SIF Round 4 Project Registration

Date of Submission

May 2025

Project Reference Number

10158067

Initial Project Details

Project Title

Hot Chips

Project Contact

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Challenge Area

Greater heat flexibility

Strategy Theme

Net zero and the energy system transition

Lead Sector

Electricity Distribution

Project Start Date

01/05/2025

Project Duration (Months)

3

Lead Funding Licensee

UKPN - London Power Networks Plc

Funding Licensee(s)

UKPN - London Power Networks Plc

Funding Mechanism

SIF Discovery - Round 4

Collaborating Networks

Northern Powergrid

Technology Areas

Heat Pumps

Energy Storage

Project Summary

Electricity demand from heating could quadruple by 2050 to over 100TWh per year, almost a third of GB's current annual electricity demand.

Hot Chips will demonstrate how data centre surplus heat could reduce the energy demand of district heat (DH) networks and explore how DNO's and data centres can work collaboratively to decarbonise DH networks.

Using water-sourced heat pumps in an ambient loop array, this project will reduce electrical demand and increase system efficiency. Coupled thermal storage will provide thermal flexibility for homes as well as electrical demand flexibility for DNOs.

Add Third Party Collaborator(s)

EDF Energy R&D UK Centre Ltd

University of Sheffield

Dalkia Energy Services

Project Budget

£149,207.00

SIF Funding

£133,079.00

Project Approaches and Desired Outcomes

Animal testing

- ○ Yes
- ◉ No

Problem statement

The heating sector in the UK contributes to nearly one third of the country's annual carbon emissions. One potential solution to decarbonising the sector is low-carbon District heat (DH). According to the Climate Change Committee, DH could meet 18% of UK heating by 2050. The heat delivered to DH networks can be derived from multiple low-carbon sources, including air, ground and water-sourced heat pumps, as well as waste heat from various sources.

DH can be flexible, but if not managed appropriately, could also be a substantial addition to peak network load. DH deployed in Great Britain so far has proven inefficient, and improvements are needed to ensure that the potential impact on the electricity network is minimised and costly network upgrades avoided.

In parallel, the UK is witnessing unprecedented growth in electricity demand to power data centres. According to NESO, demand will reach 35 TWh in 2050, equivalent to 11% of the UK's total electricity consumption. 40% of electricity from data centres is used for cooling purposes which is then lost as low-grade heat to the environment (between 25-40°C).

There are opportunities for these two cases to complement one another. This project will investigate the technical, financial and environmental feasibility of repurposing data centre surplus heat through several vectors:

· Improve individual heat pump performance of nearby residential buildings.

· Explore the potential of ambient loop district heating

· Integrate thermal storage through heat recovery technologies

· Enable greater heat flexibility through an innovative heat pump time of use tariff

By repurposing data centres' surplus heat and integrating thermal storage solutions, this project will tackle the challenges of greater heat flexibility in the UK (Challenge 2). By exploring new flexible commercial arrangements between data centres, grid operators, and heat networks this project will deliver a scalable solution to facilitate heat decarbonisation and reduce peak electricity demand, meeting the scope and the cross-cutting areas of Challenge 2.

The main users of this innovation are:

· DNOs to understand the opportunities, challenges and feasibility of repurposing data centres' surplus heat to reduce peak demand.

· Residential customers by reducing heat pump electricity demand.

· Data Centre Developers to support and accelerate the decarbonisation of heating.

This project will build upon the knowledge derived from previous innovation funded work, such as University of Sheffield's DESNZ-funded ADSorB project. We will investigate the integration of data centre heat into District Heating Networks, contributing to the understanding of this critical aspect of decarbonising the UK's heating sector.

Video Description

https://youtu.be/llHi9M1BH58

Innovation justification

Our project will propose a framework that incentivises collaboration between electricity network operators, heat networks and data centres to seek opportunities to decarbonise heat. This will become part of the business-as-usual assessment and planning activities for these parties.

We will achieve this by exploring:

· Commercial Business Model – We will investigate new commercial arrangements between data centres, network operators, and heat networks to incentivise participation. This will include assessing best practice world-wide.

· System Modelling – creating a user-friendly framework to determine benefits to different customers in the value chain. This will consistently evaluate whole system benefits considering residential heat network demands, costs and flexibility solutions such as thermal storage and dynamic tariffs.

· Ambient Loop Systems – Identify opportunities to leverage 4th and 5th generation district heating networks to repurpose low-quality heat (25-40°C) from data centres to water-source heat pumps. This will boost temperatures (55-60°C), making surplus heat a viable low carbon heating source.

For electricity networks the counterfactual is that electricity demand to serve Data Centres continues to be assessed without accounting for their capability to reduce the load of decarbonising heat in the vicinity. The installation of data centres and decarbonisation of heat will continue as distinct activities. Data centres will be installed, but valuable heat will be lost to the environment and as a result consumers will eventually pay more for less efficient heat networks or individual heat pumps.

Heat pumps and Data Centres are commercially available, however the system we are proposing in this project will require further development and testing – TRL6. In addition, the commercial and integration levels have continued to lag at CRL2 and IRL2.

The development of the waste heat market for Data Centres is too slow, jeopardising Net Zero targets. Previous Innovation investments in individual projects to collocate Data Centres and Heat Networks have not resulted in wide-spread adoption, as they were not focussed on deploying a repeatable planning approach and establishing new commercial models. Hot Chips is therefore needed, to understand the business models, blockers and motivations of the different actors in this market to find an appropriate enduring solution for them to coordinate.

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

Impacts and benefits description

DH Networks have shown varied success in the UK, with many being described as inefficient and expensive. Consequently, a third of existing heat networks are expected to be so inefficient they will need to be almost entirely replaced to comply with new technical standards.

For energy consumers, the average cost of running a heat pump is currently more than a gas boiler. This coupled with the high installation costs will deter many consumers switching their supply, thus delaying the decarbonisation of heating.

Apart from a few isolated instances, the concept of heat recovery from data centres is still sparse. For the pre innovation baseline, we have assumed that all surplus heat from data centres is currently expelled to the environment.

There is also no joined up approach between DH Networks, DNO's and Data Centres.

Expected benefits that we would like to investigate as part of this project, include but not limited to:

Financial - future reductions in the cost of operating the network

· Supplying low grade surplus heat (20–40°C) to nearby residential buildings will result in significantly increasing residential heat pump performance and therefore reduce electricity consumption from heat pumps, which provides cost reductions in

operating the network.

· Integrating individual thermal storage will further reduce peak electricity demand and provide financial benefits to network operation.

Financial - cost savings per annum on energy bills for consumers

· Improved efficiency of heat pumps due to data centres surplus heat recovery and the integration of thermal storage solutions and dynamic tariffs will lead to a reduction of heat pumps electricity consumption, leading to cost savings on energy bills for consumers.

Environmental - carbon reduction – direct CO2 savings per annum

· A reduction in heat pump electricity consumption will lead to a reduction of operational carbon emissions.

· Supporting data centres in making use of their surplus heat and supporting their own, and a wider, green transition and therefore reduce data centres' operational carbon emissions.

The Discovery project will confirm the above expected benefits and compare the solution with a Business as Usual scenarios from a technical, financial, and environmental perspectives.

Teams and resources

The Project team consists of UK Power Networks (UKPN), EDF R&D UK, University of Sheffield (UoS), Dalkia UK, Northern Powergrid (NPg). The key stakeholders provide a broad range of expertise from various sectors within the industry. With already established relationships through previous collaborations the consortium will be able to integrate seamlessly to ensure project objectives are achieved.

Partner Name: UKPN

Skills/Expertise: Own and maintain distribution networks across London, the Southeast, and the East of England. Expertise in delivering low-carbon heating, ensuring safe and reliable electricity distribution, and tackling the climate crisis.

Role: UKPN will act as the project lead, managing the overall project and providing insights throughout the process.

Partner Name: EDF

Skills/Expertise: UK's largest supplier of zero-carbon electricity with expertise in power and energy systems engineering, smart grids, technoeconomic modelling, EV transportation, data analytics, and smart digital technology.

Role: EDF will be responsible for conducting the literature review and leading the modelling work package for the Data Centre Surplus Heat project.

Partner Name: Dalkia

Skills/Expertise: EDF subsidiary providing technical and energy services across the UK, with expertise in optimising infrastructure, maintenance services, and delivering low-carbon heat solutions including heat networks

Role: Dalkia will support the modelling phase, acting as an independent verifier of the model plan and high-level calculations to ensure accuracy and feasibility. They also provide networks into Heat Network operators and existing knowledge of how they operate, to be utilised in the Discovery Phase.

Partner Name: University of Sheffield

Skills/Expertise: Research hub within the School of Engineering, focusing on climate change, energy poverty, and energy storage.

Role: The University of Sheffield will be responsible for Data Centre engagement and will contribute expertise in energy storage to the modelling work package.

Partner Name: NPg

Skills/Expertise: Manages the electricity network for over 3.6 million homes and businesses with significant expertise as a Distribution System Operator (DSO) specialising in Flexible Services.

Role: NPg will provide strategic advice throughout the discovery phase, leveraging its deep knowledge of flexible services and electricity distribution.

Project Plans and Milestones

Project management and delivery

The project plan aims at establishing robust, milestones, timelines, while maintaining open and regular communication with all stakeholders. Further detail is shown within the PMT and Gantt chart.

There are five work packages planned for Discovery:

WP1: Project Management (UKPN)

· Aims: Deliver the project on time, to budget, ensuring that project objectives and learnings are successfully achieved.

· Success criteria: Project delivered on time, to budget and to quality.

WP2: Market Analysis (EDF)

· Aims: Conduct a literature review of data centers heat reuse market in Europe and UK.

· Success criteria: Comprehensive report identifying case studies around the world, lessons learnt, current and innovative technologies, , business models and regulation impact.

WP3: Data Centre Engagement (UoS)

· Aims: Hold a series of meetings with key data centre stakeholders to inform business case discovery and prepare for alpha phase study.

· Success criteria: Report capturing the learnings from successful engagement with strategically located Data Centre Stakeholders.

WP4: System Modelling (EDF)

· Aims: High level Technical/thermal, financial and environmental modelling

· Success criteria: Report detailing the modelling methodology, assumptions, key results and validation methodology.

WP5: Conclusion and Roadmap (EDF)

· Aims: Comprehensive report identifying case studies around the world, lessons learnt, current and innovative technologies, business models and regulation impact.

· Success criteria: A report highlighting opportunities, challenges and findings from the project

Project management will use the standard best practice methods, including regular management meetings and status reporting, a risks, assumptions, issues, and dependencies log, and a stakeholder governance schedule aligned with project timelines. The risk management approach aims to mitigate the effects of uncontrollable circumstances and reduce their impact, while de-risking the project where possible before future project phases (further detail in PMT).

A key risk will be ensuring the project team can get engagement from data centre operators. Their input will be crucial for shaping the project and we will need their engagement if this project is to proceed to Alpha. The project team will leverage their existing networks and contact stakeholders as early as possible to allow ample time to incorporate their feedback. UKPN will utilise their contacts through the DSO team whilst the University of Sheffield will utilise their contacts from previous projects.

The project will not result in any planned or unplanned supply interruptions for consumers, nor do we anticipate any interaction with energy consumers or any impact on their premises.

Key outputs and dissemination

By the end of the Discovery Phase, we aim to produce:

Literature analysis

· Develop summary of data centre requirements to shape future work.

· Assess regulatory and market barriers to implementing surplus heat recovery at scale.

· This will be led by EDF with contributions by UKPN and NPG. (D2.1)

Data Centre Engagement Report

· Interviews to engage data centre providers to gather insights and summarise key inputs.

· This will be led by the University of Sheffield with input from EDF. (D3.1)

System Modelling Framework

· Develop an initial plan for System Modelling to model heat transfer and storage and to quantify cost savings, carbon reductions, and peak demand impacts for grid operators, energy suppliers, and consumers.

· Conduct high level calculation of key metrics to verify hypothesis

· This will be led by EDF and Dalkia will contribute their expertise in modelling. (D4.1)

Business Case Evaluation

· Propose a Commercial Business Model that incentivises collaboration between data centres, energy networks, and heat suppliers while ensuring fair market access.

· Establish the initial Technical, Financial, and commercial Feasibility of data centre surplus heat recovery for residential heating and heat pump optimisation.

· EDF will lead this deliverable with contributions required from all project partners. (D5.1)

Dissemination Strategy

Our key 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 with the possibility of publishing external media where appropriate.

Ensuring a Competitive Market

Our project does not undermine competitive markets but instead enhances them by:

· Introducing new market opportunities for data centres, heat network developers, and flexibility service providers.

· Providing transparent access to surplus heat, ensuring fair participation from multiple stakeholders.

· Encouraging innovative business models that support open market competition rather than exclusive partnerships.

By the end of the Discovery Phase, we will have established quantitative and qualitative assessment of the feasibility and appetite of reusing surplus heat from data centres for DH networks.

An overview of how to move into the Alpha phase and assessment of scalable deployment, ensuring that heat from data centres becomes an integrated and competitive part of the UK energy market.

Commercials

Intellectual Property Rights (IPR), procurement and contracting (not scored)

The project will follow the standard approach to IPR management as set out in the SIF Governance Document Chapter 9. In short, this means:

Each Project Participant in the Project will retain all rights in and to its background IPR.

Each Project Participant shall own all Foreground IPR that it independently creates as part of the Project, or where it is created jointly then it shall be owned in shares that are in proportion to the work done in its creation. Where any Project Participant transfers any of its rights, title or interest in or to any Foreground IPR to any other person, for example, if the Project Participant is taken over by another legal entity, it shall only do so where the assignee/transferee agrees to comply with these default IPR conditions. A Funding Party can only transfer any of its rights, title or interest in or to any Foreground IPR to any other person, subject to having regard to the true commercial value of the IPR; and the assignee/transferee agreeing to comply with these default IPR conditions.

We will capture this approach and agreement to follow it in a project collaboration agreement following award of funding.

None of the work completed by partners will be subcontracted. There are no tenders or procurements scheduled for this project.

Investment Needs

Gaia - £199k

As part of the Heat Pump Ready Stream 2 Programme, project Gaia's main aim was to demonstrate how cross sector collaboration can achieve high density deployment of ground source heat pumps (GSHP) to a target market of domestic properties in a rural location who are connected to the gas network.

South Yorkshire Sustainability Centre

Funded by Research England, the South Yorkshire Sustainability Centre's aim is to bring together interdisicplinary researchers, local authorities, businesses and third sector partners from across South Yorkshire to drive forward sustainability through knowledge exchange and co-design of solutions to regional & global sustainability challenges.

Advanced Distributed Storage for Grid Benefit (ADSorB)

The DESNZ-funded ADSorB project aims to develop, deploy and evaluate deploying a series of innovative, smart, and interoperable thermal energy stores for domestic use. The technology seeks to provide extended duration energy storage for heating and hot water demands in a way that significantly enhances UK energy flexibility and supports wider energy network resilience.

Value for money

The Discovery phase of the project will cost £149,207 in total and the total SIF funding requested is £133,079. The project partners are contributing 11% of the total project costs, through contribution of reduced rates and/or uncharged time. This is balanced across the project partners as follows:

UKPN:

- Total costs: £24,140
- Total contribution: £3,621 (15%) – Labour

- Total SIF funding request: £20,519

EDF R&D:

- Total costs: £73,646
- Total contribution: £8,338 (11%) – Labour
- Total SIF funding request: £65,308

Dalkia:

- Total costs: £9,727
- Total contribution: £0
- Total SIF funding request: £9,727

University of Sheffield:

- Total costs: £35,394
- Total contribution: £3,539 (10%) – Labour
- Total SIF funding request: £31,855

Northern Powergrid:

- Total costs: £6,300
- Total contribution: £630 (10%) – Labour
- Total SIF funding request: £5,670

Key points in relation to value for money:

These costs are proportional to the work each organisation is undertaking. There are no subcontractor costs associated with this application, and no additional funding coming from other innovation funds. The Discovery phase does not require use of pre-existing assets or facilities.

UKPN and the project team have experience successfully delivering innovation projects in the past, hence the project management approach ensures efficient coordination and delivery.

This project may also provide opportunities for further collaboration among industry stakeholders, incl. DNOs and Data Centre Operators.

The proposed solution, any plans for commercialisation of the proposed innovation and how the Project can be moved into business as usual would be applicable to all of GB.

Supporting documents

File Upload

SIF Round 4 Project Registration 2025-05-20 2_49 - 64.6 KB

Documents uploaded where applicable?

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