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Decarbonising heat with heat batteries

Case Study

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Summary

To meet the net zero carbon emissions by 2050, it is essential for housing providers to reduce the emissions of the homes they manage. Instead of relying on natural gas boilers homes can use all electric heat batteries as a way of heating their home.

This case study examines heat battery technology within retrofit the current barriers drawing on sector insights to highlight the values of heat batteries, demonstrating the importance of developing skills to build a more effective retrofit industry.

Introduction

In this RISE podcast Clare Brown is joined by Iain Duncan, Business Development Director at Tepeo, to discuss the role heat batteries can play in decarbonising housing stock at scale. The conversation introduces heat battery technology in a clear, accessible way, outlining how it works and why it is gaining attention as a low-carbon heating option for retrofit programmes. With a focus on the realities faced by housing providers, the episode explores where heat batteries may offer advantages over heat pumps, particularly across dense, space-constrained, or electrically limited homes.

Who are Tepeo

Tepeo are a certified B Corp British green technology company, with the mission to decarbonise home heat. Committed to making low carbon heating available to all. With a team of skilled engineers who have developed innovative heat battery boilers powered by smart electricity, that deliver comfort and reliability of traditional central heating whilst eliminating the need for gas. Aiming to make the transition to cleaner home heating practical and accessible.

What is a heat battery

A heat battery is an electric heating system that stores thermal energy for later use. It can be charged using electricity from on-site renewable generation, such as solar panels, or from the electricity grid. The electrical energy is converted into heat and stored within the unit, allowing it to provide space heating and/or hot water when needed. Unlike a conventional home battery, which stores electricity, a heat battery stores thermal energy, making it a form of energy storage specifically designed for heating applications.

Two models of heat batteries

- **Phase change material** – Stores heat by changing from a solid to a liquid state, rather than just getting warmer. This allows significant amount of energy to be stored in a small space, making it compact and cost – effective thermal storage solution.

> *"Phase change materials basically melt and, as they get hot, that melting process stores lots of energy without increasing the temperature."*

- **Sensible heat storage –** Energy is stored by raising the temperature of a dense storage material, such as ceramic, brick or stone. Electricity is converted into heat through heating elements, which transfer thermal energy to the storage medium. The material retains this heat and releases it when required for space heating or hot water.

> *"We take direct electrical input into heating elements that get hot, transfer that heat into a thermal store, and we are storing that energy as heat."*

Benefits

There are several advantages for retrofit projects. The benefits of heat batteries make them a potential solution for retrofit projects, supporting organisations in delivering more energy efficient low carbon homes.

- Reduce carbon emissions through electrifying the heating.
- Improved the use of renewable electricity through storing energy when supply is plentiful.
- Lower running costs.
- Practical solutions for homes where installing heat pumps may be difficult.
- Decrease demand on electricity during peak periods.

Challenges

Even with all the advantages, heat batteries also present challenges:

- Higher upfront installation costs.
- Limited awareness of the technology.
- Installers require specialists training to ensure the systems are installed correctly.

As retrofit evolves, training guidance and knowledge sharing is essential to help professionals understand and implement new heating technologies.

The Tepeo zero emission boiler (ZEB)

The Tepeo ZEB was designed to replace the traditional gas boiler, a floor standing system that charges using off peak electricity, and stores energy in a high-density ceramic core, then will release the heat into the home when needed.

"Instead of combusting a fuel like you would in a gas boiler, we're heating up a thermal store and transferring that heat into a water circuit."

Advantages

- Bypasses peak rates
- Adjusts in real time
- Compatible with existing radiators
- Zero direct emissions
- No combustion

Why was the ZEB developed

Tepoe highlights several challenges in eliminating fossil fuels and reaching net zero carbon emissions

- **Grid flexibility** – As renewable electricity enters the grid, energy demand will need to be more flexible.

> *"We wanted to build a product that provided that flexibility to the power system."*

Housing constraints are also an important consideration of heat battery installation such as:

- Historic buildings
- Conservation areas
- Limited outdoor space.

The ZEB works with the homes existing heating infrastructure and would not need to make any changes to the home.

Heat battery awareness

Despite technical progress Ian identifies that awareness is still one of the main barriers.

> *"Most people have never heard of a heat battery"*

Policy support is mainly focused on heat pumps, however the support for heat batteries through funding schemes and industry standards. Demonstrating the importance of knowledge sharing in order to promote more awareness around heat batteries. A recurring theme throughout is that no single technology will resolve every heating challenge. Highlighting that heat pumps remain an important part of the transition. However, some properties may benefit from alternative heating solutions this is dependant on what would work best for each property.

Looking ahead

The next five years may mark turning point for heat battery adoption across the UK, as awareness, policy support and industry capability continue to grow. Developments are expected to help accelerate uptake, including:

- Stronger government policy and funding support
- The introduction of dedicated MCS standards for thermal energy storage systems
- Increased engagement from local authorities
- More retrofit projects within the social housing sector
- Wider access to installer training and accreditation

Looking ahead, Ian is particularly keen to see heat battery technology play a greater role in improving the UK's older and harder-to-treat housing stock.

> *"I'd love to see more collaboration with local authorities and social housing providers. These homes are often the most challenging to decarbonise, and heat batteries have the potential to help bring a neglected part of the UK housing stock into the net zero transition."*

Resources

Referenced Resources:

Decarbonising heat with heat batteries RISE Podcast

Tepeo