



What impact can heat pumps have in domestic heating today, and how might that change over time as technology improves?

Meeting note from roundtable chaired by Paul Monks, Chief Scientific Adviser, Department for Energy Security and Net Zero

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Key points

- Heat pumps are a viable mature technology that have been successfully used for decades around the world, particularly in Asia.
- There are some evidence gaps on the journey to widescale heat pump rollout, and they are socio-technical in nature.
- Perceived complexities and unfamiliarity with these systems are putting off potential switchers.
- There is a high demand for skills in this sector. Currently the design and install of heat pumps systems are complicated, context specific and often done wrongly. Solutions like certification, licensing or mandatory training could help with this.
- There is a tension between retrofitting homes with easy to “drop in” gas boiler replacement systems versus reimagining the entire home heating system for maximum efficiency. The former is easier for manufacturers, while the latter is more energy efficient.
- Heat pumps are a huge opportunity to save people money and give people better heated homes, but there is an evidence gap around smaller homes, such as flats, and how they may be served by smaller air source heat pumps.
- If there is widescale adoption of heat pumps, this will change current electricity demand patterns. Using energy more flexibly (i.e. incorporating batteries) may change the current concept of baseload.

1. Current state of technology

1.1 Market diffusion and consumer confidence:

- Currently heat pumps are mostly being installed to early adopters, around 35,000 a year. To reach the government target of installing 600,000 per year by 2028, a more mass-market approach will be needed.
- We need to have trusted voices and narratives. Public engagement is key but there isn’t much evidence on how to improve public trust, or on how to support consumers make these choices.
- The public have a low level of understanding of heat pumps and related systems. This means consumers are more susceptible to how stories are framed.
- Currently consumers perceive heat pump systems as “more complicated” than gas boiler systems, perhaps due to their unfamiliarity with the individual components, system design and operation.
- Something like a What Works Centre could assist with this, similar to the National Retrofit Hub which is currently being established.

1.2 Skills:



- There is a large demand for skills in the sector. There are currently not enough system designers, installers or maintainers.
- Designing and installing a heat pump system is complicated and difficult. There have been cases where some installers have done a poor job, which harms the reputation of the technology. This is often due to a lack of training or experience in system design.
- Lessons could be learned from gas. Solutions like the Gas Safe Register make it easier to find a trusted professional. Certification, licensing and mandatory training could help raise skills standards and availability of professionals.
- There is currently a focus on heat pump installation skills, which has partly led to a lack of maintenance skills. Once a system is installed, it can be difficult for consumers to find maintenance professionals.

1.3 Costs:

- New heat pump systems come with high install costs, which is off-putting for consumers. Government grants help with this but have been intermittent and have not covered the full cost of the system.
- It was mentioned that high running costs were a factor which some customers found off putting. While running costs for heat pumps are typically lower when compared to those of traditional gas boilers, if a system is installed which runs at lower efficiencies this will increase running costs.
- In the UK the cost of electricity is pegged to the price of natural gas. This increases the running costs of heat pump systems to be closer to those of gas boiler systems even though they only run on electricity.
- Incentives don't always match up. For example, what is best for housing developers is a system with the cheapest installation costs. This isn't necessarily better for those who then move into those homes, who would prioritise system running costs and higher efficiency.

1.4 Physical and technical hurdles:

- The electricity distribution system currently assumes a diverse load across the grid, but heat pumps and some other green technologies such as EVs are not compatible with that. In these cases, there is a higher consistent demand, which is different from how the grid system currently operates with "peaks" of usage.
- External noise is another hurdle. This can be an issue in positioning of heat pumps, and in getting planning permissions. There is also an understanding gap on how noise should be measured.

1.5 Hot water:

- While the higher temperature of gas boilers means they are equally suited to providing space heating or hot water, the lower temperature of heat pumps is not best suited for hot water provision.
- To provide hot water, heat pumps require a water storage cylinder, similar to older generations of gas boiler systems. New combi gas boilers do not require these cylinders, so approximately 50% of the UK housing stock lack water storage cylinders now. Further, smaller homes and flats lack the spare storage space to install cylinders. As the energy efficiency of homes continues to improve, they require less space heating. This puts a larger emphasis on heating water instead.



2. Future impacts of heat pumps

2.1 Maturity:

- Heat pumps are a mature technology and have been popular in Asia for decades as part of air conditioning systems.
- UK low carbon heating is a new context for the technology. The efficiency of heat pumps is unlikely to improve significantly in the near future. They have already seen a lot of improvements over the decades in Asia and we are now seeing diminishing returns.

2.2 Market segmentation:

- Heat pump manufacturers achieve profitability by simplifying home heating systems. This typically results in segmenting the market and creating plug and play solutions at scale for different use cases or types of homes.
- Currently one of the most profitable things for manufacturers to produce is a direct “drop in” replacement for a gas boiler, as these systems are easier to install.
- There is a tension between retrofitting homes with easy to “drop in” gas boiler replacement systems versus reimagining the entire system for maximum efficiency. The former may be easier but isn't necessarily the most efficient system for a home.

2.3 Controls:

- There is a growing trend of using 3rd party controls for domestic heating systems. This is wider than just heat pumps and includes gas boilers too.
- There can be a high degree of complexity in controllers for domestic consumers, but there may be risks with giving consumers too much control over systems they may not fully understand. This may impact efficiency or effectiveness, and lead to significant consumer frustration.
- Electricity supply will be more variable in the future, related to pricing and grid demand. There will be a need for better heat pump control logic and integration with smart meters to take this into account.

2.4 Perception:

- There needs to be a major change in public perception on what a successful domestic heating system looks like. For example, point to point internal heat recovery, air to air heat recovery, heat exchangers wrapped round. A system incorporating any of these elements will look very different to what most people are currently used to, however all increase efficiency.
- Installation of heat pumps and related technologies in public sector buildings could help to build trust, confidence, and familiarity.

3. Current and future impact: Evidence gaps

- Regarding hot water tanks used in heat pump systems, legionella protection is potentially a gap. This extends to levels of risk and pasteurisation protocols.
- There is an understanding gap on how noise should be measured, especially around where heat pumps are installed and what readings should be considered during planning applications.
- There is an evidence gap around heat pump usage in smaller homes such as flats, and how they may be served by potentially smaller air source heat pumps.



- There must be more trusted voices and positive narratives regarding heat pumps to reach consumers and improve trust. Public engagement is key but there isn't much evidence on how to support consumer choice.

Participants

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