Preparing existing non-domestic buildings for the energy transition

Ryan Kirkwood, Heat Pump Business Development Manager at Baxi, discusses the importance of real data and best practice design to prepare existing building stock for low carbon heating

Back in 2010, the term ‘eco-bling’ sprang into the spotlight when Doug King, Visiting Professor of Building Engineering at the University of Bath, used it to describe “unnecessary renewable energy visibly attached to the outside of poorly designed buildings.”

He argued that simply adding renewable technologies to a building that is poorly designed and energy hungry is unlikely to make it less carbon intensive. A more effective approach, in his view, would be to start by analysing how and where the building uses energy and then design ways to improve its efficiency.

A decade later, his reasoning still resonates. Take Air Source Heat Pumps (ASHPs). Along with heat networks and hydrogen, ASHPs have an important role to play in the energy transition. But spending the entire budget on a heat pump to decarbonise an older, draughty non-domestic building without any other preparation will not necessarily guarantee success.

As heating professionals are only too aware, a poorly performing heat pump will result in high running costs, an inadequately heated building, and unreliable heating and hot water.

So how to avoid this and ensure that customers achieve best value performance for budget from a heating system refurbishment?

Setting pathways

First, it’s important to recognise that on every refurbishment project, there will be a number of constraints, such as time, budget, available power and physical space, to name but a few.

As most existing buildings will need a series of adaptations to make them heat-pump ready, it’s therefore advisable to encourage customers to identify their immediate, medium and long-term goals at the outset.

Putting a clear roadmap in place – identifying the overarching goals, the available time to complete the work, the budget and any funding opportunities – will make it possible to plan out and design the various stages of work.

Energy efficiency is absolutely critical to reducing emissions and should always be the initial consideration when addressing existing buildings. Passive measures such as roof and wall insulation, draught proofing and improving the thermal performance of windows and doors should be budgeted for first to reduce energy losses and energy usage.

Understanding the building profile

Next, understand the building profile. As King outlined, this is fundamental to ensure optimal solutions for each individual building.

There are a number of ways to go about gathering data. Desktop studies – which might include combing through utility bills or interrogating the Building Management System – are a good starting place.

But there is no substitute for measuring real flow rates in different places and conditions, over a given time. This can be extended to include comparing sample heat loss calculations against the sizing of current heat emitters. Similarly, with Domestic Hot Water (DHW) requirements, compare storage volume against peak usage.

Using the data

With this real data in place, a picture begins to emerge of how the building operates that should enable us to understand:

- the peaks in heating and DHW usage
- how this compares to the current plant sizing
- whether the heat emitters are correctly sized for the rooms.

This information can then be weighed up against the project constraints. For example, let's consider a building with marginal amount of spare electrical capacity and with an assumed high DHW load and low heating load.

If the building's DHW profile shows that the peaks are easily satisfied with the stored volume, it's reasonable to assume that recovery periods can be stretched. So one possible option may be for a small heat pump to be utilised in DHW generation.

When it comes to heating, the transition from a high temperature heating system to a low temperature heating system will be heavily dependent on the data. Options should not be identified without this – a nontrivial problem given the all-too-familiar unknowns in existing buildings.

Depending on the building profile, one option might to bracket the space heating system. Take modular Air Handling Units (AHUs), for example, which are generally served by a separate CT circuit and with coils that are relatively easy to swap from high to low temperature (access problems aside).

In many non-domestic buildings, the AHU load can account for a significant proportion of the heating load, greater than other circuits. So utilising heat pumps to decarbonise a large chunk of the heating demand, is a positive step to improved sustainability in a phased approach.

Ultimately, the goal is to transition to low carbon heating technology such as heat pumps. Reflecting this, government funding is mostly limited to full electrification of heat – helping scale up the heat pump market and meet its ambitious target of 600,000 units a year by 2028.

However, in hard to heat buildings, where project and budget constraints currently rule out an all-electric approach as a feasible option, an alternative might be to consider multivalent methods of heat and hot water generation. A multivalent approach cannot be overlooked as a first step in the heat decarbonisation process, especially when backed up by supporting data.

Balancing act

We know that while many organisations appreciate the long-term sustainability benefits of moving to low carbon heat, they are understandably concerned about the immediate cost impact of funding the transition. This has been intensified by the need to protect their businesses from rocketing energy costs.

The heating sector will be instrumental in providing guidance and support. Working together, we should encourage organisations to understand how and where their building is using energy. A key priority should be to maximise energy efficiency. The cleanest and cheapest kWh is, after all, the one we don’t use.

We can also help them to identify their own achievable path to decarbonisation. While electrifying heat where possible should be always be the aim, this must not lead to solid design practice being replaced with ‘eco-bling’.

Instead, where full decarbonisation is not currently an option, as identified by real data, multivalent solutions can have a valuable part to play in a phased approach.

There may be no silver bullet solution for decarbonisation, but there is an established best practice approach. By using real data to plot and design the best roadmap, we can protect organisations from poor performance and set them and their buildings on the path to net zero.

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