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Public acceptability of the use of hydrogen for heating and cooking in the home

Results from qualitative and quantitative research in UK

EXECUTIVE SUMMARY

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Executive summary

This report presents findings of a combined qualitative and quantitative research study that aimed to assess the public acceptability of two alternative low-carbon technologies for heating the home: hydrogen heating and heat pumps. These technologies could potentially replace natural gas in many UK households as part of the government's efforts to decrease carbon emissions in the UK. Commissioned by the Committee on Climate Change, the research was designed and conducted by Madano, in collaboration with Element Energy, a specialist energy consultancy, focusing on the low-carbon economy.

The next section provides a summary of the project, including an overview of the rationale for the research, the methodology and research findings.

Research rationale

Background, objectives and aims of the research

In order to meet legally-binding targets set by Parliament under the 2008 Climate Change Act, emissions from heating and cooking in homes need to be reduced by 20% by 2030. Heating and cooking need to be almost completely decarbonised by 2050¹. This will require a combination of improved energy efficiency and a large-scale shift from natural gas boilers to a low-carbon heating technology. This study looks at two of the main alternative options to replace natural gas: electrification through the use of highly efficient heat pumps, or potentially by switching the gas supply over to hydrogen.

There is already an existing body of research on the acceptability for heat pumps. Research was therefore required to understand household preferences and to assess public acceptability of the use of hydrogen heating in homes, relative to that of heat pumps. Specifically, this research looked to understand key barriers to acceptability, so that recommendations could be made as to how these could be overcome.

This research is a first step to understanding the challenges around public acceptability to alternatives to natural gas heating in general, and to hydrogen heating and heat pumps in particular. Findings from the research will support the Committee on Climate Change in making further recommendations about the use of these two alternative heating technologies and enable them to inform how government might begin to establish a programme of research on hydrogen.

Research approach

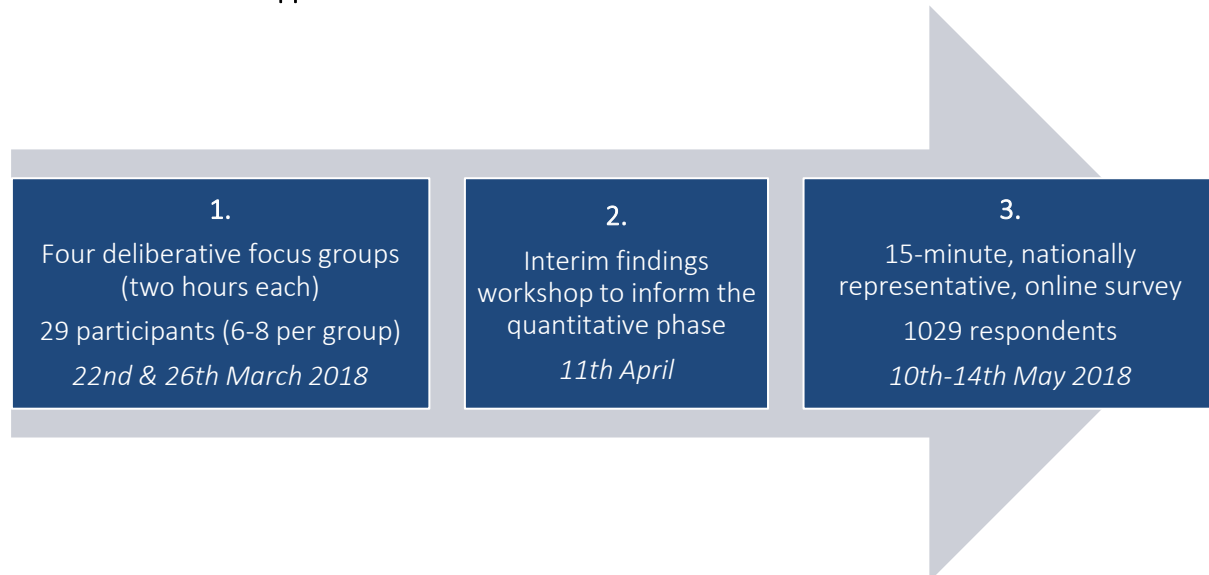
Method and sample

The research involved discussion of a complex and technical subject matter with members of the public, whose knowledge and awareness of the heating technologies was likely to be low. A socio-technical approach was therefore adopted in order to ensure clear, accurate articulation of the heating technologies alongside best practice social research techniques and expertise in order to understand and interpret human reactions to new material.

1. ¹ Committee on Climate Change. 2018. *Next Steps for UK Heat Policy*. [ONLINE] Available at: <https://www.theccc.org.uk/publication/next-steps-for-uk-heat-policy/>. [Accessed 3 August 2018].

The approach also sequenced qualitative and quantitative data collection. The qualitative phase allowed understanding of the broad range of attitudes to different aspects of the technologies. It also acted as a medium to gauge the public's ability to understand implications of the heating technologies based on receiving a small amount of information. Results from this phase then informed the design of the method, questions and research materials used to describe heating technologies in the quantitative phase, which looked to measure the prevalence of these attitudes.

Overview of research approach



Both the qualitative and quantitative samples were designed to be as nationally representative as possible, in order to capture a range of opinions from people with a diversity of backgrounds in the qualitative phase and be proportionally representative in the survey sample. Three primary sample criteria defined the split of focus groups and survey quotas: housing tenure, level of education and location. These were chosen as they were perceived to be key characteristics likely to influence overall views on the switchover from natural gas and associated heating technologies.

Key findings

Overall understanding of the need to reduce carbon emissions and the role of heating technologies

Carbon emissions reduction is viewed as an important issue, but there is limited awareness of the need to decarbonise household heating or the implications of switching over to low-carbon heating technologies.

The majority of the public are concerned about climate change and feel it is important for actions to be taken to mitigate against it. This research suggests that the public would be open to switching from natural gas to alternative low-carbon heating technologies in their homes, in order to help reduce carbon emissions and mitigate against climate change.

However, awareness amongst the public of the need for switchover is low, and knowledge of hydrogen heating and heat pumps even lower. Just over half (51%) of survey respondents had never heard of hydrogen fuel boilers, with 42% stating they had never heard of either ground source or air source heat pumps. Even once respondents receive further information about each heating technology as part of the focus groups or survey, understanding of both heat pumps and hydrogen heating remained low. At the end of the survey, less than half of respondents reported that they understood the impact and workings of the heating technologies.

There are therefore significant communications and educational challenges to overcome in order for the public to support the switchover from natural gas, especially in terms of how they would work in practice for households.

Public acceptability towards hydrogen heating and heat pumps

Acceptability of both heating technologies is limited by a lack of perceived tangible consumer benefit, which has the potential to drive scepticism towards the switchover more generally.

Both heat pumps and hydrogen heating are perceived to offer no, or limited, additional consumer benefits when compared to current natural gas heating systems. Additionally, there are significant concerns about the effort and costs that will be required by the public to install and use the new heating technology. This magnifies the need to be clear about the consumer benefits of these technologies; without this clarity it will be difficult to encourage willingness and motivation for the switchover based purely on the more abstract environmental benefits.

In the absence of clear consumer benefits, preferences towards the heating technologies tended to be driven by which had the fewest perceived drawbacks. People typically preferred the least-worst option rather than drawing on any positive factors attached to a given heating technology. However, the potential utility for heat pumps to cool homes, as well as heat them, was seen as advantageous and had some positive impact on preferences vs. hydrogen heating.

Therefore, whilst the need to reduce carbon emissions in the UK and switch to alternative low-carbon heating technologies was felt to be important amongst the majority of the respondents, the acceptability of currently available options was tempered once they learned more about the limited improvements to their lived experience in their home and the burdensome installation process.

Overall heating technology preferences

Results show that heating technology preferences are not fixed at this stage, although heat pumps appear to be the favoured option in this research study

Once provided with detailed information about the installation and lived experience of both technologies, heat pumps were the preferred heating technology amongst survey respondents. When forced to make a selection of their preferred heating technology at the end of the survey, 63% selected heat pumps and 37% chose hydrogen heating. The main reason for this was the perceived installation burden associated with hydrogen heating. However, until the end of the survey, a large minority of respondents had no preference towards either heating technology.

Ultimately, however, the research suggests that preferences are heavily influenced by how the information on alternative heating technologies is communicated. Knowledge of low-carbon energy alternatives is low and public opinion is certainly not fixed. Even within this study, changes made to explanatory materials between each phase and methodological differences appears to have had an impact on heating technology preferences.

Factors influencing heating technology preferences

Three overarching factors were identified as influencing preferences for heating technologies (described in the table below). These factors manifested differently for different people, meaning that the same factor

could lead one person to prefer heat pumps and another to prefer hydrogen depending on their overall heating preferences and understanding of the two technologies.

Explanation of factors influencing heating technology preferences

Factors influencing heating technology preferences	How this factor impacted on heating technology preference
<p>Perceptions of negative installation burden:</p> <p>The direct implications of the processes of installation for households were a key barrier to acceptance.</p>	<p>Multiple aspects of the installation were seen as burdensome for both heating technologies. The main barrier to acceptability of hydrogen heating was the one to two weeks that households would have to be disconnected from the gas supply during installation. This was seen as the most unreasonable of a number of aspects of the installation of either heating technologies.</p> <p>Other factors that felt burdensome as part of the installation process were the significant amount of new appliances required for both heat pump and hydrogen heating installation. For example, depending on the heating technology, the need to replace or get rid of all gas appliances, as well as requiring new types of appliance in order for the heating systems to work.</p>
<p>Familiarity of the lived experience of using the technologies in home, once installed:</p> <p>Unfamiliar aspects of the heating technologies created uncertainty for the public and required them to consider how they would adopt new heating behaviours and habits.</p>	<p>The difficulty envisaging how heat pumps would work in the home caused great uncertainty. Hydrogen heating, on the other hand, was seen to be a more like-for-like replacement of the current natural gas system and therefore easier to grasp.</p> <p>This unfamiliarity as to exactly how heat pumps would heat the home, whether this would meet their needs and how it would be maintained, generated lots of questions and concern, ultimately acting as a barrier towards public acceptability of heat pumps.</p>
<p>Perceptions of how well technologies would meet modern heating needs:</p> <p>Heat pumps and hydrogen heating were judged by the extent to which they are seen to offer comfort and convenience, as well as their ability to align with the trajectory of a smarter home – that is technologies that are quieter, faster and concealed.</p>	<p>Hydrogen heating was seen as progress to a more modern version of natural gas; views as to whether heat pumps represented a step forward were less clear. The cooling utility of heat pumps meant that this added consumer benefit, which helped the heating technology to be perceived as modern and innovative to an extent. However, the implications associated with certain appliances that are part of the heat pump system took away from this perception, in particular the space needed for the storage tank and the lower responsiveness of the system, which led to the impression that heat pumps were outdated and inconvenient compared to hydrogen and natural gas heating systems.</p>

The findings of this research suggest that those who concentrate on the immediate, short-term burdens of the installation will typically prefer heat pumps. This preference for heat pumps was more prominent in the survey results, potentially due to the shorter time frame in which survey participants had to reflect on all of the elements of the technologies and their installation and consider what it might be like to live with them. Alternatively, others were willing to overcome the short-term installation burden of hydrogen for what they perceived as a more familiar, modern and convenient technology. This perspective was more prominent when focus group participants had longer to reflect on the implications, often opting for what they viewed as beneficial in the longer term.

Remaining challenges to public acceptability

Both hydrogen heating and heat pumps face significant challenges to secure public acceptability.

This research does not provide a definitive conclusion about public preferences for either hydrogen heating or heat pumps. While heat pumps were ultimately preferred in the quantitative survey, it is clear that knowledge of the two technologies remains low and preferences are not fixed or embedded.

This research does allow strong conclusions to be drawn around the specific factors that drive public acceptability of alternatives to natural gas. The way in which different aspects of each heating technology are framed can influence views and ultimately swing opinion. Installation burden is of most immediate concern to the public, whilst longer-term concerns relating to system familiarity and meeting heating needs are also influential and require more considered thought.

Overall, while public acceptability of the need for the switchover is relatively high, in order for the public to accept the unavoidable burden of installation, challenges remain in explaining how heat pumps and hydrogen heating work in practice, how they contribute to reducing carbon emissions and most importantly what extra utility they provide the consumer.

Raising awareness of the need for a switchover to lower carbon heating technologies should therefore be a priority for government and industry, in order to establish a long lead-time prior to the switchover itself. This would allow educational challenges to be addressed, as well as providing the public with time to prepare for and come to terms with burdens and the benefits associated with the switchover.