HEAT PUMP READY | Department for Energy Security & Net Zero

Part of the Net Zero Innovation Portfolio

MESH
Making Efficient Systems around Heat pumps

CARBON TRUST

Project Lead: Mixergy Ltd

Partners: Centrica PLC, Vaillant Group UK Ltd

Funding:

£455,215

mixergy Vaillant centrica

The problem: How can heat pump costs be reduced?

The high capital cost of heat pump systems due to the multiple components required, such as the tank, pipework and other ancillaries, along with the internal space required for them, are all seen as barriers to heat pump uptake.

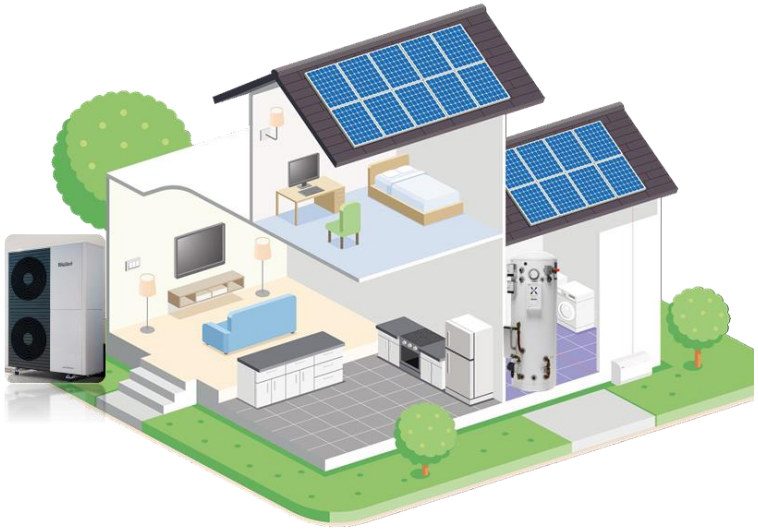
The solution

By bringing together a range of disciplines which are historically separate and reside within different businesses, and by exploiting a technique referred to as Aggregated Thermal Inertia, the central heating buffer vessel and hot water cylinder can be consolidated into a single tank, the heat pump size reduced and the system performance improved.

Project MESH is bringing together novel system design and integration, high temperature heat pumps, sensing technology, software, and intelligent thermal storage solutions across multiple business disciplines to deliver a streamlined and efficient heat pump system. This will result in reduced hardware and installation costs, improved operational coefficient of performance (COP), reduced pressure on available labour resources, and will deliver high value aftermarket service and control solutions.

> We are really excited to be taking part in Heat Pump Ready to develop the next generation of heat pump technology. By working with Vaillant and Centrica, Mixergy will develop a novel approach to reduce both OPEX and CAPEX of heat pump systems, which will accelerate the deployment of heat pump systems and help transitioning to a net zero economy.

Ren Kang
Head of R&D, Mixergy Ltd



Reducing heat pump costs while increasing system efficiency

What are we going to do?

To address problems of high heat pump hardware costs and poor system performance resulting from sub-optimally integrated component systems, the project will apply a system design and control technique referred to as Aggregated Thermal Inertia (ATI).

This is a combination of software innovation and system design which maximises the utilisation of available thermal inertia across the central heating circuits, building fabric and hot water tank, minimising short cycle efficiency penalties within the heat pump whilst eliminating ancillary components such as buffer vessels.

Why is this an improvement on current solutions?

The project aims to reduce lifetime costs, with a capex reduction of more than 20% through optimised component sizing and a further 10% saving through integration of ancillary components, yielding a total target saving of 30%, accompanied by an uplift in operational COP of up to 20% throughout the year.

By optimizing and simplifying the design and installation processes, the project will also alleviate the increased pressure on labour resources which is expected as the number of heat pump installations increase.

What would success look like?

Elimination of most ancillary components associated with the installation of a heat pump system, the ability to specify a smaller heat pump, and providing uplift of COP.

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

The core objective of project MESH is to eliminate all the ancillary vessels around the tank to preserve internal dwelling space, whilst at the same time improving the economics through greater operational efficiency.

This overcomes two common barriers to heat pump adoption, of poor space availability and concerns about running cost, assisting in improving the 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. 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.

Contact information

Name: Ren Kang

Email: ren.kang@mixergy.co.uk

www.heatpumpready.org.uk

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Project Progress (Autumn 2023)

Key Findings

- There is no standard approach or code for developing a way to control heat pumps; each manufacturer has their own communication protocol. Therefore, Mixergy needs to devise a project or commercial opportunity to incentivise heat pump manufacturers to share their protocol.
- The heat pump proposition for the new build and retrofit markets are different. The new build market is easier to achieve scale, if supported by regulation.
- New housing developers are interested in the space saving that the ATI offers and are increasingly looking to develop a coherent control system for hot water and space heating for new homes.
- Initial engaging with BRE to gain a sense of potential SAP endorsement for the ATI system has revealed they are interested in recognising the tariff arbitrage element in the future home standard.

What progress have we made so far?

A prototype Aggregated Thermal Inertia (ATI) cylinder tank for hot water has been manufactured and tested using numerical simulation vs results from the test rig. Ten tanks have now been manufactured for field trials.

A test facility including a climate control chamber has been built to allow hardware in the loop (HIL) testing for the ATI system operating along with the heat pump.

Mixergy has obtained 20 plots (10 with an ATI system and 10 with a conventional heat pump system) for winter season trials.

A Centrica retrofit trial is also underway with microbore pipes to see if a heat pump can work with a conventional cylinder, or if ATI performs better.

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

Securing a sufficient number of competent heat pump installers to commission the heat pump system turned out to be a challenge. Mixergy has had to resort to internal resource/personnel to commission the system instead.

What are our next steps?

- Monitor the performance of the ATI system at trial sites to validate/verify the performance claim.
- Seek regulatory endorsement for the ATI system