the project from partners as well as value for money to customers.

Breakdown:

UK Power Networks:

Total costs: £89,510.00

SIF-funding: £80,558.00

Passiv UK:

Total costs: £332,020.00

SIF-funding: £298,818.00

ICC

Total costs: £122,880

SIF-funding: £98,304

Passiv is allocated the largest share of the cost because they are developing the predictive heat pump control algorithms that are central to the project and are leading most workstreams. They will conduct all scenario modelling and work with a subcontractor to evaluate potential business models and regulatory barriers for the new service proposition.

As the project lead, UK Power Networks will have a central role in HeatNet. They will provide support through in-kind contributions and access to various internal teams, including network planning, regulation, and DSO functions. They will also engage a specialist subcontractor for live network planning and operational data, which will be critical to the project's success.

ICC brings globally recognised expertise in modelling the economic impact of emerging smart technologies on energy system development and operation. The team will conduct a quantitative analysis on the voltage, thermal driven reinforcement costs on local distribution networks and wider benefits across the entire energy system. They will also support the evaluation of potential regulatory barriers and enablers, leveraging their considerable expertise in this field.

The project delivers good value for money for following key reasons:

Established team: Our team has the required skills and capabilities to deliver this project quickly, efficiently, and with a high level of quality. Initial proof-of-concept modelling by Passiv during Discovery has demonstrated a technical capability in coordinating multiple heat pumps to limit the impact of voltage drop on a localised LV subnetwork, without compromising residential comfort. As a DNO, UKPN will provide key inputs on operational network data and the design requirements to help realise the potential benefits of this new capability.

Building on previous innovation and learning: Publicly and network-funded innovation projects have already extensively tested the capability of smart heat pump control systems to automate responses to DSR events. Passiv is actively commercialising this type of technology and is currently the only provider delivering this through NGESO’s market-led Demand Flexibility Service (DFS). HeatNet builds directly on this foundation, aiming to balance consumer needs for maintaining thermal comfort while limiting voltage drops and reducing demand on LV networks.

Proving the value proposition: HeatNet aims to unlock benefits from optimised heat pump coordination to reduce voltage drops and local stress at the grid edge. The benefits section outlines the opportunities for value creation and detailed metrics for tracking these benefits. During Discovery we estimated the significant value opportunity that could be realised from a HeatNet service proposition, potentially delivering net benefits of £584 million for UKPN over the next 30 years and £2.46 billion annually for the GB energy system by 2050.

Alpha phase focus: A key part of Alpha will be understanding the business models, commercial drivers, and regulatory enablers needed to unlock this potential. If this phase indicates that it is not possible to leverage the value from the HeatNet solution the project can be concluded before moving on to a demonstration in Beta. Without progressing to Alpha, the value proposition of the HeatNet service will remain unproven, leaving the potential benefits from heat pump voltage drop coordination unrealised for GB energy system customers.

This approach ensures that our costs are justified, strategically targeted, and likely to develop benefits, offering substantial value for money to consumers.

Associated Innovation Projects

- (•) Yes (Please remember to upload all required documentation)
- ( ) No (please upload your approved ANIP form as an appendix)

Supporting documents

File Upload

HeatNet - Alpha_UKRI_end_of_phase_External.pdf - 4.8 MB
HeatNet - Alpha_UKRI Mid Point Report final_vEXTERNAL.pdf - 1.8 MB
SIF Alpha Round 3 Project Registration 2024-10-23 12_29 - 89.9 KB

Documents uploaded where applicable?

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