HEAT PUMP READY | Department for Energy Security & Net Zero

Part of the Net Zero Innovation Portfolio

The Flexible Heat Pump

CARBON TRUST

Project Lead: Clear Blue Energy Limited

Partners: Sourcethermal, University of Liverpool, Pragmatic Energy

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clear blue energy | Sourcethermal | UNIVERSITY OF LIVERPOOL | pragmatic energy

The problem: The average heat pump is not competitive on running costs with natural gas boilers

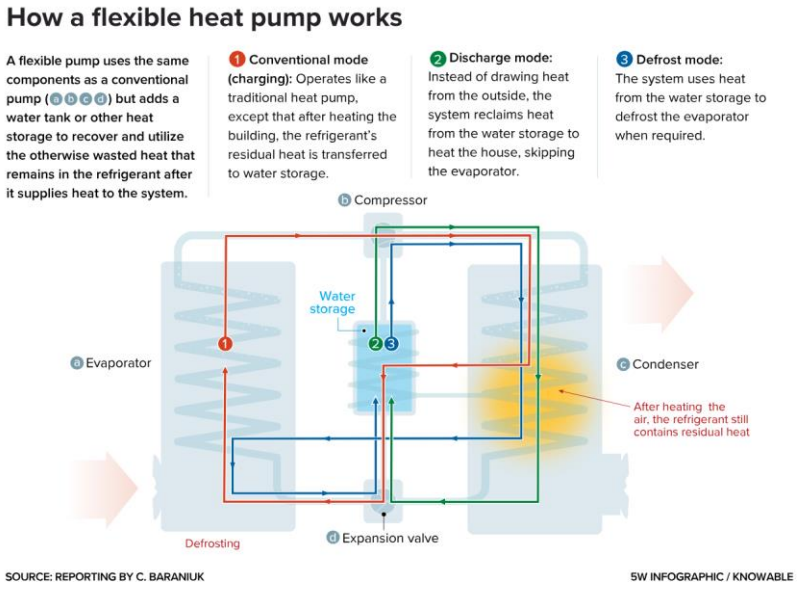
The economics of heat pumps is perhaps one of the biggest barriers to mass market uptake in the UK, with the incumbent low-cost gas boilers fuelled by low-cost mains gas supplies typically presenting a lower expense for consumers. The current residential electricity to gas price ratio for residential and light commercial users in the UK is approximately 4 to 1, meaning that heat pumps must deliver a very high Seasonal Coefficient of Performance (SCoP) to compete with natural gas boilers on running costs.

The solution

The Flexible Heat Pump has an increased SCoP by up to 20%, meaning it consumes less power per unit of heat delivered by the heat pump. It has achieved this by making defrosting of the evaporator more efficient and rapid without interrupting the ongoing supply of heat to the building and integrating multiple heat sources into an air source heat pump, for example the recovery of 'waste' heat. This solution can be applied to any form of heat pump.

> The Flexible Heat Pump can deliver significantly lower running costs than conventional heat pumps. This addresses a key barrier to mass market adoption of heat pumps – the total cost of ownership currently being higher than the incumbent solution, fossil-fuelled boilers

Adrian Richardson
Director, Clear Blue Energy Limited



Making heat pumps more efficient

What are we going to do?

The project aims to focus on producing a prototype at around 12 kW output, slightly higher than the median heat output of air source heat pumps installed under the Boiler Upgrade Scheme today (10 kW). The project is also aiming to improve the SCoP figures from median air source heat pump scores of 2.44 and 2.8 to at least 3.3.

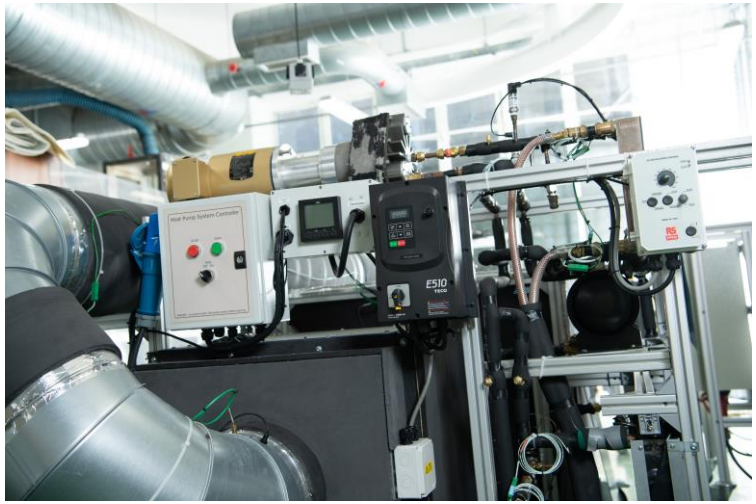
Why is this an improvement on current solutions?

Crucially, the Flexible Heat Pump can deliver running cost savings versus the most efficient condensing gas boilers at current residential energy prices, whereas conventional air source heat pumps cannot.

Key competing technologies are multistage heat pumps, which have a significant cost disadvantage, and vapour injection technology, which has a complex and costly compressor design. The simplicity of the Flexible Heat Pump concept and its ability to provide waste-heat-powered, energy-saving defrosting, without interruption to the heating supply, offers significant advantages over these existing innovations.

What would success look like?

This project is aimed at rapidly progressing the Flexible Heat Pump from current proof of concept, to readiness for precommercial pilot deployment and technology transfer to route-to-market partners. As such, success would involve creating a prototype as outlined above, demonstrating a material SCoP enhancement versus conventional air source heat pumps of between 10-20%, verifying that the heat pump's components represent a lower % of manufactured costs than conventional air source heat pumps, and a further 3 design validation prototypes to provide a template design variant of the Flexible Heat Pump to help derisk the commercialisation process.



How will this project help towards the target of installing 600,000 heat pumps per year by 2028?

The Flexible Heat Pump can have a major impact on accelerating the deployment of heat pumps in the UK by delivering a step change improvement to the performance of heat pumps and hence running cost and CO2 savings for users. By improving the customer value proposition, the Flexible Heat Pump addresses one of the key barriers to uptake of heat pumps.

The Optimised Solutions Development stream of the Heat Pump Ready programme supports the development of innovative tools, technologies and processes to overcome specific barriers to heat pump deployment in the UK. Wave 2 of this stream supports solutions aiming to improve the ease of heat pump deployment in homes that are 'complex to decarbonise', develop innovative solutions to enable heat pumps to be deployed in 'distress purchase' situations, improve performance of domestic heat pumps with low-GWP refrigerants and improve the domestic consumer experience of using and living with a heat pump.

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