HEAT PUMP READY | Department for Energy Security & Net Zero

Part of the Net Zero Innovation Portfolio

Modular Heat Pumps for Cell Based Microfactory Assembly

CARBON TRUST

Project Lead: Ventive

Partners: QM-Systems Ltd, Clear Blue Energy Ltd

Funding:

£1,498,600

ventive naturally intelligent buildings

QM SYSTEMS

clear blue energy

The problem: How to reduce the costs of heat pumps

Manufacturing of traditional heat pumps often entails long-distance transport from the factory to the end user and still requires F-gas work during installation at the home. Heat pumps also comprise a separate hot water cylinder sited internally.

The solution

An innovative microfactory approach to how heat pumps are designed and built will enable decentralised production of modular, interchangeable and scalable platform-based heat pump systems anywhere. This will reduce the costs of production - even at lower volumes - while serving individual cities and supporting local supply chains.

Ventive is designing a modular heat pump that will provide significant cost and carbon savings across the installation, operation and production phases. The unit will arrive pre-plumbed and pre-configured with monitoring and renewable energy storage to enable quick and simple installation. The heat pump will deploy an array of integrated sensors to assess the indoor environment and adapt the performance of each system, learning and optimising its operation to drive improvements in energy efficiency, energy storage and load shifting capacity.

> “We are delighted to be taking part in the Heat Pump Ready programme, as we enter a pivotal moment in history and transition away from fossil fuels. Developing the next generation of heat pump technology and energy storage is critical to delivering global targets of carbon reduction.”

Rob Morrison
CEO, Ventive

Reducing costs by modular assembly and integrated design

What are we going to do?

Ventive Home is a heat pump-based, demand responsive, fully integrated indoor environment control system, providing ventilation, heating and hot water (with heat recovery and free cooling in larger models). It arrives pre-configured with monitoring and renewable energy storage to enable quick and simple installation.

Using cost-effective microfactories designed with a minimal footprint means they can be located closer to urban areas and produce products that are customised for the local market. This smaller footprint also means that they cost less to build and will be quicker to deploy.

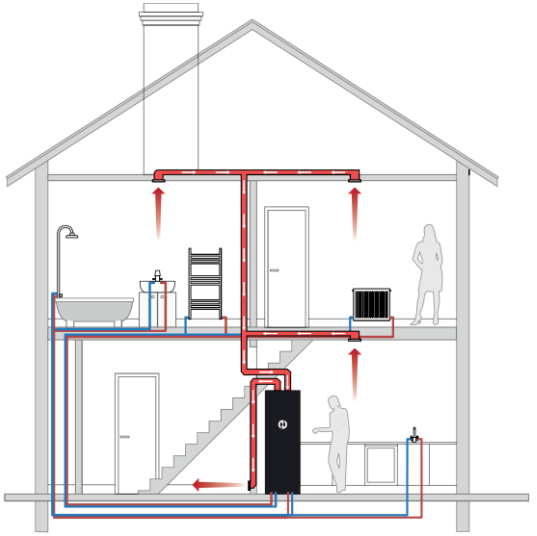
Why is this an improvement on current solutions?

Existing heat pumps suffer from a number of drawbacks, including size, cost, requirement for F-gas work during installation, and the requirement for a separate hot water cylinder.

Ventive's integrated heat pump reduces many of these drawbacks by providing a more compact design that does not require a separate water cylinder, manufactured in a way that obviates the need for F-gas work at the installation site. This reduces overall cost and enables manufacture to be located closer to the installation site. Post-installation monitoring systems also support the cost-effective running of the heat pump.

What would success look like?

The project will result in a production-ready, certified prototype, ready for manufacture at scale and deployment into homes.



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

To achieve the target, there is an urgent need for heat pump-based building services that can significantly reduce energy consumption and the cost of energy conversion (electricity to heat), while maintaining appropriate levels of comfort indoors (both air quality and thermal).

The innovative, integrated and modular heat pump from Ventive will enable a step change in how heat pumps are produced, installed and operated, each providing the necessary savings.

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. This stream supports solutions aiming to reduce the life time cost and increase the performance of domestic heat pumps, minimise home disruption whilst providing high quality installations, develop and trial financial models to support heat pump deployment, improve the heat pump consumer journey and provide a smart and flexible home energy system.

Heat Pump Ready is funded by the Department for Energy Security and Net Zero through the NZIP programme. The Collaboration & Learning stream is managed by the Carbon Trust with support from Ipsos and Technopolis.

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Funded by: Department for Energy Security & Net Zero

Supported by: Carbon Trust, Ipsos, technopolis group

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Project Progress (Autumn 2023)

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Key Findings

- The stability of the phase change materials (PCMs) trialled during charge and discharge has been a key challenge for the project and delayed some timeframes.
- Refinement of some of the equipment design, such as compressors, has led to improved performance of the PCM.
- There is a risk that the final certification certificate may be received after the project end date.

What progress have we made so far?

Good progress has been made on the software and Manufacturing Execution System (MES) with the MES interface due for completion in January/February 2024. Similarly, the supply chain strategy is being progressed and is due before the end of 2023.

The location for the micro-factory site has now been identified and will be developed in Hartlebury, Worcestershire in early 2024.

What barriers have we identified and how has this changed our approach to delivering our project?

There have been significant issues with the phase change materials (PCMs) trialled in the project, with the testing showing inadequate performance. Analysis and refinement to some of the equipment has improved this but not to the level required. A higher temperature PCM than initially planned is now the most likely candidate to be taken forward.

Many of the remaining milestones require the construction of the micro-factory facility and installation of the MES system at the relevant assembly points, so have been reprofiled to be delivered in spring 2024.The prototype is due for testing in early 2024 but receipt of certification may follow the formal project close.

What are our next steps?

Towards the end of the project the main focus will be the assembly of the micro-factory site in Hartlebury, Worcestershire. The software will be ready to integrate with the MES system and assembly line processes once the micro-factory is built.

On the technical side, further refinement of the PCM will be needed to ensure it is at the specifications required for the final product. This can then be combined with the supply chain analysis to have production ready for spring 2024 in line with the project plan.