SIF Round 3 Project Registration

Date of Submission

May 2024

Project Reference Number

10061357

Initial Project Details

Project Title

WASH

Project Contact

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Challenge Area

Unlocking energy system flexibility to accelerate electrification of heat

Strategy Theme

Flexibility and commercial evolution

Lead Sector

Electricity Distribution

Project Start Date

01/03/2024

Project Duration (Months)

3

Lead Funding Licensee

UKPN - Eastern Power Networks Plc

Funding Mechanism

SIF Discovery - Round 3

Collaborating Networks

UK Power Networks

Technology Areas

Heat Pumps

Stakeholder Engagement

Project Summary

The UK heating sector contributes nearly one third of the country's annual carbon emissions. One solution to decarbonising the sector is low-carbon district heating(DH). According to the Climate Change Committee, DH could meet 18% of Unhating by 2050. WASH will investigate the incorporation of heat from wastewater into DH networks. The objective is to assess the feasibility of wastewater heat as a source for heat pumps that supply DH networks, provide essential knowledge to assess the potential for heat pump flexibility, and explore how water companies network operators and DNOs can work collaboratively to decarbonise DH networks.

Add Third Party Collaborator(s)

Guidehouse

Project Budget

£139,183.00

SIF Funding

£125,264.00

Project Approaches and Desired Outcomes

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 heating (DH). According to the Climate Change Committee, DH could meet18% of UK heating by 2050. The heat delivered to DH networks can be derived from multiple low-carbon and water sources, including air, ground and water-sourced heat pumps, as well as waste heat from various sources. District heat can be flexible, but if not managed appropriately, could also be a substantial addition to peak network load. Wastewater heat recovery is taking place at more than 500sites worldwide, particularly in Scandinavia. However, in the UK only a few schemes are present, such as in Kingston and in Galashiels (Scotland). Electricity network impacts of wastewater heat in heat networks are therefore poorly understood.

This project takes on the challenge by investigating the incorporation of waste heat sources (sewers, treatment plants, pumping stations) into DH networks. The primary objective is to assess the feasibility of wastewater heat as a source for large, centralised heat pumps that supply DH networks. By doing so, WASH aspires to advance the decarbonisation of the heating sector.

The project aligns with the challenge 'Improving the value and capture of system benefits from heat flexibility' by expediting the utilisation of wastewater heat as a source for large, centralised heat pumps, by evaluating the impact that wastewater heat can have on heat pump (down) sizing, and by exploring commercial arrangements to incentivise DH network operators to operate their heat pumps optimally.

Potential users of this innovation span a spectrum of stakeholders, including DH network operators, water and sewerage companies, DNOs, flexibility aggregators, and local authorities. They all have a vested interest in decarbonising heating and optimising the heating infrastructure. WASH seeks to address their needs by providing essential data, insights and opportunities for collaboration. Furthermore, WASH aims to create a framework that fosters efficient decarbonisation, benefits

solutions for consumers.

WASH will build upon the knowledge derived from ongoing innovation funded work, such as UKPN's Full Circle and Heatropolis projects. These initiatives are exploring aspects of heat flexibility and network optimisation. WASH leverages these foundations to further investigate the integration of wastewater heat into DHnetworks, contributing to the understanding of this critical aspect of decarbonising the UK's heating sector.

Video Description

https://www.youtube.com/watch?v=l_xcEmbX3FQ

Innovation justification

DH networks powered by centralised heat pumps can be a flexible, low-carbon solution to reducing the UK heating sector's carbon emissions. However, due to alack of coordination currently between the DH network operators and electricity network operators and a lack of efficient sources of waste heat, there is a risk of substantial addition to peak electricity network load, which could trigger large network reinforcement costs and increased consumer electricity bills. WASH aims to address this by tapping into the potential of wastewater heat to optimise heat pump sizing and operations and enable them to operate in a more flexible manner.

Wastewater district heating is being explored in Kingston and in Galashiels(Scotland), but none of these projects consider its impacts on the electricity network. The Heatropolis SIF funded project investigates developing commercial frameworks between heat pump powered DH networks and electricity networks but does not consider the value of wastewater heat. The Full Circle SIF funded project investigates the development of a framework to best leverage waste heat from transformers rather than water and sewerage infrastructure. WASH will develop a first-of-its kind framework that will incentivise collaboration monodons, DH network operators and water and sewerage companies to decarbonise heating with minimal impact on electricity networks.

This cross-sector collaboration among partners with limited history of collaboration, along with a lack of incentive for DH networks to connect flexibly or participate in flexibility services (CRL = 3, IRL = 3) bears an element of risk.

Additionally, the limited, pilot-level exploration of this concept (TRL = 5) in the Unmakes it risky for a DNO to undertake as a BaU activity. Therefore, SIF is the most suitable funding mechanism as its structure allows partners to conduct technical feasibility assessment and then perform a demonstrator as part of the Beta Phase and improve the TRL, CRL and IRL of wastewater heat powered district heat networks to 7 or above for all three metrics. SIF mechanism offers an excellent opportunity for cross-sector collaboration, which is essential for the success of the project. The scope is appropriate as WASH focuses on a specific heat source(wastewater) and we intend to use the Discovery Phase to test this.

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

Revenues - creation of new revenue streams

New to market – processes

New to market - services

Others that are not SIF specific

Impacts and benefits description

Financial -- Future reductions in the cost of operating the electricity network

Waste heat from wastewater and sewerage network infrastructure unlocks a new low-carbon heat source for district heat networks, which could contribute towards the downsizing of the centralised heat pump and allow them to operate with greater flexibility. This can reduce the peak electricity demand of the heat networks, resulting in savings of £131,000/MVA of network reinforcement avoided.

Financial -- Cost savings per annum on energy bills for consumers

Electricity suppliers are charged a Distribution Use of System (DUoS) cost, which is then passed on to end consumers and accounts for 12-15% of total bills. Improved operational flexibility and downsizing of the centralised heat pump of a heat network will reduce peak electricity consumption and associated reinforcement which will reduce DUoS on consumer bills.

Environmental -- Carbon reduction -- Direct CO2 savings per annum

As of 2018, UK heat networks supplied 14TWh of heat, but only 1TWh (7.1%) of this supply came from low-carbon sources with gas CHP technology making up

the lion's share. Thames Water estimates that waste heat from its wastewater treatment works and sewers has the potential to meet up to 10TWh of heating demand each year (71%), which equates to 2.3 million tonnes of direct CO2savings in their license area alone. If applied across Great Britain, the CO2savings realised could be significantly larger.

Environmental -- Carbon reduction -- Indirect CO2 savings per annum

Potentially reduced requirement for network infrastructure reinforcements may result in carbon emission savings from otherwise required construction works.

Revenues -- Creation of new revenue streams

Wastewater heat can unlock a new revenue stream for water and sewerage companies, who estimate that heat from billions of litres of wastewater is currently lost. The added revenue from selling this heat to district heat networks could lower their operating costs and result in lower water bills for consumers.

New to market – Services

Improved operational flexibility could enable the district heat networks to participate more actively and for longer periods of time in flexibility services and smart connection products, creating a revenue stream for flexibility as a service.

Others - Local Job Creation

The UK government predicts that the heat networks industry could attract £60-80billion in investment by 2050 which could lead to creation of long-term jobs associated with designing, building and operating heat networks and subsequently, the systems proposed in WASH.

Teams and resources

The project partners bring extensive relevant experience and credibility to the project:

UKPN is the GB's largest electricity distributor delivering power to 8.4 million homes and businesses across London, the east and south east of England. UKPNwill lead the project, bringing engineering expertise, advising on network regulatory and policy barriers, understanding the intricacies of future electricity network requirements, and potential alignment with future district heating network operator plans (e.g., through previous collaborations with heat network operators to help them transition to net zero). UKPN would also help select trial locations to test commercial arrangements during future project phases.

Guidehouse have successfully delivered innovation projects for various DNOs over the last decade and bring expertise, specialised resources, and deep domain experience. Our choice to engage Guidehouse is bolstered by their ongoing partnership with UKPN on several innovation projects, including Indus and Heatropolis, demonstrating their effective integration and shared objectives. Guidehouse's extensive experience in energy and decarbonisation, project management, multi-stakeholder engagement / consortium development, heat network design, and use of data analysis tools, coupled with their established working relationship with UKPN, strengthens the cohesiveness of our team. Through their work on other innovation projects (e.g., Equinox), Guidehouse also brings deep expertise in solution framework design, and design of conceptual (and optimised) commercial arrangements for multi-stakeholder projects.

We are confident in having the relevant resources, equipment, and facilities inhouse, between the two main project partners, to deliver the Discovery phase of this project.

As part of our preparations for Discovery, the project idea has been shared with UK water & sewage companies through the water sector's Spring Innovation platform. We have already received an expression of interest from several companies including Anglian Water, Thames Water and Severn Trent.

A key objective of the Discovery Phase will include the engagement with these stakeholders and others to identify a suitable water & sewage company and/or district heating network operator within the UKPN licence area, who could become part of the project for the Alpha and Beta phases. We would also look to establish WASH stakeholder advisory group that will bring together an expert group to share learnings with and seek insights from as the project develops. Their involvement would be vital to the successful delivery of future project phases.

Project Plans and Milestones

Project management and delivery

There are five work packages planned for Discovery:

WP1- Literature review and learnings extraction – Guidehouse

Aims: Conduct a comprehensive literature review on the capture and utilisation of wastewater heat (incl. treatment plants, sewers, pumping stations), analysing relevant research, and case studies from both the UK and internationally.

Success criteria: Studies are identified and validated with stakeholders, report delivered on time and to high standard.

WP2- Mapping wastewater heat sources and DH network intersection, and assessment of impact of wastewater heat integration on heat pump sizing –Guidehouse

Aims: Identify areas of overlap between wastewater heat sources and prospective DH networks, engage with DH network operators to gather data and insights, provide understanding on the effects on heat pump sizing and potential for enhanced heat pump flexibility.

Success criteria: Map and report are delivered on time and to standard, validated by stakeholders.

WP3- Solution framework development – Guidehouse

Aims: Develop solution framework and design conceptual commercial arrangements which could be developed in Alpha, utilising preliminary stakeholder engagement to gauge interest in collaboration.

Success criteria: Reports are delivered on time and to high standard, validated by stakeholder input.

WP4- High-level business case development – Guidehouse

Aims: Identification of project cost and benefit streams, quantification of wastewater heat value, assess solution's scalability.

Success criteria: Spreadsheet delivered on time and to standard, verified by stakeholder input.

WP5- Project management & reporting -- UKPN & Guidehouse

Aims: To deliver the project on time, to budget, checking that project objectives and learnings are achieved.

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

Project management will use the standard best practice methods, including fortnightly management meetings and status reporting, a RAID log, and a stakeholder governance schedule aligned with project timelines. The WASH 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).

Key risks and mitigations are set out in the risk register. We will manage risks and issues using a standard risk management approach.

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

Key outputs and dissemination

The desired outcome for WASH is to develop commercial arrangements and engage with electricity DNOs, DH networks, water utility companies and flexibility aggregators to create a framework which fosters efficient decarbonisation, benefits network operators, and provides sustainable and cost-effective heating solutions for consumers.

Key outputs from Discovery

WP1 (Guidehouse) --A comprehensive literature review on the capture and utilisation of wastewater heat, validated findings with relevant stakeholders. A wastewater heat utilisation learnings report will be delivered and workshops with the relevant stakeholders will be conducted for learnings dissemination.

WP2 (Guidehouse) -- Map of wastewater heat sources and DH network intersections and assessment of impact of wastewater heat integration on heat pump sizing, including assessment of potential wastewater heat sources' (in UKPN license area) attractiveness and a summary report including an assessment of wastewater heat potential will be released for learnings dissemination.

WP3 (Guidehouse) -- A solution framework and conceptual commercial arrangements which would be further explored in the Alpha Phase. A regulatory and policy barriers report following the completion of a workshop which will discuss the solution framework developed by Guidehouse with the relevant stakeholders will be delivered by UKPN for learnings dissemination.

WP4 (Guidehouse) -- A solution cost and benefits workshop to gather effective input from stakeholders will be conducted. Insights from the workshop and a business case report will be delivered by Guidehouse for learnings dissemination.

WP5 (UKPN & Guidehouse) -- A final Discovery Phase report summarising the key findings and learnings will be delivered for learnings dissemination.

Knowledge Dissemination

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

The commercial arrangements among DNOs, DH network operators and other relevant stakeholders will be reproducible, incentivise all stakeholders involved and promote the development of competitive markets. Given the novelty of the solution and the lack of contractual precedent, a proportionate approach towards the development of this framework will be taken.

Commercials

Intellectual Property Rights (IPR) (not scored)

The project will follow the standard approach to IPR management as set out in the SIF Governance Document Chapter 9.

Value for money

The total project costs are £139,183.

The 10% compulsory contribution will be provided by UKPN and Guidehouse through an in-kind contribution via labour (£13,919 in total).

We are seeking funding through the Strategic Innovation Fund for the remaining costs (£125,264).

The balance of costs and SIF funding across the consortium is:

UKPN costs are £26,150, (with a contribution to the project of £2,616) and funding sought is £23,534.

Guidehouse costs are £113,033 (with a contribution to the project of £11,303) and funding sought is £101,730.

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.

The project delivers value for money as it explores the largely untapped potential of wastewater heat as the primary source for large heat pumps supplying district heating networks and the framework and commercial arrangements underpinning. By prioritising network areas that have higher wastewater heat potential in terms of capacity and financial value, there is increased potential gains. If successful, the project will provide a reliable, low-carbon alternative that may accelerate the decarbonisation of UK's heating sector, ultimately resulting in cost savings for energy consumers.

UKPN and Guidehouse have experience successfully delivering innovation projects in the past, hence the project management approach ensures efficient coordination and delivery. Guidehouse are suppliers on UKPN's business consultancy framework and were appointed following a competitive procurement exercise which included rates negotiations and an assessment of value for money.

Some pre-engagement with the water sector has already been conducted prior to the start of the Discovery phase to gauge interest in collaboration. Our approach ensures that appropriate water and sewerage company will be selected during Discovery, based on the outcome of the mapping exercise (WP2), hence no valuable project time would be spent on engagement with stakeholders that will not participate in future project phases.

This project may also provide opportunities for further collaboration among industry stakeholders, incl. DNOs, water and sewerage companies and district heating network 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

WASH Show and Tell ENA.pdf - 842.4 KB
WASH End of Phase ENA.pdf - 929.2 KB
SIF Round 3 Project Registration 2024-07-08 10_22 - 62.6 KB
SIF Round 3 Project Registration 2024-05-13 12_44 - 62.5 KB

Documents uploaded where applicable?

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