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Short communication

Raising the temperature of the UK heat pump market: Learning lessons from Finland

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HIGHLIGHTS

- Heat pumps are expected to play a key role in meeting the UK's 4th carbon budget.
- Today, heat pump deployment per capita in the UK is one of the lowest in Europe.
- Finland offers some policy lessons given its high level of heat pump deployment.
- Policies: raising build rates, building standards and heat pump cost-effectiveness.
- Deployment efforts should focus on buildings not heated by relatively low-cost gas.

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ABSTRACT

Heat pumps play a central role in decarbonising the UK's buildings sector as part of the Committee on Climate Change's (CCC) updated abatement scenario for meeting the UK's fourth carbon budget. However, the UK has one of the least developed heat pump markets in Europe and renewable heat output from heat pumps will need to increase by a factor of 50 over the next 15 years to be in line with the scenario. Therefore, this paper explores what lessons the UK might learn from Finland to achieve this aim considering that its current level of heat pump penetration is comparable with that outlined in the CCC scenario for 2030. Despite the two countries' characteristic differences we argue they share sufficient similarities for the UK to usefully draw some policy-based lessons from Finland including: stimulating new-build construction and renovation of existing stock; incorporating renewable heat solutions in building energy performance standards; and bringing the cost of heat pumps in-line with gas fired heating via a combination of subsidies, taxes and energy RD&D. Finally, preliminary efforts to grow the heat pump market could usefully focus on properties unconnected to the gas-grid, considering these are typically heated by relatively expensive oil or electric heating technologies.

1. Introduction

The UK has committed to reduce its greenhouse gas emissions (GHGs) by 80%, relative to 1990 levels by 2050 (CCC, 2015). To ensure it makes regular progress towards meeting this long-term target the Committee on Climate Change (CCC)[1] was established to set five-yearly carbon budgets. The fourth carbon budget (2023–27) was ratified in 2014 and this process led to an updated 2030 abatement scenario that outlined how an emissions reduction of 63% by 2030 on 1990 levels could be achieved (CCC, 2013b).

Decarbonisation of heat sits at the centre of the fourth carbon budget considering that in 2012 direct emissions[2] from heat consumption in buildings accounted for approximately 12% of total UK GHGs, (CCC, 2013c). These emissions are expected to reduce by 38% compared to 1990 levels under the 4th carbon budget and fall from 91 $MTCO_2e$ in 2012 to 64 $MTCO_2e$ by 2030 (CCC, 2013c). Achieving this target will require a radical transformation of the UK's heat

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[1] The Committee on Climate Change (the CCC) is an independent, statutory body established under the Climate Change Act 2008 whose purpose is to advise the UK Government and Devolved Administrations on emissions targets and report to Parliament on the progress made towards reducing greenhouse gas emissions and preparing for climate change.

[2] Direct GHG emissions are from sources owned or controlled by the reporting entity. In buildings this relates to space heating, cooking, hot water etc.

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sector considering the inefficiency of its building stock and the prevalence of gas fired heating (Eyre and Baruah, 2015).

The wide-scale deployment of heat pumps[3] is central to decarbonising heat under the CCC scenario, despite accounting for only a tiny fraction of the UK's current building heat supply at present (approx. 0.2%). In contrast, some European countries have enjoyed wide-scale heat pump deployment over the last 10 years (Nowak et al., 2014). Finland represents one such market leader where levels of heat pump penetration are comparable with that envisaged under the CCC's scenario for 2030. Consequently, this paper examines two questions: (1) what level of UK heat pump deployment is outlined between now and 2030 under the CCC scenario; and (2) what lessons can the UK learn from Finland to help realise this level of deployment?

2. Methodology

To address the first question three datasets were examined to identify the size of the UK heat pump market (DECC, 2014b, 2014c; Nowak et al., 2014). These were compared against current deployment levels in Finland (Statistics Finland, 2013c) and those outlined in the CCC's 2030 UK scenario (CCC, 2013a, 2013c). To address the second question academic, government and industry literature was examined to identify the factors responsible for driving growth within the Finnish heat pump market. Statistical evidence from national databases and energy sector reports was subsequently used to scrutinise whether or not lessons could be helpfully transferred to the UK. The authors are conducting original empirical work to test the robustness of these drivers and their applicability to the UK. Results will be presented in a full-length academic paper.

[3] A heat pump is defined as 'a machine, a device or installation that transfers heat from natural surroundings such as air, water or ground to buildings or industrial applications by reversing the natural flow of heat such that it flows from a lower to a higher temperature. For reversible heat pumps, it may also move heat from the building to the natural surroundings' (EU, 2010 p.19).

3. Results

3.1. An overview of UK heat sector and heat pump market

In 2013 the UK's domestic and service sector heat demand stood at 598TWh (DECC, 2014b), with the majority of this being satisfied by gas fired boilers (77%) and the rest by electricity (12%), oil (7%), bioenergy and waste (2%), solid fuel (1%) and district heating (1%) (DECC, 2014a). Heat pumps accounted for only 0.2% of the total domestic and service sector heat consumption[4] (DECC, 2014a), with 104,000 heat pumps (Nowak et al., 2014) generating 1TWh of primary energy[5] (DECC, 2014c) (Fig. 1).[6]

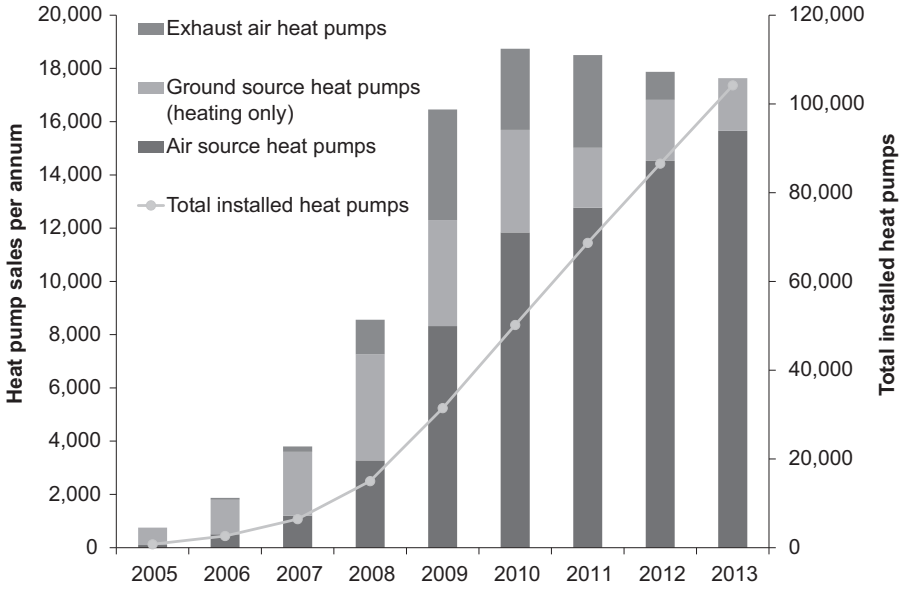

Fig. 1. UK heat pumps sales per annum and total operational devices (Nowak et al., 2014).

3.2. UK heat sector under the 2030 CCC scenario

Heat pumps play a central role in decarbonising the UK's heat sector under the CCC scenario, delivering a 14 $MtCO_2e$ reduction in emissions by 2030 on 2012 levels (CCC, 2013c). Four million domestic heat pumps across 13% of homes provide 31 TWh of primary energy production in the residential sector. A further 20 TWh generated from approximately 600,000 heat pumps in non-domestic buildings, accounting for around 30% of non-residential heat demand (CCC, 2013c; Verco, 2014). Together these 4.6 million heat pumps produce 51 TWh of renewable heat by 2030, accounting for approximately 12% of the UK's 435 TWh building sector heat consumption in 2030.[7]

Between 2010 and 2013 UK heat pump sales per annum averaged 18,000 units (Nowak et al., 2014). Were this pattern to continue between 2013 and 2030 the UK would see only 400,000

[4] It is unclear from the statistics whether this includes industrial heat pumps.

[5] This excludes their electricity input.

[6] EHPA data available only from 2005, thus excluding heat pumps installed before this date. Figure 1 assumes that all devices sold since 2005 are still in operation today. Air source category contains a small number of sanitary hot water only devices. Exhaust HPs includes both air to water and other varieties.

[7] The consumption value taken from in-house CCC calculations undertaken for the revised 4th Carbon Budget reports. Demand is lower than today primarily due efficiency improvements in the building stock (CCC, 2013d).