SIF Round 3 Project Registration

Date of Submission

May 2024

Project Reference Number

10061353

Initial Project Details

Project Title

OptiHeat

Project Contact

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Challenge Area

Unlocking energy system flexibility to accelerate electrification of heat

Strategy Theme

Net zero and the energy system transition

Lead Sector

Electricity Distribution

Project Start Date

01/03/2024

Project Duration (Months)

3

Lead Funding Licensee

UKPN - London Power Networks Plc

Funding Mechanism

SIF Discovery - Round 3

Collaborating Networks

UK Power Networks

Technology Areas

Asset Management

HVDC

Low Carbon Generation

Photovoltaics

Environmental

Project Summary

OptiHeat will transform how consumers make decisions on building fabric upgrades, heat pump and/or renewable energy technology installations. Our innovative tool optimises home upgrade recommendations and energy costs for consumers while modelling the resulting reduced load on the network.

The benefits include providing DNOs insight into the size and location of likely LCT installations – enhancing network planning efficiency and running of the networks. Additionally, it will support and empower vulnerable consumers and social landlords to efficiently upgrade their heating systems, promoting an inclusive rollout of right-sized LCTs and ensuring equitable sharing of the benefits for all in the energy transition.

Add Third Party Collaborator(s)

EDF Energy

University of Sheffield

South Yorkshire's Community Foundation

Project Budget

£125,916.00

SIF Funding

£113,324.00

Project Approaches and Desired Outcomes

Problem statement

Deploying LCTs at scale poses a challenge, requiring significant capital investment from both consumers and DNOs, alongside the time required to build additional capacity to support the LCT's demand. As part of the RIIO-ED2 determinations, Ofgem allowed £3.2bn for DNOs to upgrade capacity over the price control period. DNOs are also continually exploring ways to assess and improve the delivery of new capacity, ensuring efficient network investment.

This requires leveraging available data and information to know where to direct network investment for new capacity upgrades that support more LCT connections. However, data about LCTs connected to the network has gaps as DNOs are not always notified of an installation. Despite collaborative efforts with LAs and vulnerable customer groups to plan LCT rollout effectively, resource constraints in LAs and a lack of awareness among vulnerable groups hinder widespread rollout and the delivery of benefits across all consumer groups during the energy transition.

LCT evaluation tools offer crucial information to customers and local authorities to support them in determining the appropriate actions when making decisions on renewable technology installations. However, existing tools such as heat pump focused solutions currently focus narrowly on replacing gas-fired central heating with heat pumps.

For many households, the cost-optimal solution also includes a combination of building fabric upgrades and integrating renewable technologies, like photovoltaic panels. These investments may reduce the required heat pump capacity, alleviating aggregate power demands on electricity networks, hence reducing the need for additional grid capacity. These decisions are often complex and multifaceted, with multiple options and customers don't know what heating technology or fabric upgrades are most suited to their home.

To help with these challenges, OptiHeat will:

· Recommend the most effective sizing and combination of LCTs and fabric upgrades to achieve the most cost-effective decarbonisation. These homes can then be aggregated to understand how much grid capacity is needed for heating decarbonisation in these homes (Challenge 3, Theme 4).

· Place the needs of households, including vulnerable consumers, at the centre of decision making. In doing so, OptiHeat offers equitable approaches to grid capacity expansion costs driven by heat electrification (Theme 4).

· Will leverage the heat pump sizing methodology employed by the Catalyst tool, developed under the Heat Pump Ready Programme Stream 2. The learnings will be used to develop new decision-making processes for load mitigating investments and sizing a heat pump.

Video Description

https://youtu.be/h0POqATKoKI

Innovation justification

Providing households with the means to optimise their housing decarbonisation investments at a national scale has the potential to radically reduce future housing-related carbon emissions, while simultaneously mitigating the need for costly grid capacity upgrades and improving thermal comfort and national health outcomes.

To realise this potential, this project will demonstrate a novel proof-of-principle evolution of Catalyst. A web app which currently

enables homeowners to rapidly assess the appropriateness of substituting their boilers for heat pumps. The project will extend the scope of this app to support the identification of cost-optimal heat decarbonisation investments including building fabric upgrades, heating systems and renewable technologies.

By including relevant stakeholders and community groups (identified by South Yorkshire Community Foundation) in the tool design, the project will develop a system that is flexible enough to cater for often disparate needs of customers while offering a detailed technical solution. This type of novel intervention is a first of its kind to be developed in this field.

Discovery will define and short list use case tools, commercial and technical frameworks, and associated end-users to determine the most effective methods for interaction and intervention and to ensure that vulnerable consumer are supported. Through engagement, frameworks identified as having the maximum benefit to both networks and vulnerable customers will be proposed for development in Alpha.

A key focus for Discovery will be on the multi-objective optimisation of insulation, heating system and renewables for a single housing archetype as a proof of concept. Using the JEPlus parametric energy simulation platform a semi-detached dwelling will be modelled. This extension is shown on the right-hand side of the diagram attached in the appendix.

The project uses known technologies (insulation, heating system and renewables), so that the integration readiness level is high (IRL = 6-7), as is the commercial readiness level for able to pay customers (CRL = 6), but the online computational workflow enabling customers to identify the optimal combination of these technologies for their home is at a preliminary stage (TRL = 2-3). Additionally, the commercial readiness of more complex intervention schemes, especially those to support vulnerable consumers is low (CRL = 3).

With a broad palette of beneficiaries (individual homeowners, social housing providers, DNOs and energy utilities), there is no clear alternative mechanism to fund this work other than the SIF. Any counterfactual approach that did not build on the Catalyst tool would lead to extended delivery times.

Impacts and benefits selection (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 – direct CO2 savings per annum

Environmental - carbon reduction – indirect CO2 savings per annum

Others that are not SIF specific

Impacts and benefits description

Financial - future reductions in the cost of operating the network

Increasing the number of lower power heat pumps installed, while being able to anticipate heat pump load growth thanks to the planning tool, will help DNOs reduce the load on the network and the resultant need for reinforcement. This will reduce the operating costs of the network and allow for load growth mitigations through investments and awareness campaigns.

- Metrics: number of optimally sized heat pumps installed in specific area, reduction on network operating costs, heat pump load growth evolution

Environmental - carbon reduction – direct CO2 savings per annum

Lowering the barriers to installing heat pumps, by supporting vulnerable consumer groups, LAs with effective planning of retrofitting a portion of their housing stock with heat pumps and other upgrades will decrease the number of gas boilers. Not other customers can use this tool as well. This will result in direct CO2 savings.

- Metrics: number of heat pumps installed

Environmental - carbon reduction – indirect CO2 savings per annum

Increasing the number of lower power heat pumps installed will reduce the total electrical consumption of new heat pumps. As the UK electricity still has an average carbon intensity of 0.207kg emitted per kWh of electricity generated, this will act to indirectly reduce CO2 emissions.

Financial - cost savings per annum on energy bills for consumers,

Heat pump, LCT installation and fabric upgrades will increase household energy efficiency, leading to reduction in energy bills for consumers.

· Metric: cost saved per annum on energy bills for consumers following recommendations deployment (predicted vs controlled)

Others that are not SIF specific

Initial tool frameworks include:

- Enabling consumers to evaluate cost-effective load mitigating investments and automatic interfacing with the DNO

This provides benefits for:

- A DNO: visibility of new connections pipeline for validation process and increase visibility of additional loads on the network (potentially by updates/notifications), cohesive planning enabled to mitigate the effect of potentially large cumulative loads, cost-effective alternatives provided to reinforcing the network, support vulnerable consumers under RIIO commitments
- Consumers: streamline process of decarbonising home
- Vulnerable consumers: tailored support to install a cost-effective heat solution, even potential free access to the solution
- Local authorities or housing associations: cost optimal investment in their housing stock, better justification of building upgrades to stakeholders, investment and advice implications to reduce bills and the cost of potential installations.

Teams and resources

OptiHeat has four key Project Partners :

UK Power Networks: UK's largest electricity distributor delivering power to 8.5 million homes and businesses. UKPN are responsible for owning and maintaining the cables and assets in our licence area.

Role: UKPN will lead this project and be responsible for overall project management (WP4) and dissemination of information across the industry. Our stakeholder engagement, planning and IT teams will contribute with relevant information and subject matter expertise.

EDF UK R&D: Integral part of the EDF Group and responsible for leading UK research activities. The team has significant experience in developing and managing complex, multi partner, multiphase energy innovation projects, ranging from tens of thousands to multimillion pounds contract value. We are currently working in the Heat Pump Ready Programme, funded by DESNZ, and have recently delivered a project in the first phase of the Alternative Energy Markets Competition.

Role: EDF will lead the tool framework options (WP2), conduct a literature review and map stakeholders involved in the different

tool frameworks to evaluate and refine them (WP3).

University of Sheffield (UoS): are the creators of the dynamic simulation model. EDF and University of Sheffield have an established partnership aiming to accelerate heat pump deployment. UoS has considerable expertise in analysis and design of clean energy processes and the study of energy systems. UoS works in partnership with South Yorkshire Sustainability Centre (SYSC) which connects world-leading research with regional partners to develop and implement plans to reduce emissions, while also providing jobs and economic growth

Role: UoS will lead the development of the heat loss calculation methodology (WP1). SYSC will perform the literature review (WP2))

South Yorkshire's Community Foundation (SYCF) has an extensive knowledge of community-based organisations across South Yorkshire. Further, they have conducted multiple research projects (occasionally assisted by The University of Sheffield) that measure community engagement, impact reporting, and highlighting priorities that need to be addressed to improve regional resilience and growth; this experience makes them well placed to lead on stakeholder engagement planning.

Role: SYCF will lead the stakeholder research phase 1 (WP3)

With a partnership including a DNO, an energy supplier, academia and consumer representative groups, this consortium is well placed to deliver a meaningful and successful project considering the needs of many stakeholders.

We are confident in having the relevant resources, equipment and facilities inhouse, between the project partners, to deliver the project successfully.

Project Plans and Milestones

Project management and delivery

There are four work packages proposed for OptiHeat:

WP1: Development of heat calculation methodology (UoS)

· Aims: Develop the heat loss calculation methodology, extending the UoS current workflow to recommend load reducing investments.

· Success criteria: Simulation and optimisation can effectively search for cost-optimal investments to decarbonise heat

WP2: Tool framework design (EDF R&D)

· Aims: Design several tool architectures and stakeholder journeys that will be iteratively informed and evaluated in WP3

· Success criteria: number of frameworks design, frameworks short listed

WP3: Stakeholder research (SYCF)

· Aims: Conduct a literature review and map stakeholders to evaluate and refine them. Define engagement plan for trial

· Success criteria: literature review identifies and evaluates existing work in the area. Stakeholder map, frameworks evaluated and shortlisted and engagement plan defined

WP4: Project Management, governance, and liason (UKPN)

· Aims: Deliver the project on time, to budget, checking that project objectives and learning are achieved.

· Success criteria: project delivered on time, in budget and quality

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

UKPN has highly effective innovation governance procedures. The project has progressed through UKPN's internal Innovation and Project Governance and Control Governance processes (SR 07 005i) and will continue to be managed under this governance.

Each Partner will assign a dedicated project manager to coordinate their resources and input to the project.

The Gantt Chart uploaded for Q7.3 breaks down the activities into four WPs made up of individual subtasks and dependencies have been clearly laid out in the document. To ensure effective delivery, roles and responsibilities have been agreed among the project partners and assigned against WP/ subtask.

The risk register uploaded for Q7.2 within the PMT lists risks and mitigation strategies identified. Risks identified at this stage include:

1. Frameworks proposed are not technically or commercially feasible

2. Frameworks are too complex resulting in a lack of understanding of their potential benefits among stakeholders

3. Frameworks locking stakeholders into schemes with a long duration, potentially exposing them to unfavourable circumstances

We will manage risks and issues using a standard risk management approach, refreshed for project meetings.

At this stage, there are no identified risks in relation to policy and regulatory changes with regards to deployment, nor potential for supply interruptions to customers.

Key outputs and dissemination

At the end of Discovery the project will have achieved three main objectives:

- The technical evolution of the UoS's heat pump sizing methodology to include recommendations of load mitigating investments for a single typical house (WP1)

- The design of several shortlisted frameworks to enable stakeholders to benefit from this improved heat pump recommendation methodology.(WP2)

- The planning of future engagement work to canvass stakeholders on the framework designs shortlisted as part of the Discovery Phase. (WP3)

The primary dissemination will be through the deliverables and the project endpoint report. The exact format of this will be agreed during the kick off stages of the project, but we anticipate the report to consist of the following key parts:

Framework design (WP2) outcomes

To provide a comprehensive overview of the methodology development occurring WP2 there will be a separate section of the final report dedicated to this. The Partner responsible for the delivery of this will be the University of Sheffield.

Engagement plan

To set out the methodology for engaging stakeholders and taking on board their feedback to maximise the effectiveness of the application of the heat loss methodology, an engagement report will be created. The responsibility for this will lie with South Yorkshire Community Foundation.

Literature review

To systematically evaluate and document work previously conducted, setting out best practice for stakeholder engagement and methods for systematic intervention. This will be led by the UoS (Sustainability Centre).

Finalised Framework presentation

To complete the first stage of design the shortlisted frameworks will be laid out in preparation for Alpha phase. This will be delivered by EDF Energy R&D.

Final project status report. A non-technical summary of the project, the final view of deliverables and sub-reports, including annexes, datasets, etc as appropriate, will be delivered by EDF Energy R&D.

Knowledge Dissemination

Project outputs will be uploaded to the Smarter Networks Portal and feature on the UKPN website with specific project learnings being disseminated at the IUK Show & Tell events. The project will be presented at other UKPN events should the opportunity arise.

UKPN will look to share project successes and discoveries via its social media channels and publish external media where appropriate.

As detailed above the outputs of OptiHeat will be made available to all networks and therefore does not undermine competitive markets.

Commercials

Intellectual Property Rights (IPR) (not scored)

The parties agree to adopt the default IPR arrangements for this project as set out in Section 9 of the SIF Governance document for the purposes of the Discovery phase of OptiHeat only.

However, EDF, UoS and SYCF reserve the right to propose a modified IPR position with respect to any future Alpha or Beta Phases carried out with respect to this project.

Value for money

The Discovery phase of the project will cost £125,916 in total and the total SIF funding requested is £113,324. This is balanced across the project partners as follows:

- UKPN:
  - Total costs: £30,384
  - Total contribution: £3,039 (10%)
  - Total SIF funding request: £27,345
- EDF R&D:
  - Total costs: £42,348
  - Total contribution: £5,035 (12%)
  - Total SIF funding request: £37,313
- University of Sheffield:
  - Total costs: £45,184
  - Total contribution: £4,518 (10%)
  - Total SIF funding request: £40,665
- South Yorkshire Community Foundation:
  - Total costs: £8,000
  - Total contribution: £0 (0%)
  - Total SIF funding request: £8,000

EDF R&D will cover the 10% contribution for EDF R&D and SYCF in the Discovery, through internal private funds. UKPN is also contributing to 10% of the costs.

UoS is making a 10% contribution through central strategic funds.

There are not any subcontractor costs anticipated from the discovery phase of the project.

Key points in relation to value for money:

· The previous development of a heat pump sizing methodology and existing framework established as part of Project Catalyst (with a total project cost of £757k, funded as part of the Heat Pump Ready programme) will provide a strong basis for the project to launch from. It will save consumers the cost of creating the initial heat pump sizing methodology and the core aspects of designing the methods of interaction between the frameworks and the modelling.

· The frameworks developed and the engagement research work will be directly used to formulate the commercial proposition and inform integration of the tool (the development of which is planned to be conducted during the alpha stage of the project) in business as usual. The methods for commercialisation will be developed once the frameworks Commercialisation will be scoped in discovery phase.

OptiHeat commercialisation plans would be developed through the project. A lead could be to leverage EDF's customer base, but this will only be made possible through strategic partnerships with local authorities or housing association, having at their disposal more accurate recommendations tools. OptiHeat could even move to BAU for EDF owner occupiers linked to EDF Heat Pump proposition to make holistic recommendations. All partners are focused on helping Britain achieve Net Zero and through the development of new tools such as OptiHeat, there is potential to commercialise within EDF customer propositions.

Supporting documents

File Upload

OptiHeat - Show and Tell - v0.6 - clean.pdf - 832.3 KB
OptiHeat - SIF Rd3 Discovery Phase - End of Phase - v0.6 - clean.pdf - 1.4 MB
SIF Round 3 Project Registration 2024-07-08 10_24 - 64.2 KB
SIF Round 3 Project Registration 2024-05-13 10_43 - 64.1 KB

Documents uploaded where applicable?

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