Domestic Heat Decarbonisation Insight

Final report

PUBLICFIRST

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Acknowledgements

This report was prepared by Public First for the National Energy System Operator (NESO).

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Executive Summary

The United Kingdom has a binding national and international legal target to reach net zero by 2050. Domestic gas heating poses an important challenge to meeting these commitments, as it makes up 12% of the UK's carbon emissions. The government has targets for installing 600,000 heat pumps a year by 2028 and consulting on the role of hydrogen in heating in 2025.

In parallel, the National Energy System Operator (NESO) has a mandate to plan and operate our increasingly complex energy system in a way that considers the interactions across electricity, gas and other forms of energy. To do this effectively, NESO must understand the potential demand for electrification or hydrogen for heating and other options, as well as the impact of flexible operation.

Public awareness of low carbon heat solutions and the acceptability of these options has been well studied. However, very few studies ask consumers to directly choose between future low carbon heating options (for example, heat pumps, district heat networks or hydrogen boilers) in the absence of gas boilers.

This project delivers the first thorough analysis of how consumers in Great Britain trade off different attributes when looking to install a heating system. This data snapshot is vital to inform policy making, pathway modelling and network planning and will be reflected in future versions of NESO's Future Energy Scenarios. To do this we polled 9,758 nationally-representative GB residents and conducted eight focus groups with renters, homeowners, house-hunters and landlords.

These are the key findings:

Public concern about climate change is real but it is a second-tier issue. It is considered the fifth most urgent issue facing the country right now, after the cost of living, the quality of the NHS, the state of the economy and levels of immigration. 16% of Britons include the threat of climate change among their top three concerns. However, asked directly, 40% of GB adults believe it is one of the most pressing issues of our time, and 12% that it is the single most important issue.

Self-reported awareness of heating technologies and energy efficiency is low among GB households, particularly when it comes to low-carbon technologies. While gas boilers are nearly universally recognised — 95% of adults are familiar with the term, and only 3% have

never heard of it — fewer than 45% of GB adults feel informed about electric alternatives (excluding electric boilers). Awareness is especially low for heat pumps; over 40% of adults said they'd "never heard of this term before", and just 12% feel they "fully understand" how they work. This knowledge gap extends beyond specific technologies to include awareness of EPC ratings: 60% of GB adults do not know their property's EPC rating.

Upfront capital costs dominate the investment decisions made by households. For many households, financing a large, one-off purchase is a significant challenge. While most GB adults can manage smaller unexpected expenses between £500 and £1,000, the ability to absorb larger costs — such as £5,000 — is far less common. Even among higher-social grade households (AB social grade), nearly one-third (32%) would struggle to finance such expenses. Running costs also influence decision-making, but the size of the initial investment is the dominant factor. Households are more sensitive to increases in running costs when initial, capital costs are manageable.

Financial resilience and willingness to invest is more complex than household income. While high-income households are generally better positioned to absorb the upfront costs of heating systems, our research shows that tenure still significantly shapes their perception of affordability. Renters, when asked to consider what they would do if they owned their home, are both less financially resilient and less willing to invest, regardless of income. In fact, high-income renters (with household incomes above £60,000 a year) and low-income homeowners (with household incomes below £45,000 a year) display a **similar willingness** to invest in mid- to high-cost solutions. High-income homeowners (with household incomes above £100,000 a year), by contrast, show stronger readiness to act, combining financial capacity with high awareness of low-carbon options and a greater likelihood of planning proactive upgrades. Landlords also emerge as a key group, showcasing strong financial resilience and a steady inclination to invest in both their own properties and their rental units. Although they exercise a bit more caution when it comes to rental properties, their overall willingness to invest remains well above the national average at every cost point.

As well as cost considerations, the **perceived complexity and practical requirements of switching to low carbon heating currently create barriers to members of the public considering a switch**. For this reason low carbon alternatives were considered more appealing when they seemed familiar and simple: for example, electric boilers were more popular than their costs might otherwise predict. This finding may have material impacts on electricity demand if regulations to restrict fossil fuel heating precede widening awareness and familiarity with more efficient technologies.

When providing flexibility, regular, more subtle adjustments are favoured over larger, less frequent changes to home temperature. We also explored the willingness of households to engage with time-of-use tariffs for heating as a way to deliver cost savings on energy bills. The most popular option offered to the public involved "a subtle and likely unnoticeable reduction of up to 1.5°C for a maximum duration of 3 hours at a time, occurring most days throughout the winter season", this scored more favourably than a reduction of up to 3°C, even when this was only up to 20 days per year during the winter heating season.

Willingness to engage with time of use tariffs was not highly elastic based on the level of savings achieved. Acceptance peaked at 72% of those polled when they were offered £400 savings over a year but remained above 58% even at the lowest savings level offered: £40.

Methodology

About Public First

Public First is a global strategic consultancy that works to help organisations better understand public opinion, analyse economic trends, and craft new policy proposals.

Research questions

This research was designed to create an evidence base that would be used by NESO in several ways:

- To improve modelling of heat technology adoption and operation within Future Energy Scenarios and more widely
- For use by NESO to develop improved heat demand profiles for energy system modelling
- For use by NESO to develop reports and consider future areas of research

Quantitative research

Public First ran a nationally representative survey of 9,758 members of the GB public on 5th - 16th December 2024 for the National Energy System Operator (NESO). The sample aimed to be nationally representative on combined age and gender, region, and socio-economic grade. The results are weighted to ensure they are representative on these measures.

The survey was extensive and highly detailed.

Qualitative research

With the poll analysis complete, the research team conducted eight focus groups with the British public, speaking to landlords, renters, homeowners and homebuyers recruited on the following specification. These demographic groups were chosen to allow us to further investigate the impact of tenure on attitudes and priorities. We also further subdivided by household income band.[1]

[1] Throughout this report, 'we' refers to Public First.

Reporting

This report is not an exhaustive description of that work but instead focuses on addressing the key research questions and drawing out the most interesting and notable insights from the analysis. The appendix includes additional graphs and the technical report, which documents the full methodology including sampling approach, survey questions, data cleaning and analysis.

CHAPTER ONE:

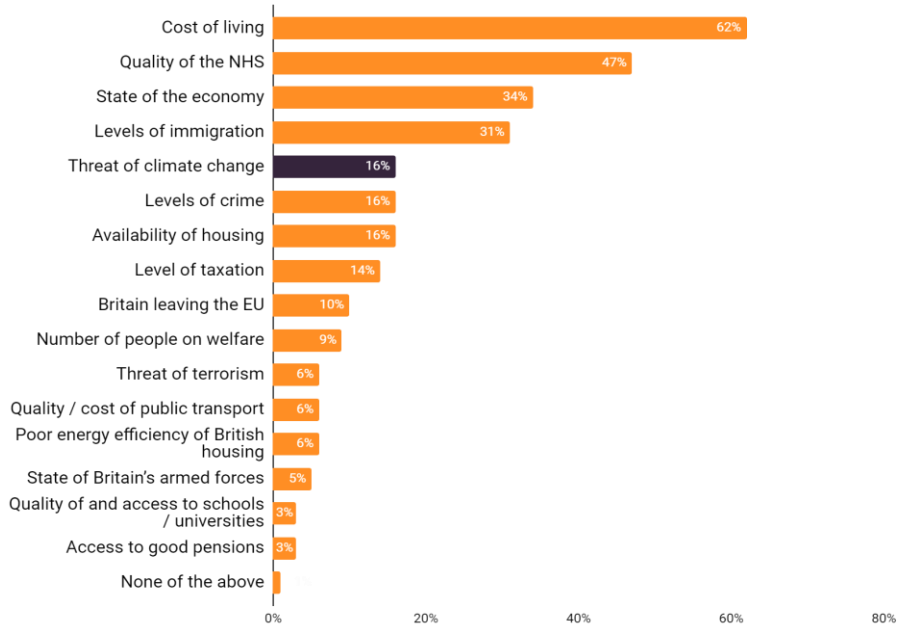
Context: attitudes and current heating systems

1.1 Attitudes towards decarbonisation

Do the British public view tackling climate change as a priority?

GB adults consider the cost of living, the quality of the NHS, and the state of the economy as the three most urgent issues facing the country right now. Levels of immigration are also viewed as a greater priority than climate change by GB adults (15% more of adults see it as a top three issue). Just 16% include the threat of climate change among their top three concerns.

Figure 1 - In GB, climate change is seen as a lower priority issue than the cost of living, the state of the NHS, the economy and immigration.



Survey question: Which do you think are the most important issues facing the country at this time? Please select up to three. Note: Percentages represent the proportion of respondents who selected each option. Totals may exceed 100% because respondents could select more than one option.

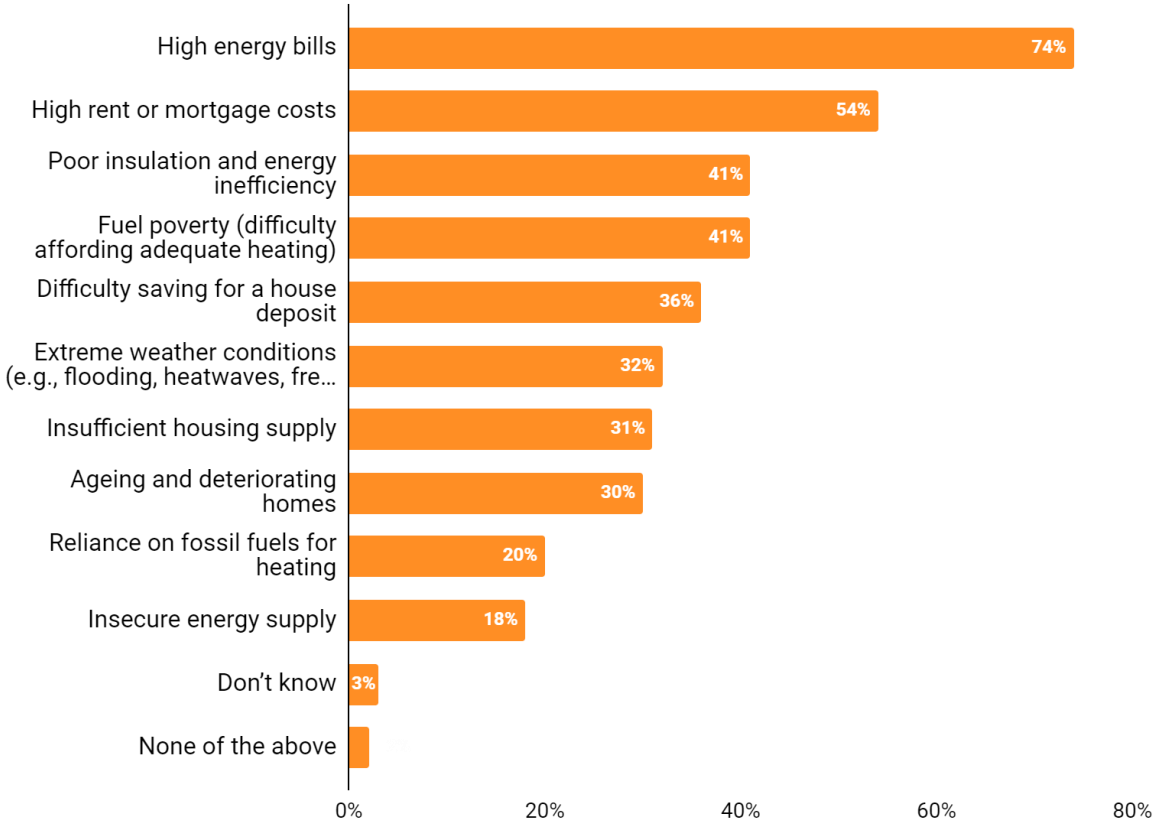
However, the public *are* concerned about climate change. Asked directly, 40% of GB adults believe it is one of the most pressing issues of our time, and 12% that it is the single most important issue. Just under a third (32%) state that climate change is a concern but other issues are more important at the moment, only 6% of the public believe climate change is not a concern at all.

Concern about and prioritisation of climate change is influenced by age and income, but it is not as simple as younger Britons caring more about environmental issues. Young adults do tend to view climate change as a more pressing concern, for example, 44% of 25-34 year olds view climate change as one of the most pressing issues of our time, compared to 38% of adults 65 and older. However, 18-24 year olds are the *least* likely age group to rank the threat of climate change as one of the three most important issues. Instead, availability of housing and levels of crime are a greater concern. When asked what the most significant concern is for British households, older generations are more likely to think reliance on fossil fuels for heating is a concern compared to younger generations, by a difference of 11%. Income also plays a role in shaping attitudes - 57% of households earning at least £100,000 per year view climate change as a top priority, compared to just 36% of those earning below £30,000 per year. However, both income groups are equally unlikely to view reliance on fossil fuels as a top issue.

Energy costs are a significant concern for GB households, irrespective of what heating system they use, living situation, or income. 74% of GB adults identified high energy bills as the most pressing issue British homes are currently facing. Other key concerns included high rent or mortgage payments (54%), inadequate insulation and general energy inefficiency (41%).

When asked which issues currently facing British homes and housing are most important, unsurprisingly, high rent or mortgage costs are most acutely felt by private renters (66%) and mortgage holders (62%), while the challenge of saving for a house deposit is most pronounced among private renters, with 42% identifying it as a significant concern [See Figure 3, on the following page]. Additionally, fuel poverty is disproportionately a concern for households earning less than £30,000, with 44% choosing this, compared to just 29% of households earning at least £100,000 per year.

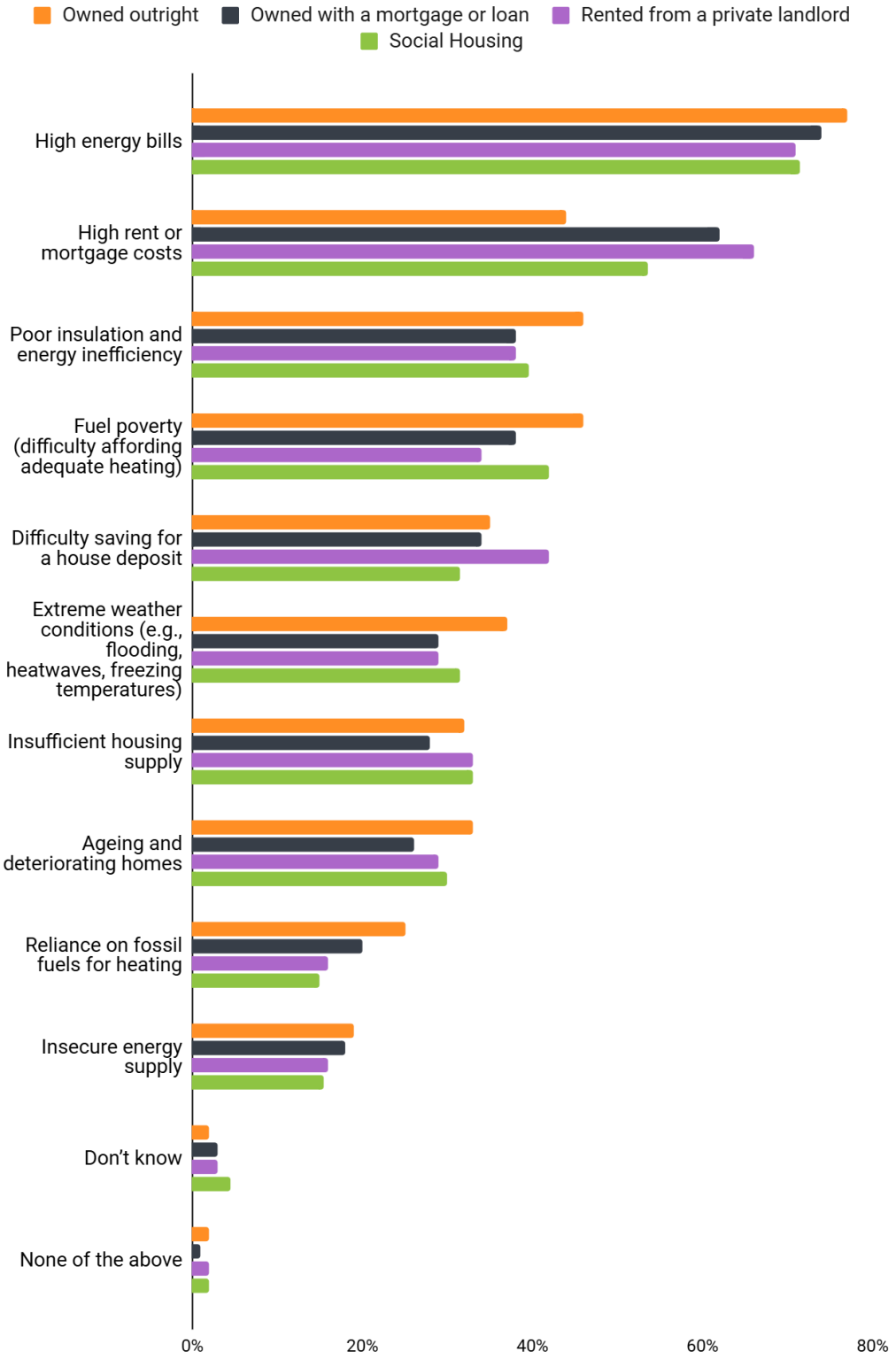
Figure 2 - Issues that cause occupants to incur costs are seen as the most important.



Survey question: In your opinion, which of the following are the most important issues currently facing British homes and housing? Select all that apply. Note: Percentages represent the proportion of respondents who selected each option. Totals may exceed 100% because respondents could select more than one option.

Those who are more concerned about tackling climate change view issues related to energy use and decarbonisation as more important [See: Appendix]. These individuals are more likely to highlight issues such as poor insulation (52% compared to the national average of 41%), extreme weather conditions (45% vs. 32%), and dependence on fossil fuels (40% vs. 20%). However, affordability remains a shared concern, with high energy bills and rent/mortgage costs ranking as the top priorities.

Figure 3 - Homeowners, especially those who own outright, are more worried about fuel poverty and extreme weather.



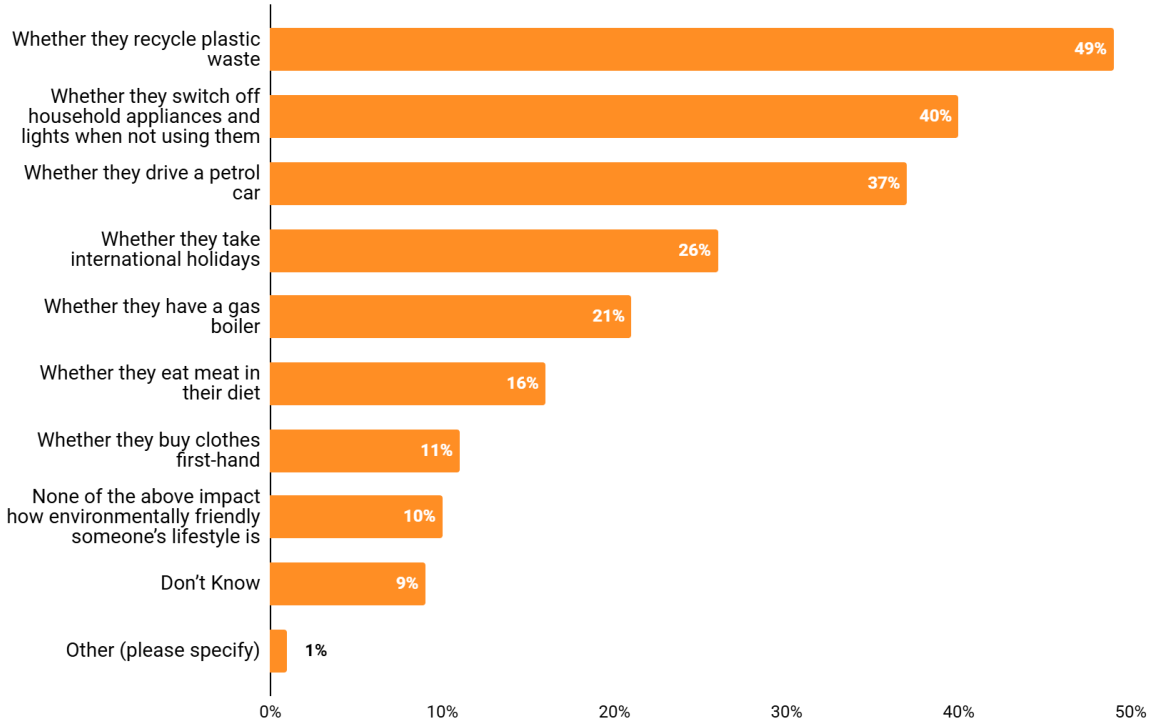
Survey question: In your opinion, which of the following are the most important issues currently facing British homes and housing? Select all that apply. Note: Percentages represent the proportion of respondents who selected each option. Totals may exceed 100% because respondents could select more than one option.

Do the British public think they have agency or impact?

Many remain uncertain about the impact that their own actions can make on climate change. There are mixed views with over a third (36%) believing that the things they do in their life don't make much of a difference to climate change, 33% that they do make a difference, and 28% that they neither agree nor disagree.

Current levels of awareness of the impact of home heating on the environment are low. When the British public was asked to select which actions they think have the greatest impact on how environmentally friendly a person's lifestyle is, whether they have a gas boiler was selected by less than a quarter of the public (21%). Yet, home heating accounts for around 12% of the UK's emissions (according to the latest government statistics) and gas heating alone contributes 10% of territorial emissions. In comparison, a far greater number of the public viewed whether they recycle plastic as an important factor (49%), followed by switching off appliances when not in use (40%) and whether they drive a petrol car (37%). There were no striking variations in responses to these questions by demographics such as age, income or region.

Figure 4 - People think recycling is the most environmentally friendly lifestyle measure.



Survey Question: Which of the following do you think has the biggest impact on how environmentally friendly somebody's lifestyle is? Select up to three of the following. Note: Percentages represent the proportion of respondents who selected each option. Totals may exceed 100% because respondents could select more than one option.

FOCUS GROUP FINDINGS

Box 1. A qualitative typology of core demographic groups and how they think about their properties

Landlords

Our focus groups show that landlords' primary concern is making sure their business is viable. This means that their priorities are remaining compliant with regulations while reducing direct costs and keeping tenants happy.

EPCs were considered opaque, with the whole industry dependent on assessors to understand what needs to be done to keep properties legal. Landlords find the grading system opaque and require professional advice to tell them what a property requires in order to reach EPC C. Our landlords mentioned that some assessors are better than others at understanding "how to get a good rating" and it is worth paying more for these individuals who are more adept at getting acceptable ratings out of the standard questionnaire. Once an acceptable level is reached on the EPC assessment, none of our landlords had much appetite for further efficiency improvements on a home in which they never planned to live themselves. These were seen as unnecessary expenses and most cared only that tenants were warm, didn't suffer from damp, and had hot water.

Most heating system changes happen as emergency purchases and the landlord's chief concerns are speed of install and price. This makes them very prone to re-installing the current technology - usually a gas boiler. Among landlords with larger portfolios, this urgency and cost-focus is compounded by a reliance on tradespeople or managing agents on the ground, whose tendency to default to replacing like-for-like is even stronger.

This context makes the regulatory structure, and the views of heating tradespeople, paramount in decarbonising rental properties.

Renters

Renters are highly aware of rising energy costs and have already adapted their heating habits to save money. They are open to time of use tariffs and flexible technology, especially if these help them reduce bills. However, concerns around complexity, installation, trust in providers, and maintaining control over heating are barriers to adoption. While unfamiliar policy discussions around phasing out gas boilers, participants were generally receptive to low-carbon alternatives, attracted by potential cost savings and environmental benefits, though they remained cautious about installation and performance.

While location is clearly the key factor in choosing a property, renters do look out for properties with higher energy efficiency. Some renters feel that they have limited agency in choosing a heating system or a home with greater energy efficiency. For these people, there was a certain amount of resignation that - in a tight property market - often there was no good choice, and tenants had little power to ask for improvements.

Homeowners

By virtue of both living in and owning the home, homeowners care about their experience of heating as well as their heating system as a financial asset.
Homeowners want their heating to come on at their preferred temperature when they need it - not just when energy is cheap/off-peak. Technologies like Hive are liked because they are seen as convenient and easy to control. Though the quantitative data shows widespread enthusiasm for time of use tariffs, the focus groups demonstrated more scepticism towards technologies such as flexible tariffs or heat networks because they feared loss of control of their bills and comfort.

This group sees their heating system as an investment - while they expect to pay thousands of pounds for it, they also want it to last. This is both to get their money's worth and for the reliability of warmth.

Homeowners are interested in how running costs might be cheaper and are keen to "crunch the numbers" on alternative heating systems. Some worried about investments not being worthwhile if they moved house sooner than expected. Visual and physical-space considerations also matter, as does noise. Incentives to reduce upfront costs and nudges to consider future plans during regular maintenance checks could be beneficial for this group. New financial products may be required to shift high CAPEX costs into a more

manageable format or to ensure that they are not left paying off a new heating system after they have moved home.

Homebuyers

Buyers reflected a lot of the same attitudes as general homeowners, but with greater focus on a heating system as an asset.

The condition and age of a boiler was important to buyers as they viewed potential properties, although they did not consider the running costs. Buyers were nervous about having to do an emergency replacement with a significant outlay at a time of reduced savings from buying a home. This made reliability key.

Green mortgages were a new concept. While they hadn't heard of these before, they were initially appealing: all agreed that if you can cut costs in the current cost of living crisis then that is a good thing and many were enthused that they'd also be 'doing their bit for the environment'. Amongst our house hunting renters this was also expressed as a risk mitigation strategy - investing while government cash or finance was available to move to low-carbon alternatives if a fossil fuel phase out is likely to force their hand eventually anyway. However, there was some scepticism about how long favourable interest rates would last, suggesting that government-backed rates over a specified long-term period would be reassuring.

1.2 The current state of GB homes: reported heating systems, housing conditions and financial resilience

How financially resilient is the GB public?

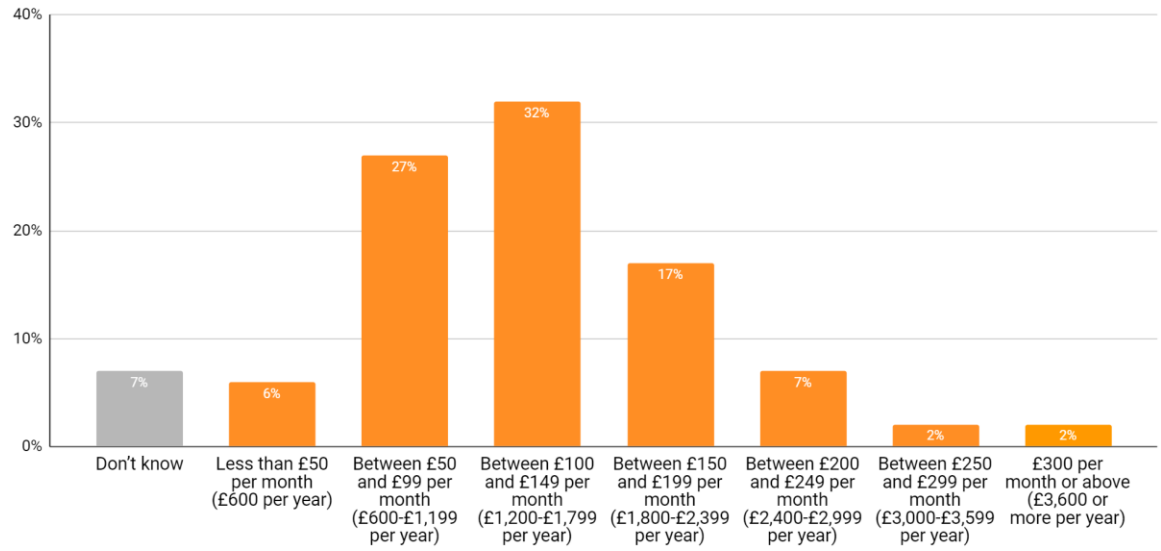
55% of GB adults say they could easily afford an emergency expenditure (for example, home or car repairs, or to deal with a health problem) of £500. This ranged from 43% among those aged 18-24, to 74% among those aged 65 and over. For a £1,000 emergency expenditure, 41% could easily afford it. However, for a £5,000 emergency expenditure, half of GB adults (50%) indicated they could not afford it. This inability to respond to emergency expenditure is part of a wider feeling of financial insecurity among the public. The great majority (79%) of those who could not afford a £5,000 emergency expense also report feeling somewhat financially insecure.

Approximately 60% of households currently spend between £50 and £150 per month on energy bills (gas and electricity). For comparison, the average GB annual direct debit for a typical household's electricity and gas in January 2025 was £1738[2], approximately £145 per month.[3] Meanwhile, 28% pay £150 or more, and with this rising to 41% among households with two parents with two or more children. Those who feel financially comfortable tend to pay higher energy bills (38% of those who feel very financially comfortable pay more than £150). 26% of those who say they have no money for luxuries pay more than £150 a month for energy bills, as do 26% of those who say they cannot afford their costs and often have to go without essentials (for example, food and heating) [See: Appendix].

[2] Reported energy spending may include EV charging for some households, unlike petrol costs, which are typically excluded. This may influence reported energy costs and should be considered when interpreting averages

[3] Ofgem, Energy Price Cap, accessed 18 February 2025

Figure 5 - The amount households in Great Britain pay for their energy bills varies, with the most common figure being between £100 and £149 per month.



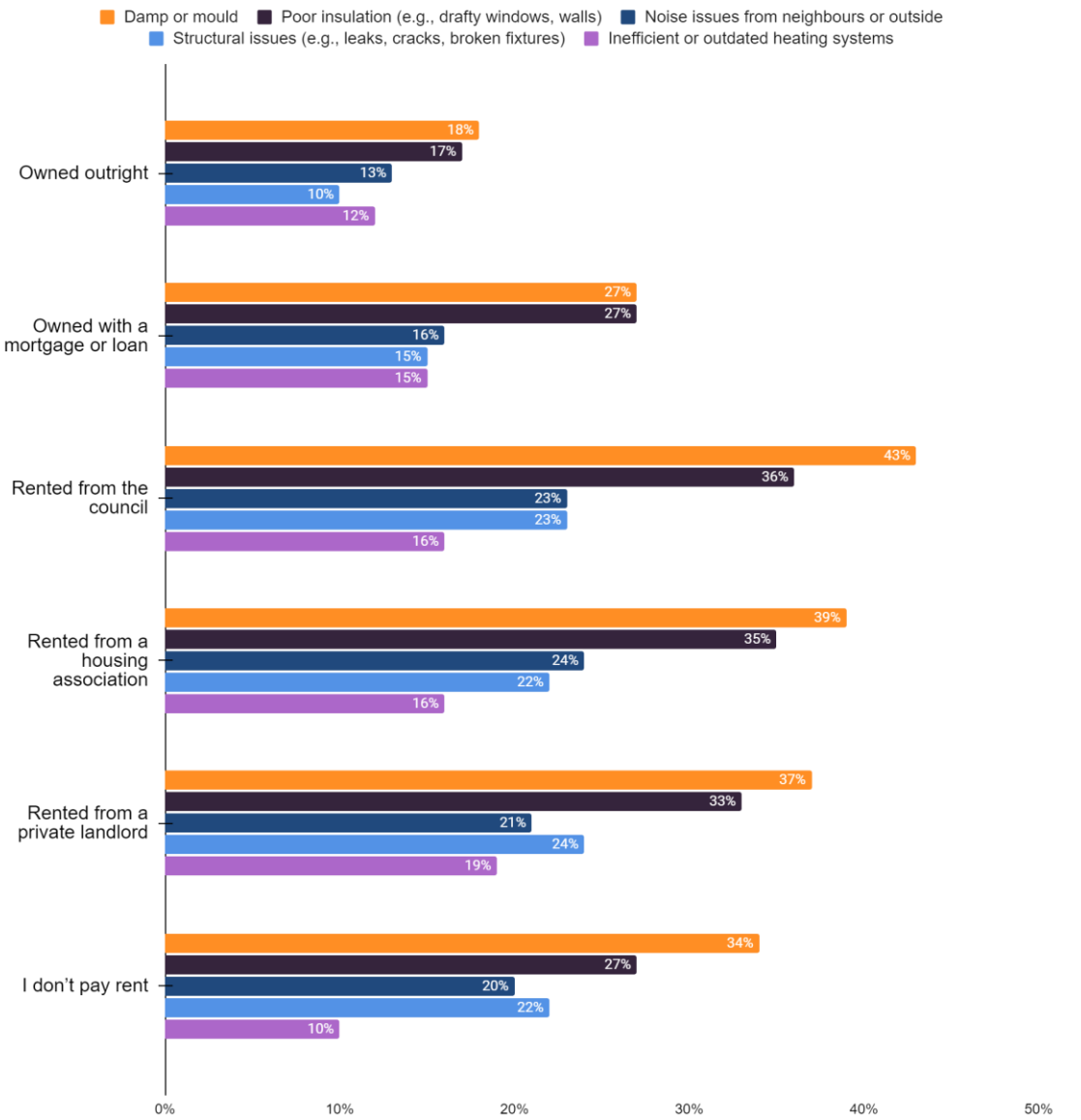
Survey question: Which of the following is closest to what you currently pay for your energy bills (gas and electricity) each month? Please give your best estimate. Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding.

Current housing conditions in Great Britain

Over a quarter of the public have experienced poor insulation, damp or mould in their current home. A further 16% report structural issues for example, leaks, cracks and broken fixtures to their homes and 14% inefficient or outdated heating systems.

This varies significantly by tenure, with **those renting their homes much more likely to have experienced poor housing conditions in their current property,** particularly if rented from the council. Over a third of those renting from the council (43%) report experiencing damp or mould, compared to just 18% of those that own their home outright.

Figure 6 - Issues people have faced in their homes vary by their tenure type.



Survey question: Which of the following issues have you experienced in your current home? Please select all that apply. Note: Percentages represent the proportion of respondents who selected each option. Totals may exceed 100% because respondents could select more than one option.

This also varied by income and social grade, with 36% of those with household income before tax of £10,000 or less reporting they have experienced damp or mould in their current home, dropping to less than 10% of those with a household income of £125,000 or more.

Overall, our analysis shows that tenure and income both affect the likelihood of damp or mould, but in different ways:

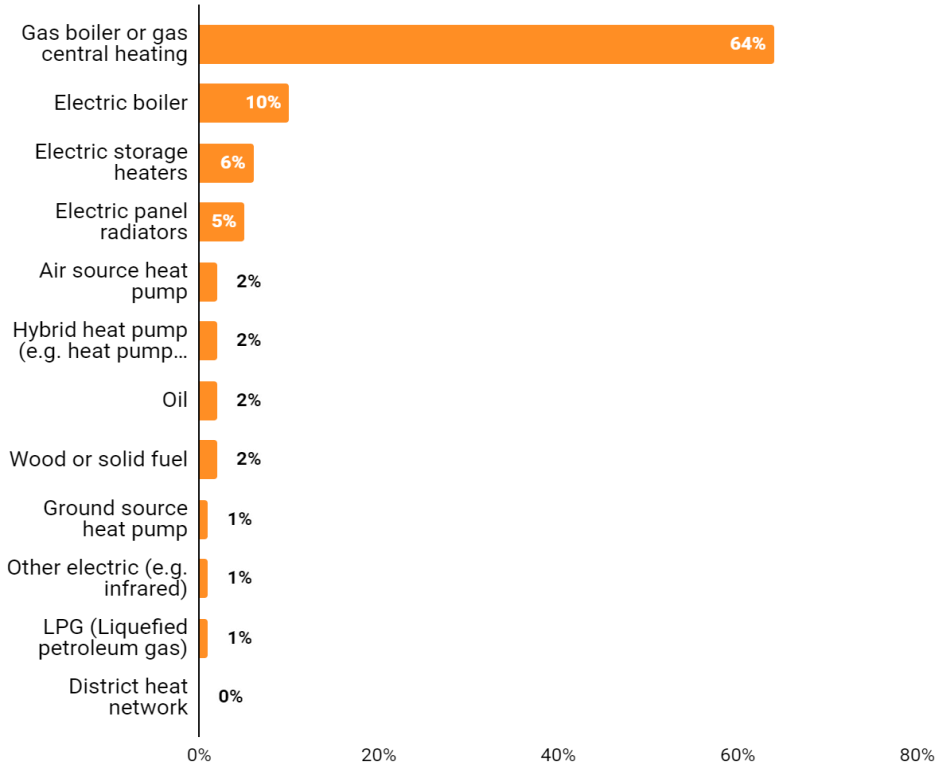
- Tenure is a strong predictor overall — renters are at greater risk than homeowners.
- Income only clearly affects risk among homeowners, not renters.

How do GB households heat their homes?

The survey asked people about the type of central heating their household uses. **Most households (64%) reported relying on gas central heating**. In comparison, **electric heating options**, such as electric boilers and storage heaters, are far less common, with just **21%** of households using them. **Heat pumps**, whether air, ground, or hybrid types, remain niche, with only **2–5%** of households adopting this low-carbon technology. We note that these figures are self-reported and differ considerably from secondary data sources on home-heating systems [For more discussion, see: Why do the survey results suggest a reduced dominance of gas boilers compared to other data sources?].

Electrification and gas grid connection is strongly determined by geography, with a higher proportion of homes with electric-only heating being found in **London**, likely due to high-rise flats that avoid mains gas connections because of fire safety concerns.

Figure 7 - An overwhelming majority of households in Great Britain use gas to heat their home.



Survey question: Which of the following is the main way you heat your home? If you use multiple heating sources, select the one you use the most. Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding.

We also asked respondents whether they currently have any of the following technologies at home, including smart meters, smart thermostats, electric vehicles and chargers, solar panels, other forms of electricity generation, and home energy storage. Nearly **one-third of**

households have yet to adopt any. Among those who have, 51% of people have not adopted any smart techs other than a smart meter installed by their supplier. However, it is important to note that the solar panel figure appears higher than other analyses, which suggest only around 5% of homes have them.[4]

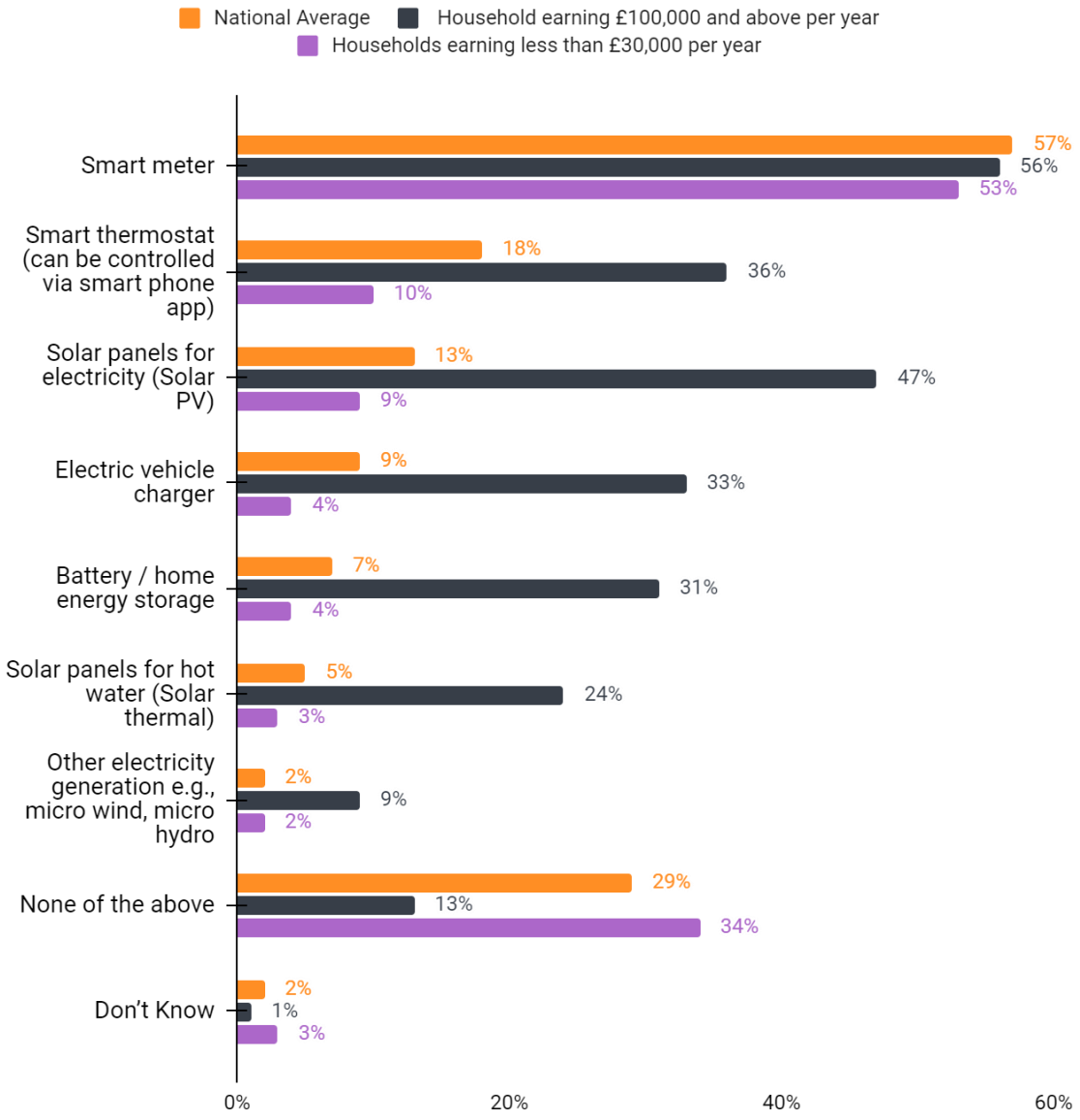
Adoption is notably higher among households with greater financial means (those with an annual household income of £100,000 or more) who show above-average uptake across all of the technologies in question [See: Figure 8, below]. Nearly half (47%) have installed solar panels for electricity, compared to just 9% of lower-income households (earning below £30,000 or less a year). Similarly, 33% of high-income households own an EV charger, while only 4% of lower-income households do. Even for lower-cost technologies like smart thermostats, adoption remains skewed: 36% of high-income households use them, versus just 10% of lower-income households.

Homeownership seems to play a major role in these disparities. In our sample, 85% of high-income households are homeowners, and 43% of them are also landlords. Notably, landlords in this high-income group are the most likely to have adopted many of these technologies in their own homes.

These insights indicate that the adoption of smart and low-carbon technologies tends towards those most able to afford them, highlighting the need for incentives to encourage broader uptake among less affluent households.

[4] Sheffield Solar API Platform: GB PV DC Capacity Report: https://api.solar.sheffield.ac.uk/pvlive/capacity [Accessed 17 March 2025]

Figure 8 - Households with greater financial means show the highest levels of adoption for many technologies



Survey question: Do you currently have any of the following low carbon technologies at home? (Select all that apply) Please only select answers which you or people in your household use. Note: Percentages represent respondents selecting each option. Totals may exceed 100% due to multiple selections.

Why do the survey results suggest a reduced dominance of gas boilers compared to other data sources?

Discrepancies arise when these findings are compared to other public data, which suggest that approximately 80% of GB homes use gas boilers, a much higher dominance of gas boilers for home heating than this survey (17pp difference). For example, Scottish census and ONS data suggest that 79% of GB homes use mains gas for central heating.[5] This discrepancy could be for a number of reasons:

- **Differences in sampling**: For example, the ONS data which reports 80% of dwellings in England and Wales use mains gas for their central heating is drawn from EPC data, which therefore excludes homes without or with an out-of-date EPC. This means the ONS data is neither a complete nor up-to-date picture of GB homes and may particularly under-represent the oldest and least improved homes in our housing stock.
- **Misreporting in the survey** due to misunderstanding the question or a lack of awareness, for example respondents could have mistakenly identified their secondary heating source (for example, portable heaters) as their primary system. Surveys rely on individual knowledge, which can vary. This may explain why 0% of respondents report using a District Heat System - users may not realise they are connected to such systems and confuse them with individual heating systems.

Overall, it is likely that both of the above are at play - that existing public data may overreport the dominance of gas boilers, and that the survey underreports them. This discrepancy is evidence of the reality that the GB public have a low awareness and understanding of their current heating technology.

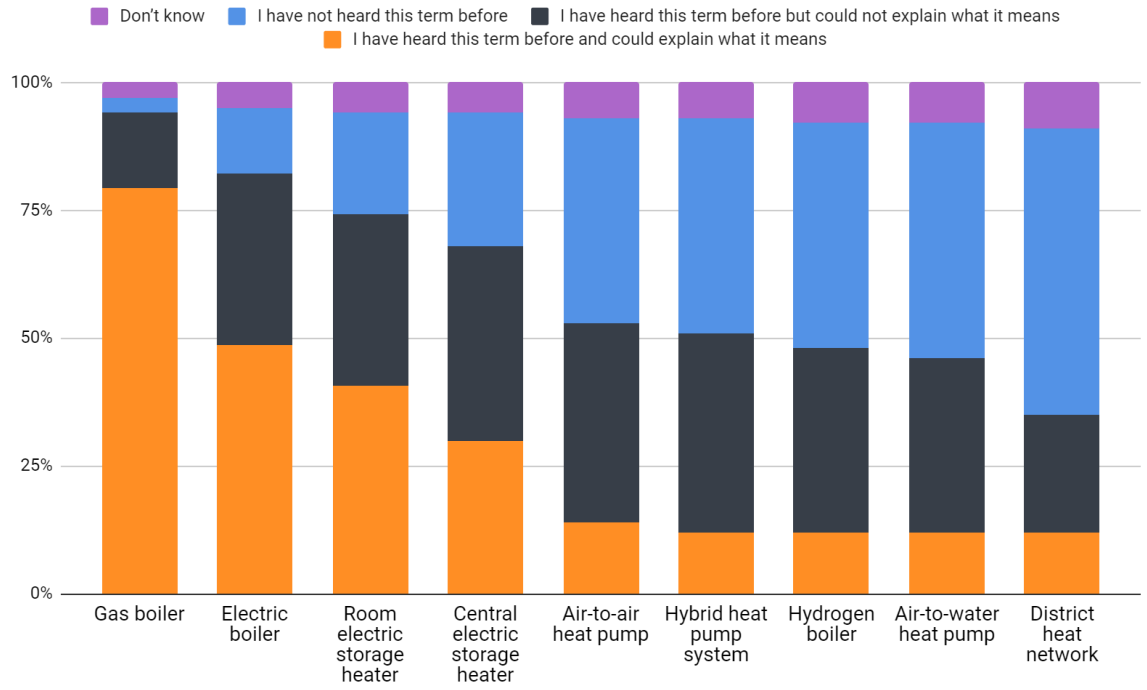
[5] Combined data sets: UK Data Service, Scotland's Census 2022: UV407: Central Heating, August 2024 and ONS, Main fuel type or method of heating used in central heating, England and Wales: March 2024, October 2024

1.3 Awareness of and attitudes towards energy and heating

How familiar is the public with low-carbon technologies?

Self-reported awareness of heating technologies and energy efficiency is low among GB households, particularly when it comes to low-carbon technologies. While gas boilers are nearly universally recognised - 95% of adults are familiar with the term, and only 3% have never heard of it - fewer than 45% of GB adults feel informed about electric alternatives (excluding electric boilers). Awareness is especially low for heat pumps; over 40% of adults said they'd "never heard of this term before," and just 12% feel they "fully understand" how they work.

Figure 9 - Many people have either not heard of or do not understand many low carbon heating systems.



Survey question: How familiar are you with the following types of heating systems? Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding

Box 2. Low awareness and vulnerability to misinformation

The low awareness shown in the poll was evident in our focus groups and though many of our participants were open to the idea of a more sustainable form of heating, their lack of knowledge leaves an opportunity for mis- and disinformation to take root.

For example, nearly all of the landlords we spoke to had almost no knowledge of lower-carbon heating systems. In each group we had one strident anti-heat pump voice. Each group also contained a landlord who had changed a rental property over to electric heating. In both cases, the anti-heat pump voice was more strident - and often inaccurate - but the other group members found them compelling as it was the first time they had heard about the technology. In the group of landlords with larger portfolios, three landlords had some positive personal experience of heat pumps which did appeal to others but they remained less opinionated and outspoken about their benefits than the less-experienced participants with negative views. Here are two examples of the blend of anecdote with misinformation that we observed:

"These pumps require bigger radiators. They require under floor heating. They can't use micro piping to the existing radiators. And lots of properties have got that. And most people I've talked to have a backup gas boiler."

Male, 70
Landlord, Small Portfolio

"Heat pumps don't supply a lot of heat. They're very underpowered, so unless you've got a very warm property to begin with, no point putting a heat pump in, because people will be cold and they'll have to have other sources of heating in the property."

Male , 42
Landlord, Larger portfolio

We also heard repeated comparisons drawn between electric vehicles and low carbon heating. This narrative was consistently negative: that government is pushing consumers to buy EVs before the technology and infrastructure is ready.

"I like the moral crusade of what government is trying to achieve, but I think, like [he] said, it's like the car roll out. It's completely ill thought out, and it's not working because there's no engineers."

Male, 28
Landlord, Smaller portfolio

"In the past, we've been promised that it's the new best thing. I mean, look at electric cars, and then actually they're not good, as you find out 10 years later. Oh, actually, it's not this big promise that everyone said it was. So, I think people are a bit reticent to just go out and spend a lot of money getting the next best thing. And then thinking, wow, is it? Is it really?"

Female, 41
Renter, House hunting

Overcoming low awareness and public concerns about the readiness of the technology will require social proof. We are currently in the very early phases of adoption in the UK and this knowledge gap is to be expected.

When asked who they would turn to for advice on heat pumps or other low carbon technologies, participants name-checked Martin Lewis, but also their friends, colleagues and family members. Britons want to hear the lived experience of homeowners who have installed low carbon technologies. In the meantime, the lack of information creates suspicion. One group noted that "you don't even see adverts for them", and the default assumption given this lack of awareness is that heat pumps must be a new, untested technology. This perception must be overcome if uptake is to accelerate.

EPCs

The knowledge gap extends beyond specific technologies to include awareness of EPC ratings: 60% of GB adults do not know their property's EPC rating.

The data also highlights a **gender divide in awareness and confidence**:

- On average, men were more likely than women to report familiarity with low carbon heating systems. For example, **60% of men** reported they had heard of an air-to-air heat pump compared to just **46% of women.**
- Similarly, 46% of men were aware of their property's EPC rating compared to 34% of women

This divide reflects broader trends in self-reported confidence with technology, where men may overestimate their understanding and women may underestimate theirs. It is also consistent with previous Public First research in April 2024[6], which found a difference of 18% between male and female respondents' belief that they could explain what the term heat pump meant.[7] That is not to discount the importance of this finding as a barrier to heat decarbonisation: the comparable difference for gas boilers is 81% of men vs 79% of women reporting familiarity.

Landlords appear to be more informed than the general population, particularly about energy efficiency. Only 26% of landlords are unaware of the EPC rating of their own home, and they also report greater familiarity with various heating systems. For example, 60% of landlords have heard of "district heat networks," and 26% can explain what they are; nationally, 56% of GB adults say they have never encountered the term.

The focus group findings make clear that EPCs are clearly a potent driver of landlord behaviour towards the homes in their rental portfolio, demonstrating the impact that statutory targets can have. An increase in regulation was mentioned by several landlords - especially in our smaller portfolio group - as a reason for getting rid of some of their properties that could not be upgraded to EPC C in a cost-efficient manner. It was clear that all of our participants used EPC assessors and their findings had been influential in decisions to upgrade the energy efficiency of their portfolio. There were also signs that the potential for licensing regimes to discourage gas in rental properties could be a powerful motivator for electrification.

This relationship between EPCs and landlord behaviour is mediated by EPC assessors, on whom landlords are heavily dependent: they find the grading system opaque and require professional advice to tell them what a property requires in order to reach EPC C.

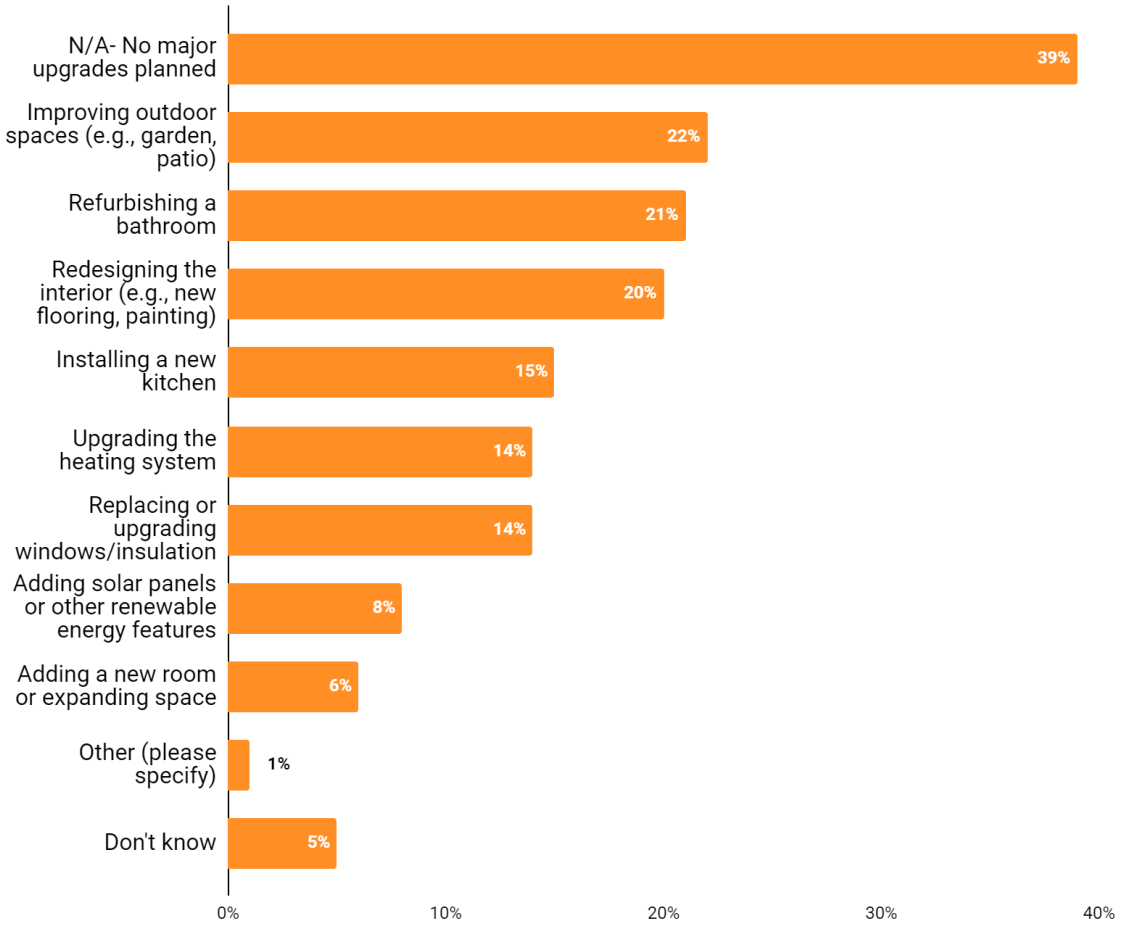
[6] Public First, British Gas Net Zero Homes index, October 2024: https://www.publicfirst.co.uk/new-polling-for-british-gas-and-the-net-zero-home-index-2024.html

[7] Public First, Upgrade: How to deliver better homes by 2030, July 2024: https://www.publicfirst.co.uk/upgrade-better-homes-by-2030.html

What are the public's plans for property improvements?

Despite widespread concern over rising energy costs, the majority of GB homeowners are not prioritising energy-focused home improvements. Nearly 2 in 5 homeowners (39%) report no plans for major renovations, and among those who do, they favour outdoor upgrades, bathroom refurbishments, and interior redesigns. Cost and carbon-saving measures - such as upgrading insulation, improving heating systems, or adding solar panels - remain far less common.

Figure 10 - Nearly 2 in 5 homeowners do not have any upgrades planned, and if they do, most are not to the heating system.



Survey question: Are there any major upgrades planned for the property you live in, either by you or your landlord, in the next few years? Please select all that apply. Note: Percentages represent respondents selecting each option. Totals may exceed 100% due to multiple selections. 'Don't know' and 'None of the above' reflect actual respondent counts as exclusive choices.

A major factor contributing to this low uptake in energy efficiency is future housing plans. Only 25% of homeowners anticipate moving within five years, and 22% are unsure how long they will stay in their current home. Our research indicates a non-linear relationship between plans to stay in a property and major upgrade plans. Specifically, the likelihood of planning upgrades is lower for those with very short- or very long-term housing plans, while it peaks for those with mid-term plans. 37% of those planning to move in the next 12 months have some upgrades planned, which rises to 70% for those who plan to live where they are for 3-10 years, and returns to 48% for those who plan to live in their home for more than 15 years.

For the property they live in, landlords are more likely than other homeowners to pursue energy-related upgrades. Only 16% have no renovation plans for their own home, with 30% intending to improve heating systems (compared to 12% of the general population). They are also more likely than the general public (23% vs. 7%) to add renewable energy features like solar panels to their own homes. Notably, younger landlords were more likely to be considering improving heating systems in their own home. 34% of landlords under the age of 35 reported planning this upgrade in their home, compared to just 13% of landlords over the age of 65.

Renters, on the other hand, have limited control over making property upgrades. When asked which improvements they would most like their landlord to implement in their rental property, if any, the most common responses were better insulation or weatherproofing (41%) and energy-efficient appliances (39%). These upgrades were seen as top priorities for reducing energy bills and improving comfort.

Interestingly, our focus group findings indicated that landlords also feel that their agency is constrained in upgrading rental properties. Landlords want to keep tenants happy and down time between tenancies to a minimum. That means making swift decisions that aim to minimise disruption within the rental property; usually this leads to like-for-like replacement of a gas boiler that has broken mid-tenancy.

Between tenants, if renovation is required, there is more opportunity for a change of system, but the likelihood that the timing for this will align with the need to replace a heating system is very small - and few landlords will replace a heating system that isn't broken unless there is the threat of additional regulation that would render that property not viable for letting.

“I will treat my tenants how I would want to be treated by a landlord myself, and I wouldn't want to leave them without heating. So, it had to be done straight away, and I couldn't manage it on hand. So, I remember it costing a lot and not being happy, but just pushing the button to go ahead and getting someone to fit it for me remotely. “

Female, 49
Landlord, Small portfolio

“I renovated one of my properties... It's a flat, so it’s pretty warm. So I changed it all to electricity. Took out all the gas because I was renovating anyway... I know eventually we're going to all have to get rid of them, because of the licencing that's in the area where I got my rental properties. So I took the opportunity whilst I was taking apart the floorboards and redoing all the electrics to do that. “

Female, 46
Landlord, Larger portfolio

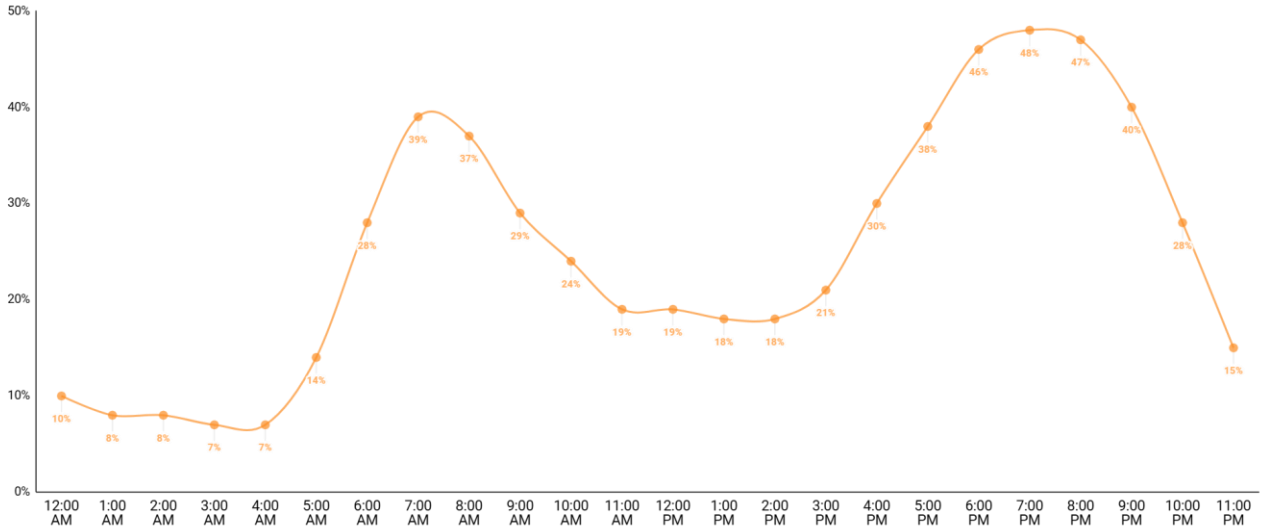
CHAPTER TWO:

Heating usage in Great Britain today

2.1 Current home heating practices, occupancy trends, and influencing factors

Weekends and weekday evenings see the highest demand for household heating in GB (76% and 68% respectively), with a significant surge between 6 PM and 8 PM. Another spike occurs in the morning from 7 AM to 8 AM, followed by a considerable drop during working hours and overnight. Although overnight heating is generally low, it's notably higher in homes utilising electric heating and heat pumps, potentially due to the operational differences between these systems and gas boilers. Respondents reported using similar heating usage (times and temperatures) throughout the days across both weekend days and weekdays.

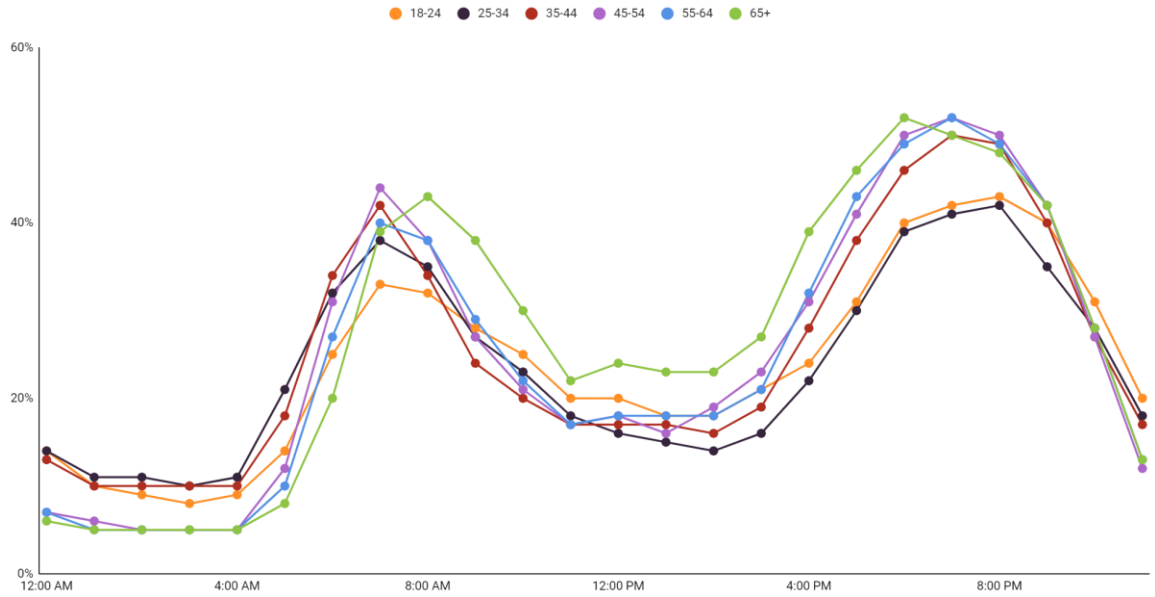
Figure 11 - Heating demand is highest when people wake up and before they go to sleep in the evenings.



Survey question: On a typical day in winter when people are home, what hours of the day does your household normally have the heating turned on? Select all that apply. Note: Percentages represent respondents selecting each option. Totals may exceed 100% due to multiple selections.

Heating patterns — including average heating duration, and overall trends — remain largely consistent across different demographic groups. We find some indication that a higher proportion of the oldest individuals tended to have heating on during the day, while the younger groups and the wealthiest tended to be more likely to keep heating on overnight or in the early hours of the morning.

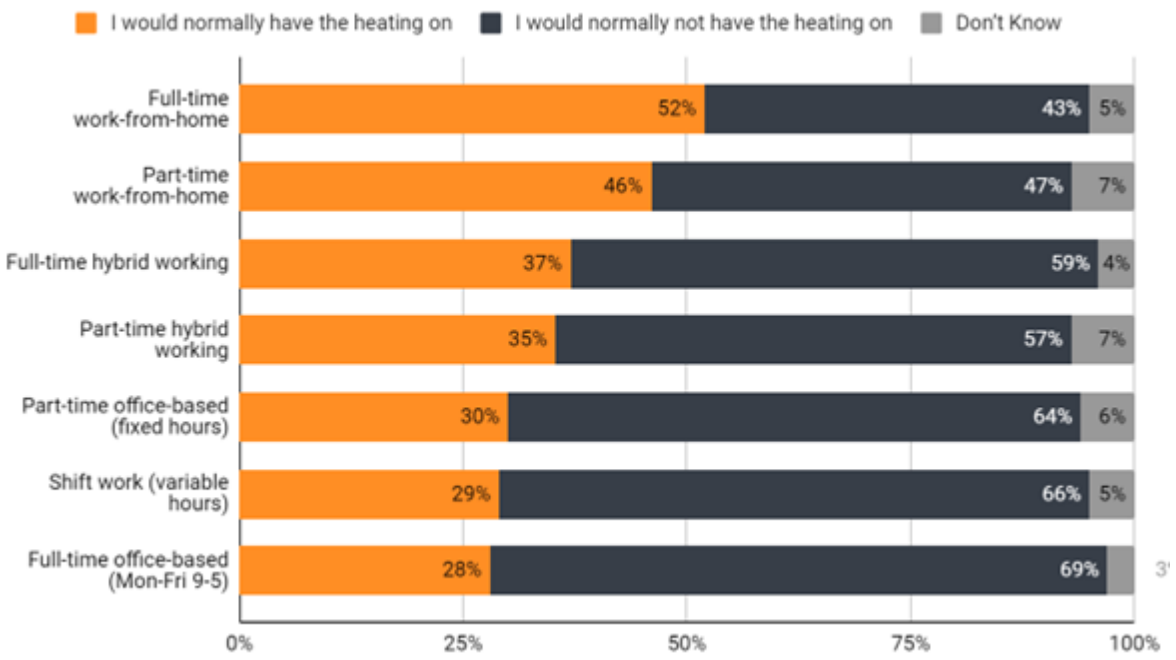
Figure 12 - Older individuals are more likely to heat their homes during the day



Survey question: On a typical day in winter when people are home, what hours of the day does your household normally have the heating turned on? Select all that apply. Note: Percentages represent respondents selecting each option. Totals may exceed 100% due to multiple selections.

Working from home — whether full-time or part-time — was strongly associated with higher daytime heating usage on weekdays (9 AM to 5 PM). Full-time remote workers report the highest usage during this period (52%), followed by part-time remote workers (46%) and full-time hybrid workers (37%). We also found no evidence for different home heating patterns among those with smart meters, compared to those without.

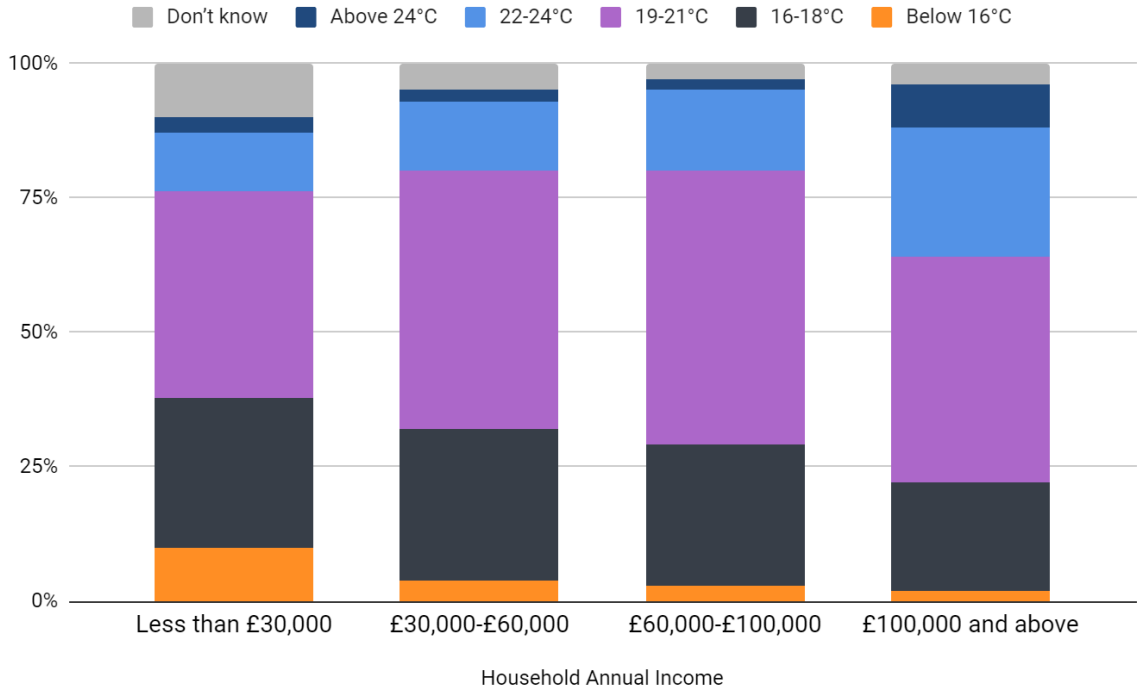
Figure 13 - The more people work from home, the more they have the heating on during the day.



Survey question: During winter, do you typically have your home heating on in the following scenarios? : During weekday working hours (9am-5pm). Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding

A high number of households (44%) maintain winter home temperatures between 19°C and 21°C. However, some variations exist based on heating fuel and household type. For example, homes using wood or solid fuel heating tend to be cooler, with 40% maintaining temperatures below 18°C. Older people also indicated a preference for cooler temperatures (38% below 18°C for those aged 55+) compared to younger people (28% for those aged 18-24) who opt for warmer temperatures. Similarly, higher-income households earning at least £100,000 per year, on average, maintain higher indoor temperatures than households earning below £30,000 per year [See: Figure 14, below]. This trend is particularly pronounced among homeowners. While 28% of high-income homeowners (with household incomes over £100,000 annually) keep their homes at temperatures above 21°C, only 10% of low-income homeowners (with household incomes under £45,000) do the same. In fact, 40% of low-income homeowners report maintaining indoor temperatures below 18°C, a fact that may well be connected with our findings on mould [See: Current housing conditions in Great Britain].

Figure 14 - Higher income households tend to maintain warmer temperatures



Survey question: On average, what temperature do you maintain in your home in winter when the heating is on? Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding.

The majority (77%) of GB adults actively track and monitor their energy usage, often taking steps to reduce consumption, while only 7% pay little attention to it. Manual control of heating (51%) is the most common approach, suggesting that many prefer hands-on management of heating rather than relying on automated schedules (29%). Higher-income households are, on average, more inclined toward automated heating schedules, whereas lower-income households predominantly rely on manual control. Over half (52%) of low-income homeowners use manual control, rising to 60% among low-income renters. This disparity likely reflects the affordability and accessibility of advanced technologies like smart thermostats and fewer concerns over cost savings among wealthier households. Smart thermostats, for example, are used by 37% of high-income homeowners (above £100,000 per year), but only 16% of their low-income counterparts. [See: Box 2 for more observations on the reality of smart thermostat use from our focus groups].

FOCUS GROUP FINDINGS

Box 3. A note on control and smart thermostats

Homeowners like control. They want their heating to come on at their preferred temperature when they need it - not just when energy is cheap/off-peak. This is true whether households prefer their home warmer or cooler. The primary divide seems to be between families that use their thermostat to control temperature - with the occasional battle between family members over the preferred temperature, and those who keep temperature stable but exert control by turning the whole system on or off.

Smart thermostat technologies like Hive (the only brand that was name-checked in our focus groups) were popular with users because they are seen as convenient and easy to control, but we must never assume households with smart thermostats will be more open to time of use or automated heating. Few of our participants used the scheduling functions of these systems - instead they liked the ability to switch on their heating on their way home, or to adjust the thermostat from their sofa.

Homeowners were intensely sceptical of any product or service that reduced their perceived control. Even when this was paired with cost savings, homeowners tended to both expect that such a system would save them little and prefer not to know, as they were reluctant to change their behaviour - for example, by running more appliances during off-peak hours. All assumed that such a tariff would require additional mental load. Embedded in these assumptions was the belief that potential savings might be higher for large families - which might make the trade-offs worthwhile in this situation but not for smaller households.

2.2 Value of flexibility in home heating

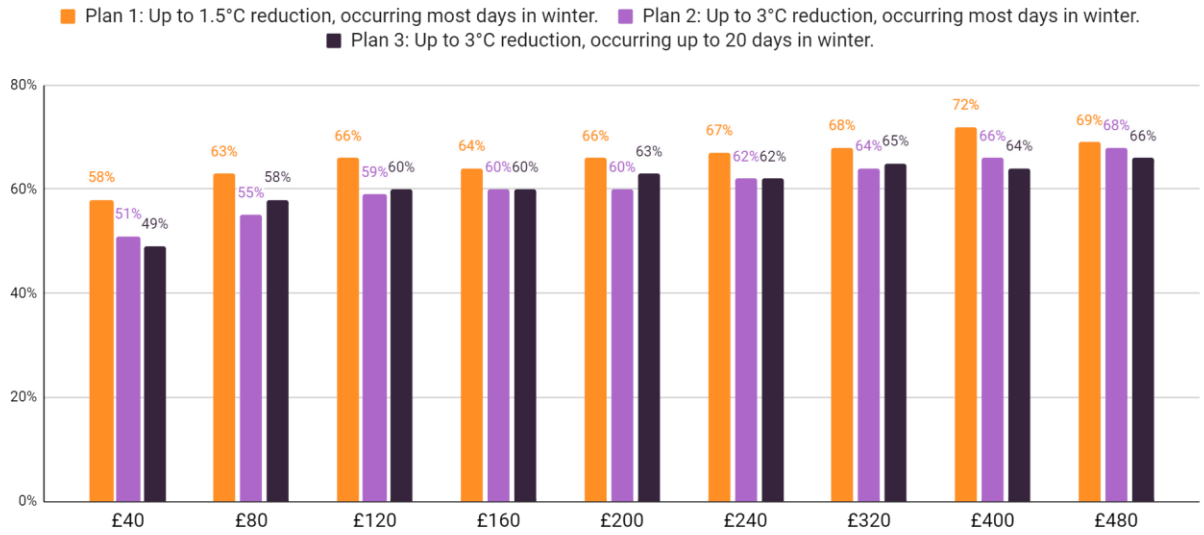
We explored time-of-use tariffs as a way to deliver cost savings on energy bills by introducing three hypothetical automated heating adjustment plans designed to reduce heating costs during peak electricity prices. The respondents were randomly split into three groups, where each group was presented with different versions of an energy-saving plan. Each plan varied in the degree, duration, and frequency of temperature reductions:

- **Plan 1:** A subtle and likely unnoticeable reduction of up to 1.5°C for a maximum duration of 3 hours at a time, occurring most days throughout the winter season.
- **Plan 2:** A reduction of up to 3°C for a maximum duration of 3 hours at a time, may require you to put on an extra layer, occurring on most days throughout the winter season.
- **Plan 3:** A reduction of up to 3°C for a maximum duration of 3 hours at a time, may require you to put on an extra layer, occurring up to 20 days per year during the winter heating season.

Participants were also informed that they could override these adjustments if necessary, though they were advised that frequent overrides might reduce overall savings.

Respondents were asked if they would accept these plans at three different savings levels—low, medium, or high—each randomly assigned, with annual savings ranging from £40 to £480.

Figure 15 - Any amount of savings via a plan is viewed positively.



Survey question: Would you accept this plan if it saved you £X annually? Yes, I would accept this plan.

Overall, Plan 1 consistently achieved the highest acceptance rates across all savings levels, demonstrating the appeal of subtle adjustments. Acceptance peaked at 72% for £400 savings but remained above 58% even at the lowest savings level of £40. Plans 2 and 3 followed a similar pattern, but Plan 3 outperformed Plan 2 at moderate savings levels, likely due to its reduced frequency of adjustments. For instance, Plan 3 achieved 60% acceptance at £120 savings, whereas Plan 2 only reached the same level at £160. This is consistent across different demographics groups and household types.

FOCUS GROUP FINDINGS

Box 4. Qualitative responses to time of use tariffs and automation

Time of use tariffs are a conundrum for the public: they like to think of themselves as savvy, and everyone identifies that high bills are a pressure on their quality of life at the moment. Yet, while most declare themselves open to time of use tariffs, many also discuss a long list of concerns about their implementation, primarily complexity, installation, trust in providers, and desire to maintain control over heating.

A significant minority of focus group participants were already utilising existing energy-saving deals from their providers, such as free energy hours, and tried to avoid using energy during peak times. However, these people were also perplexed by the concept of automation and most people shared a distrust of energy providers - or the idea of a different service provider. Participants didn't believe that the savings would be substantial enough to be worth the stress (and pressure to change behaviour) that they anticipated.

Even in groups that had participants who were happy using time of use tariffs, other participants found reasons it would not work for them, while those already engaged did not want or need support to automate their

energy usage within that tariff. Most worried that either their experience would be worse or their costs would not reduce.

"To be honest, I don't really find any of it appealing. I don't really understand how it would work. Yeah, I don't think that would work for me, because my heating system is very old. I've never had a smart meter. I don't really understand how that would work."

Man, 44
Renter, Private sector

"I think it's a bit of pressure, almost, where you feel that you're compelled to kind of get everything done within them, within that time frame, rather than being flexible. At the minute, I've got the flexibility to do what I want, whenever I want to do it, but if I had that kind of option, I might feel the pressure to have to get it all done, like within them four hours on a Saturday, and I don't want to do that, so I'd rather not."

Female, 38
Homeowner, Mid income

"Unless it was going to save us a huge amount of money, I don't think that would interest me, because I don't think it would change the way we have our heating set."

Male, 38
Homeowner, Mid Income

CHAPTER THREE:

Role of cost in home heating decision making

3.1 Reaction to emergency purchase

This section of the survey explored consumers' financial resilience and reaction to changing Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) levels. These questions were technology agnostic for several reasons.

Firstly, as older boilers reach the end of their lifespans, many households face the challenge of installing greener, more energy-efficient replacements. These systems often require substantial upfront investment, and the ability to fund such expenses hinges on households' financial resilience. Current government grants for homeowners, such as a £7,500 grant for homeowners to replace their gas boiler with an air- or ground- source heat pump may be phased out in the longer term. In turn, new low carbon technologies may become cheaper as they become more mainstream.

Other new factors may influence consumer choice - for example increased familiarity of low carbon technologies may mean the choice is driven more by cost/benefit than currently is the case. It is likely that influencing factors in the 2030's and 40's will be different to those now. Taking a long term view, it is therefore important to understand how consumers react to CAPEX and OPEX regardless of technology type, or grant offering.

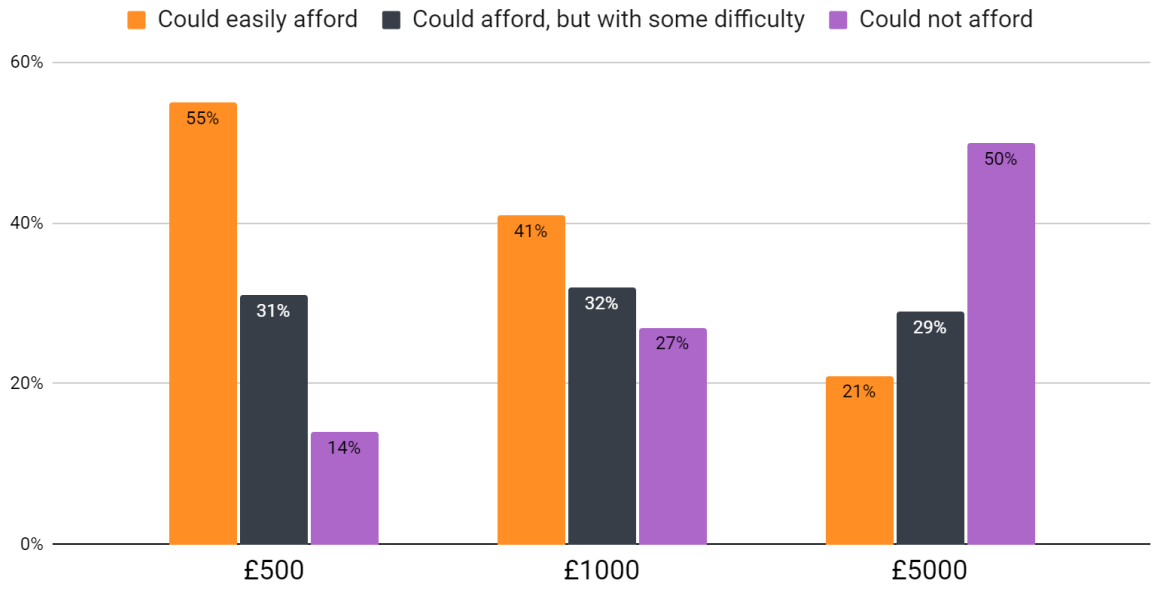
As part of this, we were particularly interested in landlords as a distinct group, given their dual roles as both homeowners and providers of rental properties. To capture this nuance, landlords were asked to respond to certain questions twice — once in relation to their own home, and once for one of their rental properties.

Financial Readiness

For many households, financing a large, one-off purchase is a significant challenge. While most GB adults can manage smaller unexpected expenses between £500 and £1,000, the ability to absorb larger costs — such as £5,000 — is far less common. Even among

higher-social grade households (AB social grade), nearly one-third (32%) would struggle to finance such expenses.

Figure 16 - More than half of households could not afford or would struggle to afford an emergency payment of over £1000.

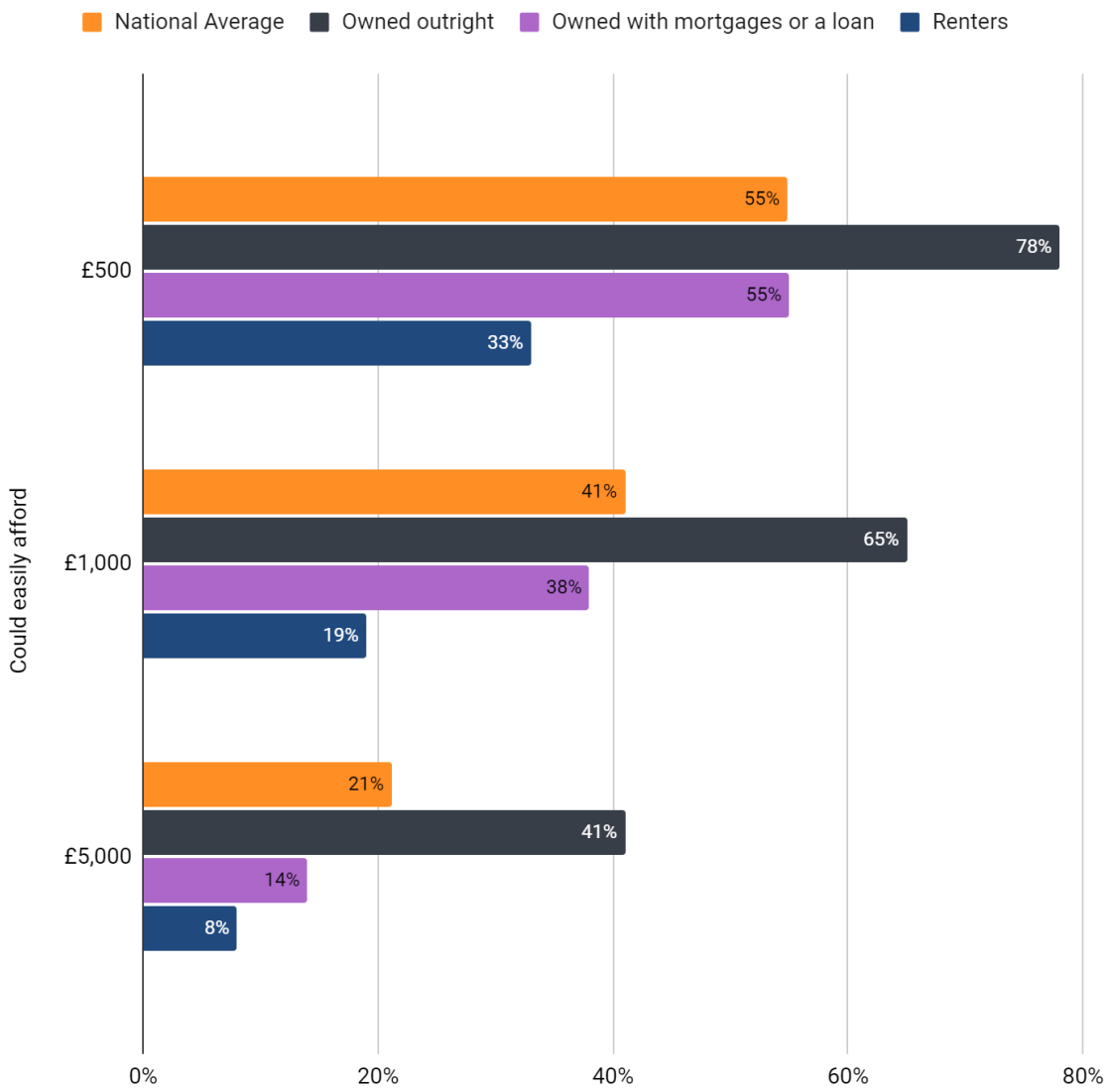


Survey question: If your household had to find money for an unexpected emergency expense, could you afford to pay the following amounts? This might be to pay for something like urgent home or car repairs, or to deal with a health problem etc. Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding.

Outright homeowners are more able to afford these expenses compared to renters or mortgaged homeowners, who often find it challenging to manage even modest expenses of £500. When the cost rises to £5,000, only 8% of renters report being able to cover the expense, compared to 41% of homeowners (outright). Overall, landlords' financial stability more closely aligns with that of outright homeowners, with 35% able to easily cover a £5,000 expense for their own home [See: Appendix].

Household type further influences people's ability to afford unexpected expenditures. Single elderly households, often benefiting from stable income sources like pensions, show relatively strong financial security. In contrast, 45% of single-parent households struggle to manage costs above £500, reflecting the financial challenges faced by this group.

Figure 17 - Most people who can afford emergency payments own their home outright.



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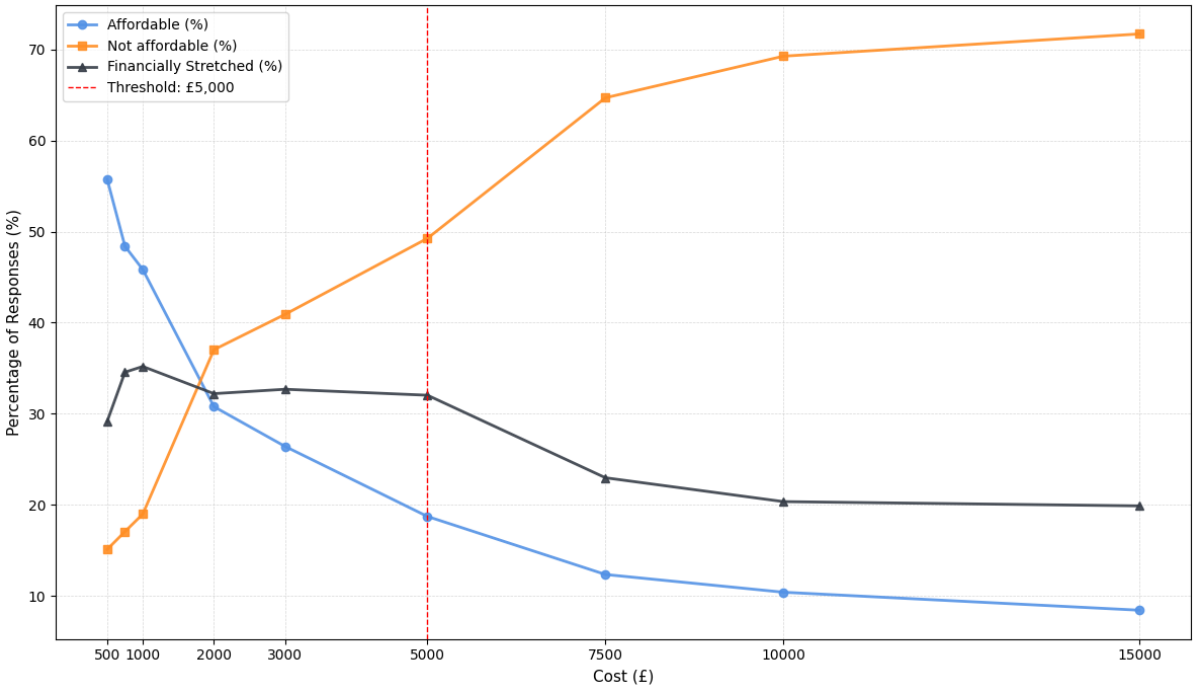
Heating System Replacement Scenario

To explore the financial impacts on adoption further, we asked respondents to imagine a scenario where their heating system needed to be replaced and randomly presented them with a cost of doing so. The options ranged from as little as £500 to as high as £15,000. For each potential expense, participants were asked if they could (1) afford it easily, (2) afford it but with difficulty, or (3) not afford it at all.

Figure 18 - Most households cannot afford a heating system replacement with an upfront cost of over £5,000



Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view? Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding

The results show that affordability declines rapidly as costs increase, with two critical thresholds emerging:

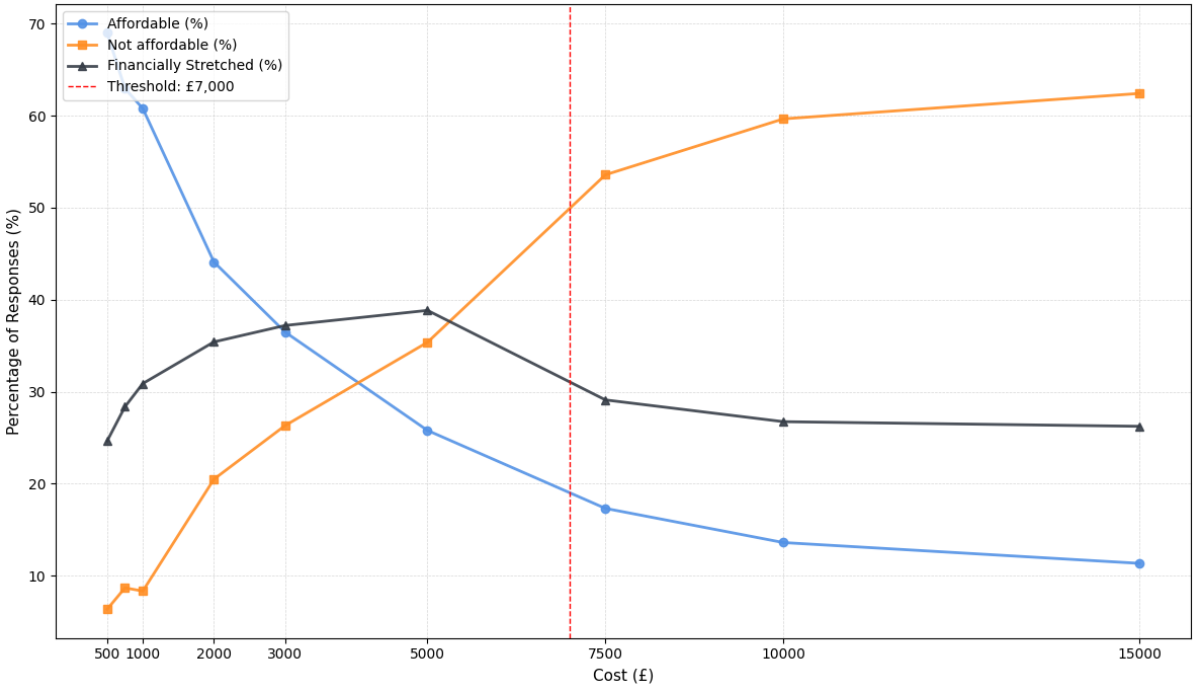
1. **£2,000 - The Early Stress Point.** At £2,000, the proportion of households that could still comfortably afford the expense drops to approximately 30%. This is the point at which more people find the cost "affordable with difficulty" or "unaffordable" than easily "affordable". Therefore indicating a financial barrier above which more households start to feel stretched when investing in a heating system.
2. **£5,000 – The Critical Affordability Threshold.** At £5,000, affordability challenges deepen, with the majority (50%) of households reporting they are unable to meet this cost. By £10,000, over 70% of households indicate they cannot afford the expense, even with difficulty.

To understand how these patterns might extend to even larger expenditures, we modelled hypothetical costs ranging up to £45,000. This projection indicated that once expenses reach £20,000, 83% of households would consider replacement unattainable; by £30,000, the figure climbs to over 90%; and at £45,000, more than 96% of households find it completely unaffordable. For context, the average cost of a gas boiler replacement—a new combi boiler, including installation—is approximately £3,000. For more information on this calculation [See: Technical Report].

Comparisons across different types of housing tenure and ownership shed further light on these affordability challenges [See: Appendix]. All respondents were asked to decide as if they were choosing how to heat their own home, regardless of their current living situation. Renters are especially susceptible to hardship, often struggling when upfront costs surpass £2,000. Outright homeowners are generally more financially secure but still experience a significant affordability decline around £11,000, while homeowners with mortgages show signs of financial strain at a much lower threshold—around £5,000. For their rental property, landlords demonstrate the greatest financial resilience remaining below the 50% "not affordable" threshold between £500 and £15,000. However, projections indicate that even landlords would reach a stress threshold at £25,000, highlighting that their stronger position is not unlimited, particularly as costs escalate.

These differences in affordability by tenure help explain broader patterns in the data. Renters, in particular, appear to be driving early affordability stress across the overall sample. When this group is excluded from the analysis, the point at which upfront costs become unaffordable shifts from approximately £5,000 to £7,000. This is important to note, given that few renters would be likely to pay the upfront costs of replacing their heating system.

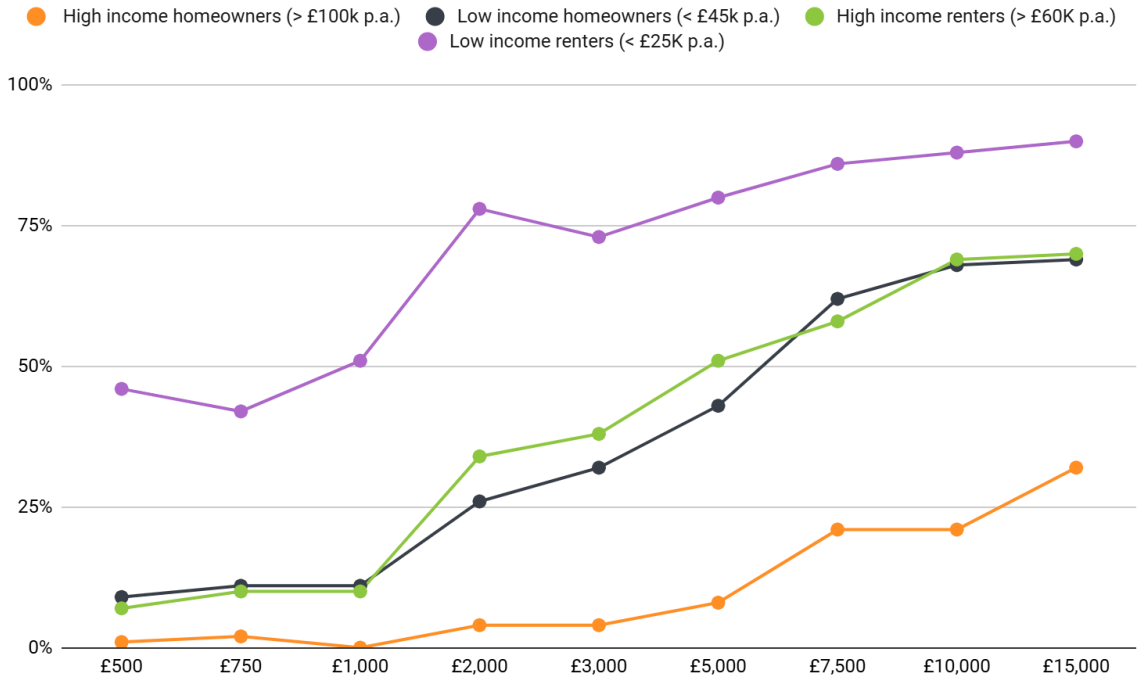
Figure 19 - When renters are removed from the analysis the affordability threshold shifts from around £5,000 to closer to £7,000.



Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view? Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding

Affordability was also examined by income level within both renters and homeowners. As expected, higher-income households, whether renting or owning, reported a greater ability to absorb upfront costs. However, differences persist when comparing tenure types at similar income levels. Low-income renters (with household incomes under £25,000 per annum) report widespread unaffordability at costs as low as £1,000. In contrast, low-income homeowners (with household incomes under £45,000 p.a.) show a more gradual decline, with the tipping point closer to £6,000. Even high-income renters (above £60,000 p.a.) report greater unaffordability than low-income homeowners across nearly all cost levels. While high-income renters show more resilience than low-income renters, they still cross the 50% unaffordability threshold at around £5,000—earlier than their homeowner counterparts with lower incomes.

Figure 20 - Perceived unaffordability for upfront costs by Low- and High-Income Renters and Homeowners



Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view? Note: The percentage represents the proportion of respondents who selected "I would not be able to afford this" at the corresponding price level.

This suggests that tenure shapes perceptions of affordability in ways that income alone does not fully capture. Even among individuals with relatively high incomes, renters show greater financial sensitivity to heating system replacement costs. We see this despite having asked all respondents to consider the costs as if they were responsible for the home themselves.

Willingness to Purchase Across CAPEX and OPEX Levels

Home heating decisions require a trade-off between upfront and running costs. Many sustainable home heating solutions have higher upfront costs but may offer savings in the long-run through more manageable monthly costs. To explore this, we conducted a Gabor-Granger exercise. The Gabor-Granger pricing analysis is a well-established method that determines the highest price that customers are willing to pay for a product by testing their purchase interest at different price points. Respondents were presented with various combinations of initial installation costs (CAPEX) ranging from £1,000 to £10,000, and monthly operating expenses (OPEX) ranging from £25 to £175. For each combination, participants indicated their willingness to purchase the system.

Households displayed the strongest willingness to pay for systems with low upfront costs. As CAPEX increases, perceived affordability diminishes, even when monthly operating costs are low. For example, at the lowest OPEX level of £25/month, acceptability drops from 84% at a £1,000 CAPEX to 58% at a £10,000 CAPEX. The decline in acceptance becomes more pronounced once CAPEX exceeds the £5,000 threshold, aligning with earlier findings about affordability stress points.

Figure 21 - Small operating expense increases shift people's perspective substantially

Survey question: Imagine your heating system needs replacing. Would you be willing to purchase a new heating system with an initial installation cost of £X and a monthly operating expense of £X (£X yearly)? Yes, I would be willing to purchase it. Note: The percentage represents the proportion of respondents willing to purchase at or below the corresponding price level.

While both cost components influence willingness to adopt, the data indicates that CAPEX may play a somewhat stronger role in limiting acceptability. Across all OPEX levels, acceptability steadily declines as CAPEX increases, without exception. For instance, at a fixed OPEX of £130/month, acceptability declines steadily from 42% at £1,000 CAPEX to just 23% at £10,000. However, OPEX remains important, particularly when initial costs are more affordable. At £1,000 CAPEX, increasing OPEX from £25 to £175/month reduces willingness from 84% to 18% — a 66-point drop. However, the same OPEX range at £10,000 CAPEX produces a smaller decline (from 58% to 10%), suggesting that OPEX is most influential when CAPEX is not already acting as a barrier.

Contextualising the results

To understand how the public trade-off between CAPEX and OPEX, we conducted a Gabor-Granger exercise. Participants received a randomised CAPEX level and then responded to an iteratively adjusting OPEX level in order to find the maximum they would be willing to pay. For example, if someone accepted an OPEX level of £100, then they would be asked about a new OPEX level randomly selected between £115 and £175. If they turned down an OPEX level of £130, then they would be shown £115. The process was repeated until a participant's "turning point" had been defined.

As expected in this type of exercise, some participants consistently accepted or rejected all OPEX values presented to them. This happened when their assigned CAPEX level positioned them in a range where every OPEX option was either entirely acceptable (if CAPEX was well below their affordability threshold) or entirely unacceptable (if CAPEX was well above their affordability threshold).

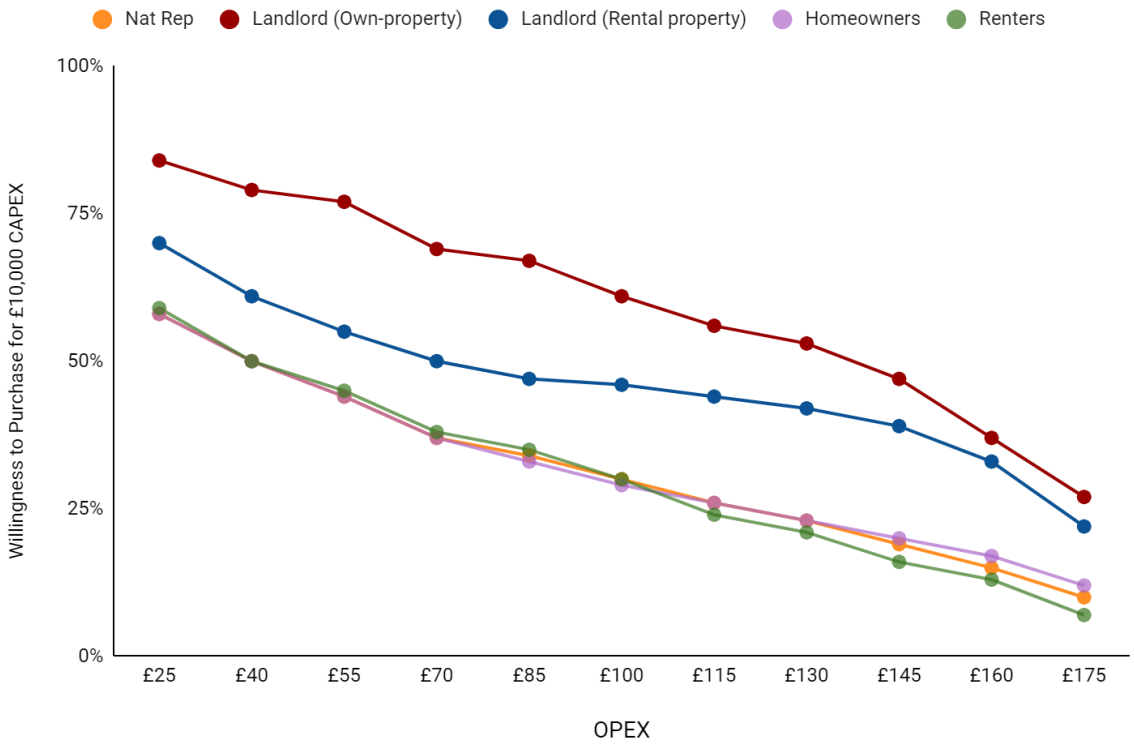
3.2 The impact of financial and tenure security on heat decisions

The path to low-carbon heating is shaped not just by costs, but by how households weigh those costs against their financial resilience, their ability to control property upgrades, and their awareness of alternative heating systems. Different combinations of income and tenure create different kinds of barriers to adopting.

Landlords were asked to consider both their own primary residence and their most recently let-out rental property when responding to questions about willingness to invest in heating systems. **They show the highest willingness to invest in heating systems in both contexts, even at high upfront costs.** For their own homes, at £10,000 CAPEX and £25/month OPEX, acceptance remains at 84%, far above the national average of 58%, reflecting their greater

financial resilience. Under the same CAPEX for their most recently let-out properties, acceptance is 72% at a £25 OPEX but falls below 50% once OPEX reaches £85. By contrast, for owner-occupied properties, acceptance does not fall below 50% until monthly OPEX hits £145. At the highest OPEX levels (£160–£175/month), willingness converges, suggesting that extremely high ongoing costs make both types of investments equally unattractive. Overall, landlords are more willing to invest more capital in their own homes than in rental properties, but they still invest more in their rental properties than the general population does in their own homes.

Figure 22 - Landlords show the highest willingness to pay for heating systems, even at high £10,000 *upfront costs.*



Survey question: Imagine your heating system needs replacing. Would you be willing to purchase a new heating system with an initial installation cost of £X and a monthly operating expense of £X (£X yearly)?: Yes, I would be willing to purchase it. Note: The percentage represents the proportion of respondents willing to purchase at or below the corresponding price level

Renters and homeowners, in comparison, exhibit lower willingness to invest in heating systems due to tighter financial constraints and differing priorities. All respondents were asked to decide as if they were choosing how to heat their own home, regardless of their current living situation. Renters are particularly cost-sensitive even when placed in a hypothetical homeownership scenario. Their willingness to purchase drops below 40% at relatively modest CAPEX levels (£1,000–£3,500) when OPEX reaches £100/month. Homeowners display slightly greater resilience but face similar constraints, with willingness

decreasing sharply beyond £5,000 CAPEX. At higher CAPEX values, such as £10,000, the distinction between renters and homeowners becomes minimal [See: Figure 22, above], as both groups encounter significant affordability challenges.

While income shapes willingness to invest, it does not fully explain the patterns observed. Low-income renters (with household incomes below £25,000 per annum.) are the most financially constrained, with willingness falling below 30% at relatively low total cost levels — often around £2,000 — when monthly payments exceed £70. High-income homeowners consistently report the highest willingness to invest, with more than half remaining willing even at £10,000 system costs and elevated monthly payments. However, high-income renters (with household incomes above £60,000 p.a.) and low-income homeowners (with household incomes £45,000 p.a.) show similar willingness to invest at mid-to-high cost levels. For both groups, willingness to invest in a £5,000 system declines steadily as OPEX increases, converging at around 30–40% when monthly costs reach £100–£115.

These findings mirror patterns observed in the previous section on upfront costs, reinforcing the idea that tenure plays a role in affordability perceptions and investment decisions which go beyond income alone. This suggests that renters' heightened cost sensitivity might be influenced by other factors such as differing perceptions of investment risk or less familiarity with large home-related expenditures. These behavioural differences, however, fall outside the scope of this study and cannot be directly tested with the available data.

FOCUS GROUP FINDINGS

Box 5. Tenure, income and heat decisions

We also saw this interaction of tenure and income reflected in our focus groups. Renters are very aware of rising energy costs and have already made changes to their heating habits to save money. Many renters expressed anxiety about future costs. All groups were relatively uninformed about low carbon and flexible alternatives, but income makes a difference to the level of agency they feel in addressing these concerns. As an example, when choosing rental properties, mid-income renters consider windows, energy ratings, insulation, and heating systems. Low-income renters often

do not, due to the high demand and limited options in the housing market, and the dominance of other factors - primarily location.

Low-income renters feel less able to make decisions based on energy efficiency and know less about the tools available to them to reduce bills. They also tended to be more passive, assuming that agency sat with their landlord and there was little use in holding strong views on heating and energy efficiency.

"It depends on the landlord, right? Like he's the one who's going to change. So if it doesn't affect his needs and like our needs, then it's fine for me and our friends. So it doesn't affect me, really."

Male, 23
Private tenant, Low income

Mid income renters are more likely than their poorer counterparts to see time of use tariffs and lower carbon alternatives as a positive opportunity to save money and improve their homes and environmental footprint.

"The first thing I look at is what windows it's got, what its energy rating is, and usually like how well it's insulated as well. The house I'm living in at the moment, its roof insulation is terrible. We must pump so much heat that just gets lost through the roof."

Female, 41
Social tenant, Mid income

Figure 23 - High-income renters and Low-income homeowners show similar willingness to invest

Survey question: Imagine your heating system needs replacing. Would you be willing to purchase a new heating system with an initial installation cost of £X and a monthly operating expense of £X (£X yearly)?: Yes, I would be willing to purchase it Note: The percentage represents the proportion of respondents willing to purchase at or below the corresponding price level.

High-income homeowners (with household incomes above £100,000 per annum) are best positioned to adopt low-carbon heating. A third (33%) plan to upgrade their heating system, and over a quarter (28%) are planning solar or other renewable additions. This group is the most familiar with advanced heating technologies (for example, 35% can explain what an air-to-water heat pump is), the most likely to say they would replace a heating system before it breaks, and the most environmentally engaged—56% view climate change as one of the most pressing issues, and 74% would like more information about reducing their carbon footprint.

Low-income homeowners (with household incomes below £45,000 p.a.), by contrast, face a more complex set of challenges. A large share face financial strain—79% cite high energy bills as a concern and 49% identify fuel poverty as a key housing issue. Most (74%) remain reliant on gas boilers, with little knowledge of alternatives: over 60% do not know their EPC rating, and just 10% can explain an air-to-water heat pump. While the majority would invest in a new system if upfront costs stay around £5,000–£6,000, only 11% anticipate upgrading

soon, and nearly half report no major home improvements planned—suggesting limited opportunity to act without external support.

Tenure matters — but so does future tenure

While renters typically lack control over heating system decisions, their intentions—especially around future homeownership—offer important insight into likely behaviours over time. This is particularly relevant in the context of this study, where all respondents were asked to imagine themselves as the decision-maker for their property.

Among **high-income renters**, a clear majority (60%) plan to buy a home within the next five years—including 14% within the next year. This group already shows a level of awareness and interest that matches or exceeds some current homeowners: **53% know their EPC rating**, and most are aware of key low-carbon technologies. As tenants, 44% want better thermal comfort and 43% seek energy-saving upgrades. When imagining ownership, their willingness to invest mirrors that of low-income homeowners—dropping off above £5,000—but their combination of awareness, income, and plans to purchase suggests strong potential for future uptake, given affordable options.

Low-income renters, however, remain in a more precarious position. Only 21% expect to buy a home in the next five years, and most have little influence over heating upgrades. The survey results indicate that awareness is low (32% know their EPC), and housing conditions are often poor. Few are disconnected from the energy system altogether—13% do not pay their energy bills directly. Even in a hypothetical ownership scenario, affordability stress appears early, often between £1,000 and £2,000. Here, barriers are not just financial, but reflect a broader lack of access to information, control, and feasible upgrade routes.

"A couple of winters ago, I just didn't know where the money was going. It was just like, you top up, and then it's gone... heating is expensive, but that was the first year where I was actually really stressed about it."

Female, 40
Council tenant, House hunting

"It's just not something that I know lots of information about, and looking at it it's kind of scary, the cost of the installations are quite scary too. But obviously I'm renting so if that was then covered, and as long as someone gave you the basic information and talked me through everything, I would be open to it."

Male, 66
Private tenant, Mid income

CHAPTER FOUR:

Future technology

4.1 Understanding what drives different technology choices

To better understand household motivations for adopting future technologies, we conducted a conjoint experiment using hypothetical system profiles. Conjoint experiments are a well-established method for analysing how people evaluate products, services, or policies by simulating real-world decision-making scenarios.

Our system profiles varied across six key attributes:

Table 1: Conjoint features, randomly varied between technology profiles

Feature	Item
Upfront cost	• £1,000 • £1,500 • £2,000 • £2,500 • £3,000
Running cost	• £50 per month • £75 per month • £100 per month • £125 per month • £150 per month
Indoor space	• Similar to a kitchen wall cabinet. • Similar to a washing machine. • Floor-to-ceiling cupboard
Outdoor space	• None • Similar to a kitchen wall cabinet • Similar to two washing machines side by side

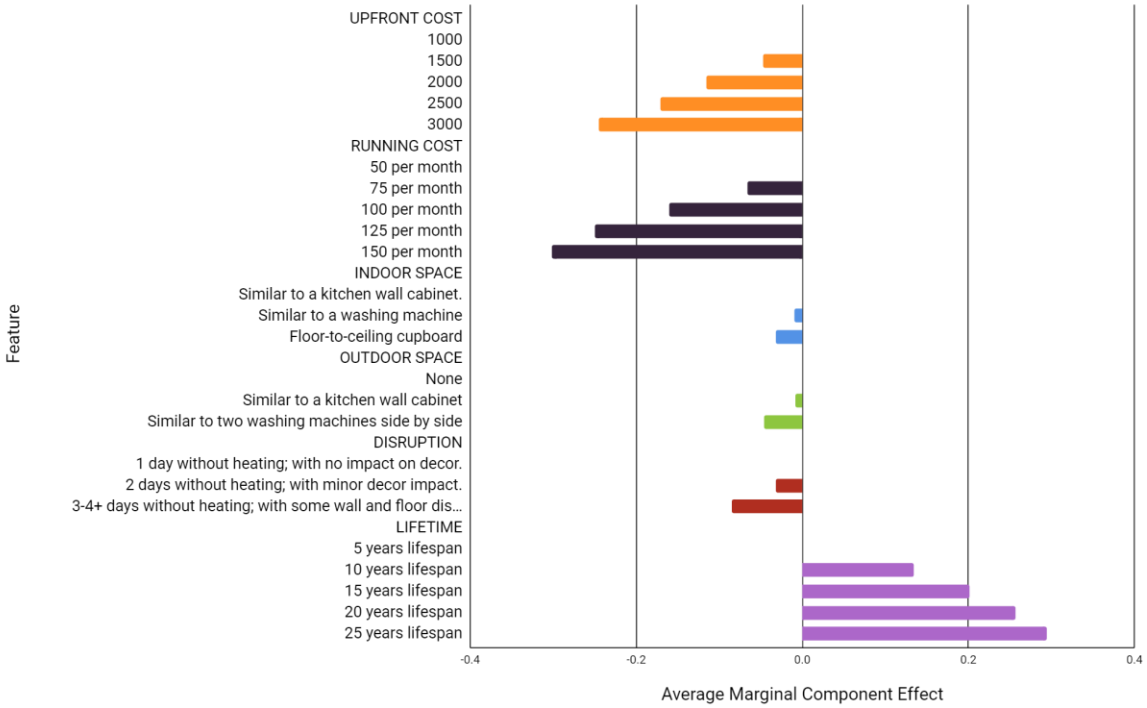
Disruption	• 1 day without heating; with no impact on décor. • 2 days without heating; with minor décor impact. • 3-4+ days without heating; with some wall and floor disruption.
Lifespan	• 5 years lifespan • 10 years lifespan • 15 years lifespan • 20 years lifespan • 25 years lifespan

These profiles were presented without names or visuals and prior to any questions involving actual technology descriptions. This ensured a tech-agnostic approach that focused participants on functional attributes rather than any preconceived biases or associations with specific technologies. Participants are therefore purely trading off attributes like lifespan, cost and space requirements.

Participants were presented with 6 pairs of hypothetical systems, each with randomly selected combinations of these attributes, and asked to choose which they preferred. A follow-up question asked them to rate the importance of each attribute on a scale of 1 (Not important) to 5 (Very important), allowing us to also measure their reported perceptions of each feature's importance.

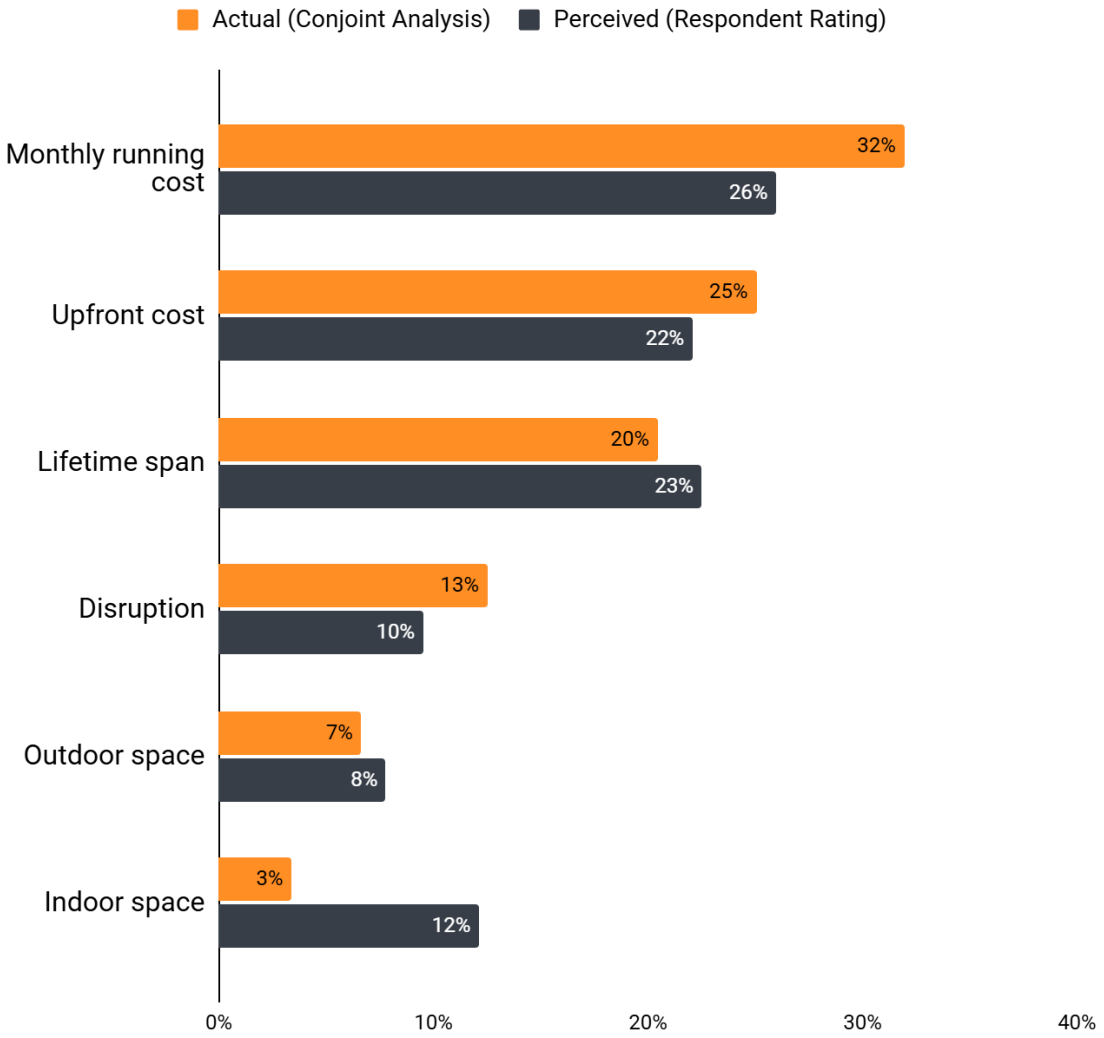
These results are analysed in the aggregate. There are 3,375 possible combinations of features from the above, so it is not possible to understand how an individual would respond to each one (we predicted each unique combination was assessed by an average of around 35 respondents). Instead, we can infer the impact of each feature on generalised selection rates across a number of trials. This is done using the Average Marginal Component Effect (AMCE), which measures how changing one attribute affects the likelihood of a respondent selecting a profile, averaged across all other attributes. The figure below represents this, with positive values indicating increased likelihood, negative values indicating a decrease, and longer bars representing stronger effects.

Figure 24 - Marginal Effect Plot



Survey Question (Conjoint Experiment): Imagine your heating system needs replacing. Below are two possible options with different features. You will be shown 6 pairs to choose from. In each instance, please review the information about each option carefully and then indicate the one you would choose as if you were deciding how to heat your own home. Based on the features presented, which heating system would you prefer to install in your home?

Figure 25 - Consumers place the highest value on affordability and durability when selecting a system.



Survey Question (Conjoint Experiment): Imagine your heating system needs replacing. Below are two possible options with different features. You will be shown 6 pairs to choose from. In each instance, please review the information about each option carefully and then indicate the one you would choose as if you were deciding how to heat your own home. Based on the features presented, which heating system would you prefer to install in your home?

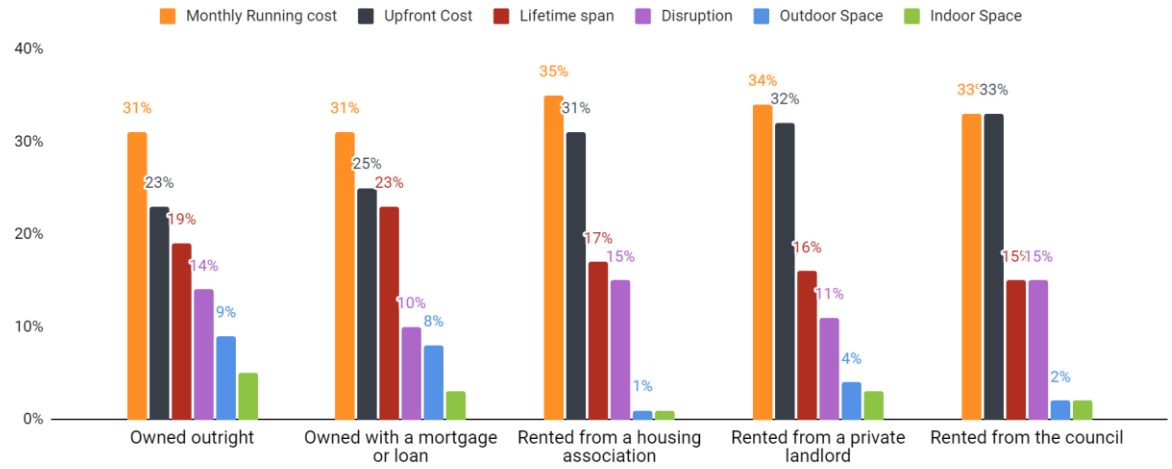
Survey Question (Respondent rating): When you were deciding between these options, how important were the following to your decisions? (1 = Not important, 5 = Very important)

Note: The percentages reflect the relative importance of each factor in the overall decision, totalling 100%. Higher percentages indicate factors that have a greater influence compared to others.

The results consistently show that running costs, lifespan, and upfront costs are the most important factors influencing consumer decisions about heating systems, both in the choice-based conjoint experiment and the importance ratings. Affordability emerged as a key concern, with systems that have low monthly costs (£50–£75) and upfront prices (£1,000–£2,000) being the most preferred options. Lifespan was also highly valued, with a strong preference for systems with a longer durability (20–25 years). The importance of these attributes remained broadly consistent across different demographic groups,

suggesting that affordability and durability are universally desired, regardless of factors like age, or household size and composition.

Figure 26 - Costs and lifetime span are universally desired, regardless of tenure.



Survey Question (Conjoint Experiment): Imagine your heating system needs replacing. Below are two possible options with different features. You will be shown 6 pairs to choose from. In each instance, please review the information about each option carefully and then indicate the one you would choose as if you were deciding how to heat your own home. Based on the features presented, which heating system would you prefer to install in your home?

Secondary factors, such as disruption and space requirements (both indoor and outdoor), were also influential but carried less weight compared to cost and lifespan. While participants valued systems with minimal downtime and compact designs, they were more likely to prioritise affordability and longevity over these considerations. For instance, consumers were 9 times more sensitive to monthly running costs than indoor space and 3 times more sensitive to lifetime than outdoor space, indicating a greater willingness to accept larger space demands for lower costs or longer product durability. Similarly, they also indicated twice as much willingness to endure more disruptive installations for lower upfront costs.

How can we explain the differences in perceived importance or running cost and upfront cost?

In the Gabor-Granger exercise, we found that OPEX was a secondary impact compared to CAPEX. Households display the strongest willingness to pay for systems with low upfront cost. Previous consumer surveys validate this finding - consumers are more likely to report that upfront cost is an important barrier to them investing in a heat pump, compared to concerns that it won't reduce their energy bills enough.[8] These surveys are however

[8] Public First, Upgrade: How to deliver better homes by 2030, Polling table 268, July 2024 and British Gas, Net Zero Action Rankings: Third Report, Polling table 110, October 2024

designed differently, they ask consumers to self-report barriers, rather than inferring the barriers based on the technology choices consumers make.

In the Conjoint exercise, participants evaluated hypothetical heating system profiles that differed in features such as running cost, upfront cost, installation disruption, and space requirements. We found that respondents prioritised low running cost over high upfront cost, which is different in the Gabor-Granger exercise.

This difference in prioritisation of features can be explained by the difference in price ranges and decision contexts tested in each exercise.

In the Gabor-Granger exercise, upfront costs (CAPEX) reached up to £10,000 (and even higher in hypothetical scenarios). When costs exceeded £5,000, a large proportion of respondents found the expense unaffordable, emphasising the importance of CAPEX over OPEX. In the conjoint, the highest CAPEX tested was £3,000. Within this more affordable range, people found the costs at least somewhat feasible, making monthly running costs (OPEX) more decisive.

We used a lower CAPEX range (up to £3,000) to reflect a scenario where upfront cost is within a feasible range for more households. This ensured that respondents could meaningfully weigh price and other product attributes rather than rejecting options outright due to affordability constraints.

High CAPEX triggers a "sticker shock" effect, where people become fixated on the immediate financial hurdle and may overlook the long-term savings from lower running costs. Lower CAPEX values are less likely to be a deal-breaker, so people become more sensitive to other features—especially monthly expenses—when deciding between heating systems.

Although the two experimental tests seem to contradict one other, they do not and reveal important insights on how consumers respond to CAPEX and OPEX:

1. Upfront costs set the boundaries for consumer choice. If a system's initial price is too high, most consumers will reject it outright, regardless of potential savings on running costs.
2. Once CAPEX is within a manageable range, running costs become a key driver. When upfront costs are lower, consumers feel more flexibility to consider OPEX as a deciding factor.

4.2 Evaluating choice for future technologies

As households prepare to replace their heating systems in the coming years, understanding technology choices is essential to determine energy system and consumer cost impacts. While financial considerations play a significant role in these decisions, other factors — such as awareness, perceived advantages, and practical limitations — also influence choices. To better understand how consumers will navigate these decisions in the future, we needed an approach that could capture real-world trade-offs rather than simply asking consumers what they think they might choose. To achieve this, we conducted a MaxDiff exercise. MaxDiff is a questioning technique that asks respondents to make repeated binary choices between pairs of options, allowing researchers to identify which items are most and least preferred overall by forcing direct trade-offs.

Participants were shown 13 pairs of hypothetical heating system profiles [See: Technical Report for more information] and asked to choose which one they would most prefer to install in their home. We provided clear and structured descriptions of each system as some heating technologies are less common. Each heating system profile included:

- Images of the system
- Key features of the system:
    - Space requirements
    - Installation time and disruption
    - Average running and installation costs[9]
    - Technology lifespan and maintenance
    - A short overview explaining how the system works and its environmental impact

Through this analysis, we can rank the technologies based on their weighted preferences, offering a more accurate representation of how consumers prioritise different heating solutions.

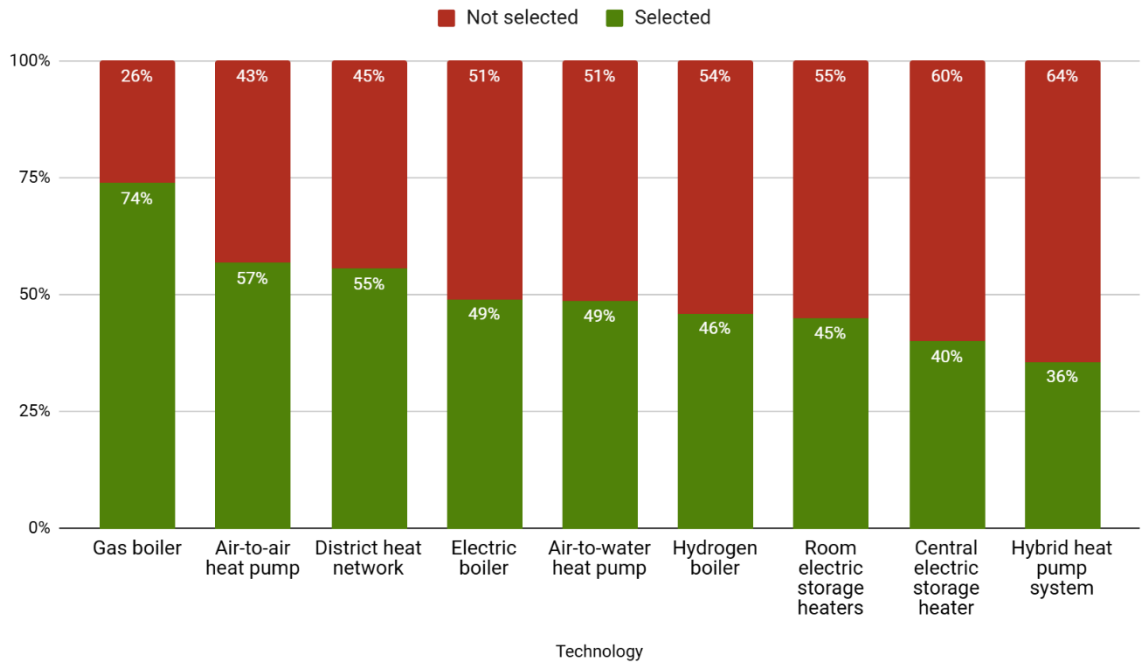
To quantify preferences, we calculated the selection frequency of each technology based on its appearances in paired comparisons by dividing the number of selections by the total number of appearances. This provides an indication of the relative appeal of each technology when directly compared to alternatives.

Results show that 74% of the times that participants were shown a gas boiler option, they selected it over the alternative. This indicates that they are currently the dominant option

[9] For heat pumps (air-to-water and air-to-air), installation costs were presented with government grants applied — for example, "£11,800 (£4,300 after government grant)". For other technologies the prices are hypothetical or based on available data.

in terms of preference. Air-to-air heat pumps and district heat networks follow, showing moderate popularity but still significantly behind gas boilers. Electric boilers and Air-to-water heat pumps sit in the middle of the scale, with lower preference levels. At the lower end, hydrogen boilers, room electric storage heaters, and central electric storage heaters see limited preference. The hybrid heat pump system ranks lowest, indicating minimal preference in comparison. This distribution highlights the strong position of gas boilers while suggesting that alternative heating technologies have varying degrees of preference, with some lagging significantly behind.

Figure 27 - Selection Rates of Heating Technologies: Preferred vs. Not Selected Options.



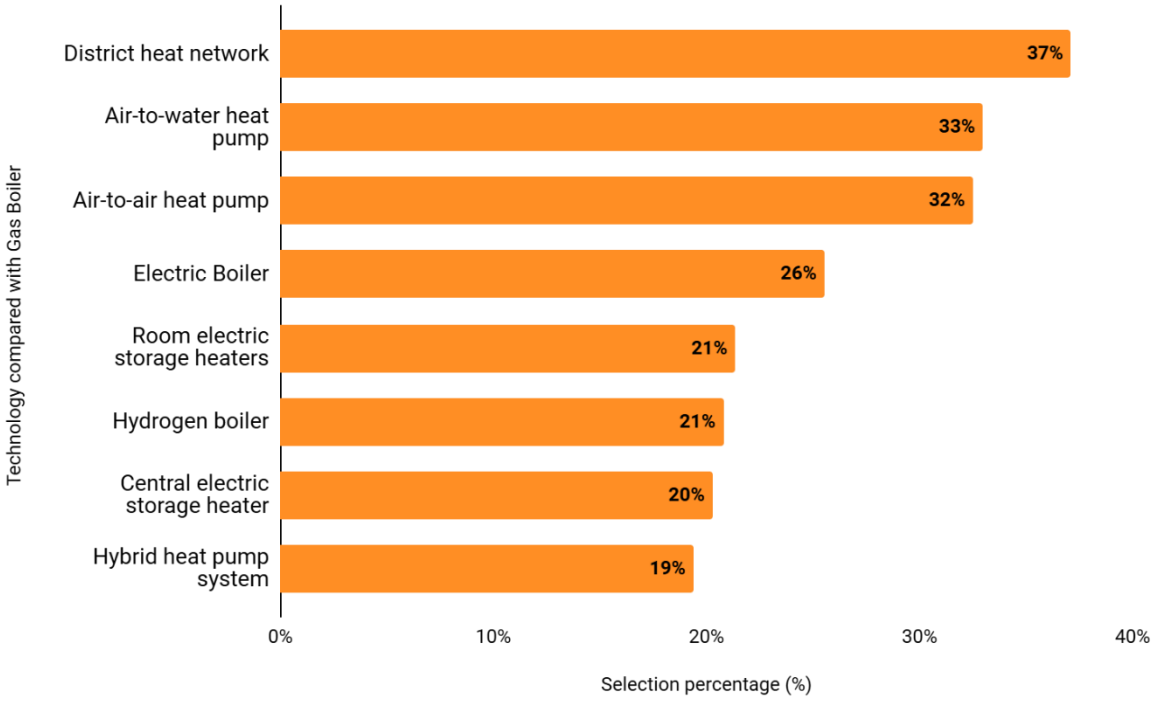
Survey Question: Between the following two options, which heating system would you MOST prefer to install in your home? Note: The percentage shows how often each technology was selected out of the times it appeared in pairwise comparisons. Total may not equal 100% due to rounding.

Across all demographics—including age, income, tenure, and region—gas boilers remain the top choice, with air-to-air heat pumps and district heat networks consistently ranking in the top three. Those who already have a gas boiler select this option 81% of the time it is shown. Younger respondents were more inclined to select alternatives to gas boilers, though they would still typically lean towards the gas boiler option (picking it 63% of the time), whereas the oldest respondents were more consistently inclined to the boiler option (picking it 83% of the time).

While income did have an impact, it was only among those on the highest incomes within the sample (with household incomes at least £100,000 p.a.). The gas boiler option would be

selected 74% of the time it was shown to those earning less than £100,000 each year, but for those earning more this dipped to 60%. Similarly, for landlords when considering their own homes it dipped to 63%. We see a smaller dip among those who indicated that the environment was among their chief concerns, to 69% selection, again indicating that ultimately it is affordability which shifts adoption.

Figure 28 - Proportion of times that an alternative technology was selected when compared to a Gas Boiler. District Heat Networks were the most likely to be picked over gas boilers.



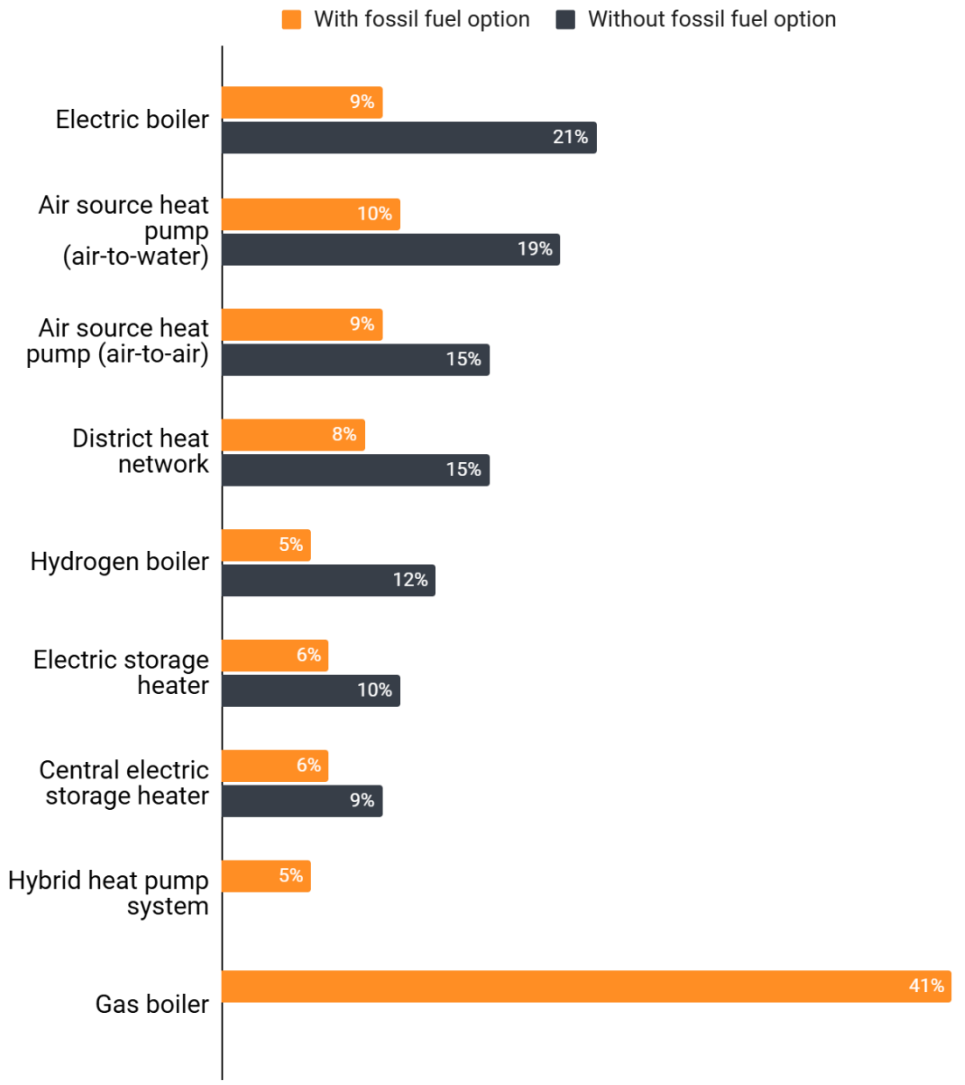
Survey Question: Between the following two options, which heating system would you MOST prefer to install in your home? Note: The percentage shows how often each technology was selected out of the times it appeared in pairwise comparisons. Total doesn't add up to 100% because each technology is evaluated independently based on how often it was selected in its comparison with Gas Boiler, not as parts of a whole.

It is important to note that this analysis provides a comparative measure of how different heating technologies perform against one another in direct choices, rather than indicating absolute desirability or expected adoption. What we can infer is that, when the information is laid out to people and they are forced to choose, gas boilers are the dominant choice.

Implications for a fossil fuel ban and grants

We set out to understand how decisions about home heating would be made if fossil-fuel technologies were unavailable. To do this, the sample was split into two. Half of the respondents were presented with home-heating systems with fossil fuel options included in the options, half without them included. This question was after the MaxDiff exercise, so the participants were already somewhat familiar with the technologies described. Naturally, this approach cannot fully capture what a hypothetical decision made in the context of a removal of fossil fuel options or equivalent would be like, but it provides some indications as to the impact of a potential gas boiler phase out.

Figure 29 - Home heating choices with and without fossil fuel options presented



Survey Question: Which heating system would you choose if your heating system reached the end of its life today? [See: Technical Report for full item description]. Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding.

Our results indicate that electric boilers are the main beneficiary from fossil fuel removal, becoming the most selected option (21%). However, under these conditions Britons are willing to consider a wide spread of technologies.

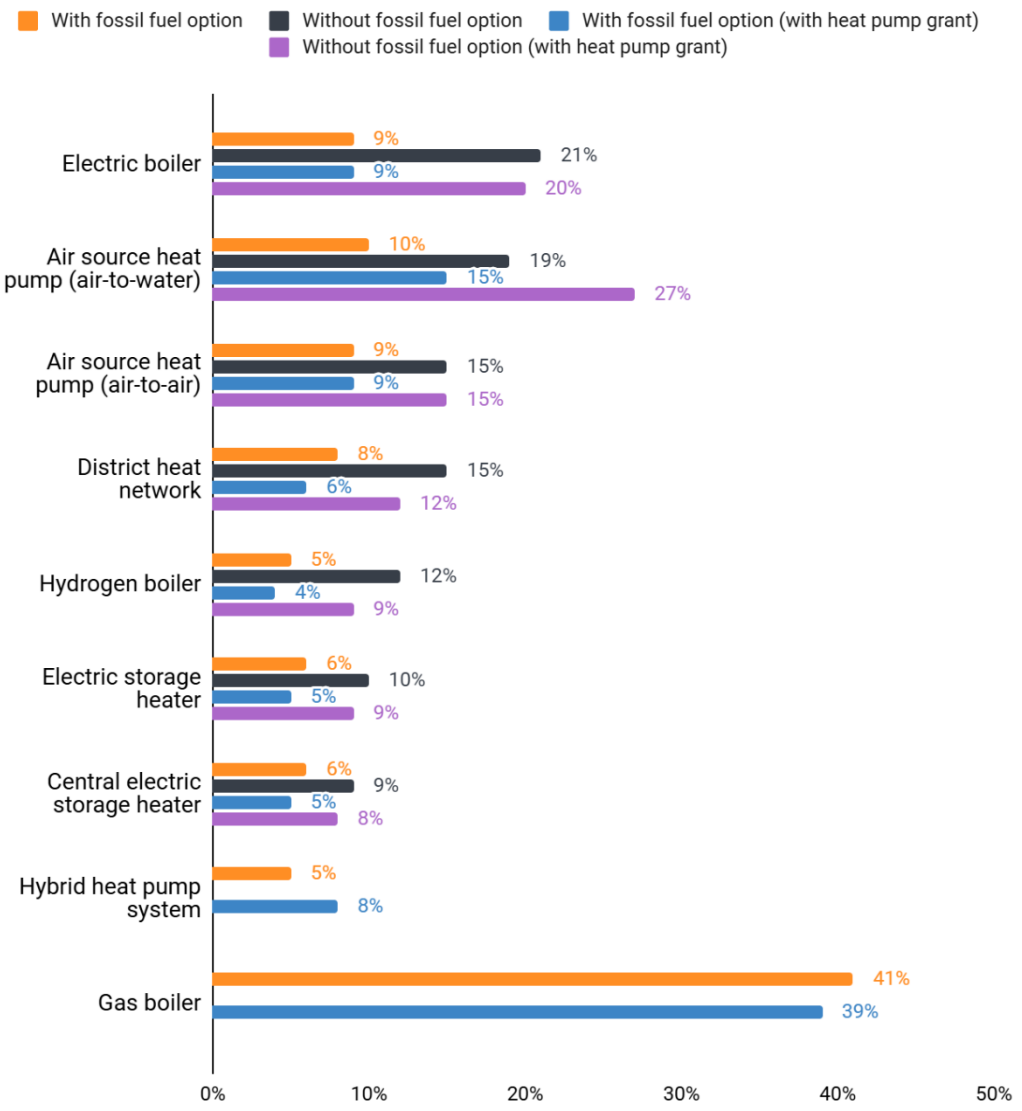
Grants are a key tool in the government's plans to hasten the switch to lower carbon heating systems. To explore the effectiveness of this strategy, we split the sample further in two, with half of respondents seeing the list of technologies with government grants included in the price calculation, and half without these grants. The adoption of air-to-water heat pumps increased by 8 percentage points when grants were provided, meaning it became the most adopted technology when fossil fuels were not an option (27%). Interestingly we saw no impact on the rate of selection for air-to-air heat pumps when grants were included. Grants increased interest only in the air-to-water option. We cannot be sure of the driver of this, though it could relate to the higher running costs for air-to-air options (£552/year vs. £365/year) as the grants bring the two heat pump options to parity on CAPEX, or to other specifics such as the requirement for blowers in each room.

However, when fossil fuel options were presented, preference for gas boilers stayed level no matter whether grants were offered or not (41% without grants, 39% with grants, a difference that was not significant at the $p<0.05$ level[10]). The results indicate that these grants are likely to have the biggest impact if fossil fuel options are not available.

When provided with fossil fuel options, age played a significant role in option selection. Between 25% and 26% of 18-24 year olds would select a gas boiler, compared to 55%-58% of those aged 65 and over. After fossil fuel options were removed, we note that younger respondents tended to gravitate more towards electric boilers than heat pumps, whereas older individuals were more likely to select heat pumps. In part, this could be driven by a misunderstanding of the technology. We find that 22% of the youngest respondents report already using an electric boiler in their home, compared to just 1% of those aged 65.

[10] A z-test for the difference between two proportions was used to compare the proportions (41% without grants vs. 39% with grants). The z-test evaluates whether the difference between two independent population proportions is statistically significant.

Figure 30 - Home heating choices with and without fossil fuel options and grants presented



Survey Question : Which heating system would you choose if your heating system reached the end of its life today? [See: Technical Report for full item description]. Note: Percentages represent the proportion of respondents who selected each option. Total may not equal 100% due to rounding.

4.3 Additional decision factors raised by the qualitative research

Of course, not every factor in decisions about heating systems can be captured by quantitative analysis. That is why we also carried out qualitative research amongst key demographic groups. In addition to the factors covered in the poll, and the desire for control - which is covered extensively above but also applies to district heating, particularly - focus group participants raised the following categories of concerns about installing a new heating system:

- **Concerns about the practicality within particular types of property.** Participants wanted to know whether there was space for heat pumps in flats and where external units would be fitted. How would the process work in leasehold properties, they asked, or where a management company ran their property. Some people also raised concerns about whether new technologies would work in older, poorly insulated properties in which it might be difficult or expensive to improve the energy efficiency.

"I think it depends. [My properties] are all flats or leasehold flats. So I couldn't just do that. Where'd you put that outside unit, that fan thing. You can't put it on for everyone. You know, they're not going to all run on one."

Female, 45
Landlord, Larger portfolio

"Can you cover it? Though? Are you allowed? Because obviously it's going to need some. Surely, it needs ventilation. And then if you've got kids as well, young children playing in your garden that's just a logistical nightmare? "

Female, 40
Homeowner, New buyer

- **Concerns about reliability and a lack of trained engineers.** Reliability is a key feature identified in the focus groups and one of the reasons why the public feel nervous about technology with which they are unfamiliar. They don't feel confident that they could deal with any issues that arise, nor were they certain that an engineer would be available when they needed one in an emergency. This was in stark contrast to the present state of affairs where every focus group participant knew who they would call if their boiler malfunctioned.

"I'm also sceptical about the running cost, prices and the lifespan, considering that this technology has been around for five or so years, how do they know it's gonna last for 15? So, yeah, I'm very sceptical about that. Like, what's the rate of it breaking down? What are the repair costs like for me?"

Male, 30

Homeowner, Low income

"My worry is, if my tenant says, 'Oh, your electric source heat pump's broke', and then there's a lack of engineers. We always hear about there not being enough government roll out of these things. Is there gonna be enough trained engineers to come and do it? Like they failed with smart meters. I've tried to book with British Gas multiple times. They never turn up."

Male, 28

Landlord, Small portfolio

Reliability was a particularly important factor for house-hunting new buyers as they considered properties. Buyers were especially nervous about having to do an emergency replacement with a significant outlay at a time when their savings had been reduced by buying a home. In the focus groups, buyers estimated a higher cost for replacing their heating system than homeowners did. This was likely because new buyers had engaged on this topic more recently. In contrast, few settled homeowners had thought about replacing their system in recent years but they were more likely to consider running costs compared with boiler age when house hunting than new buyers.

"When viewing the homes in October, that was one of my first questions, because in a home, it's a big expense to replace the heating system. You then want to make sure you're not having a big expense while moving in to replace the heating system, and you want it to at least last a few years."

Male, 32

Homeowner, House hunting

- **Concerns about noise levels.** Noise is another feature that is hard to capture in a quantitative survey but was a concern for some participants, especially when discussing the two heat pump options. With air-to-air pumps, the internal units themselves were considered a source of noise, the air-to-water pump was considered a potential source of nuisance noise both to the householder and their neighbours.

"I would think that would make a noise that would really just irritate me, to be honest, and a lot of the other ones, it's the amount of space they take up, some of the flats above any space, and then you put in the system there with the cylinder and everything else, and that's half a bedroom gone."

Male, 61

Social housing tenant

- **Scepticism about the long-term viability of current alternative heating technologies.** While the public are open to the idea of low-carbon heating, there is a low level of suspicion over whether these are, indeed, the settled options for the future, or actually another option will become available if we wait a bit longer. This is compounded by concern over whether Great Britain's infrastructure is sufficiently prepared for widespread adoption of electric heating.

"We're seeing an awful lot of moves around hydrogen, and certainly in the motor industry, that's starting to move ahead. And there are boilers which can work on hydrogen. Hydrogen systems are in place which can be adapted to hydrogen. It's just not the thing that the government is pushing. So, you know, I'm not going either way."

Male, 70
Landlord, Small Portfolio

"I'm wondering is the technology advanced enough that it's actually going to be a benefit, and would I need to be using it a lot more than I am my current boiler to get the benefits out of it?"

Male, 38
Homeowner, Mid income

- **Concerns about electrification of heat due to high (and variable) electricity costs.** Concern about infrastructure readiness is related to concerns about electricity prices being high - and their potential to rise still further. Households are nervous about becoming reliant on a single energy bill if that might prove an expensive mistake.

"I wouldn't want to put my tenants in a position where they have to have an electric boiler and have like, inflated costs, if not necessary. "

Female, 49
Landlord, Small portfolio

- **Complexity and aversion to the new vs familiarity.** Perhaps even trickier to quantify is the impact of perceived novelty and complexity. This has two downsides for the public. First, homeowners want to weigh up costs and benefits of alternatives. They are interested in how running costs might be cheaper and are keen to "crunch the numbers" on alternative heating systems - dealing with a new technology with few examples to learn from makes this process harder and more intimidating. Second, when considering the operation of the heating system itself, the public were put off by the idea of having to learn how a new technology worked. They assumed it would take 'brain space' that they simply did not have, and add complexity to their lives. This was seen as a major downside.

An example from our focus groups: the case of the electric boiler. Our poll showed a discrepancy: electric boilers score less well when presented in a "tech agnostic" manner with no name or photo and better once a name and photograph are provided. This discrepancy may point to external factors such as consumer familiarity or preconceived biases that influence responses in simulated real-world scenarios but cannot be fully accounted for in a technology-agnostic experiment.

In light of the qualitative findings we have just described, this finding is less surprising. Britons are keen on alternative heating systems that look as much as possible like what they already know.

Electric boilers tested very well in the focus groups, despite our hypothetical technology profiles showing that they have a far higher running cost than heat pumps or district heating. This result appears to contradict the overwhelming feedback that participants are struggling with bills and are prepared to go to great lengths to reduce them.

However, it is completely in line with our other findings: that Britons are concerned about adding additional complexity to their lives, do not trust low carbon alternatives that they perceive as 'innovative', and worry about the many practical changes that would be required to install heat pumps or the loss of control that would result from them moving to district heat solutions.

"I think I'd prefer the electric boiler, only because it just looks neat and small. All the others seem to be massive and it's just seems to require a lot of work, whereas a little electric boiler just seems to be quite easy and that's all I want, really, something simple, the more things you have, the more complicated, and the more things that are going to go wrong."

Female, 35
Homeowner, Mid income

"I'm not sure where in my house or garden I'd put that fan thing, and does it have to be always on? It looks potentially quite noisy. And then that [water tank] on the right. It looks huge. It looks like sort of six foot big. I'm not really sure whether that's going to go. My loft, maybe? So, yeah, purely aesthetic, I'd go for the electric boiler."

Male, 34
Homeowner, Low income

"Personally, if I was going to go for any of those, I'd go for the electric boiler, because one is minimal disruption. So there's going to be, you know, less upheaval in the house. Although the running costs are not cheap, they're not that different to what they are now. But it's cleaner energy, which I assume this is what this is about - environment."

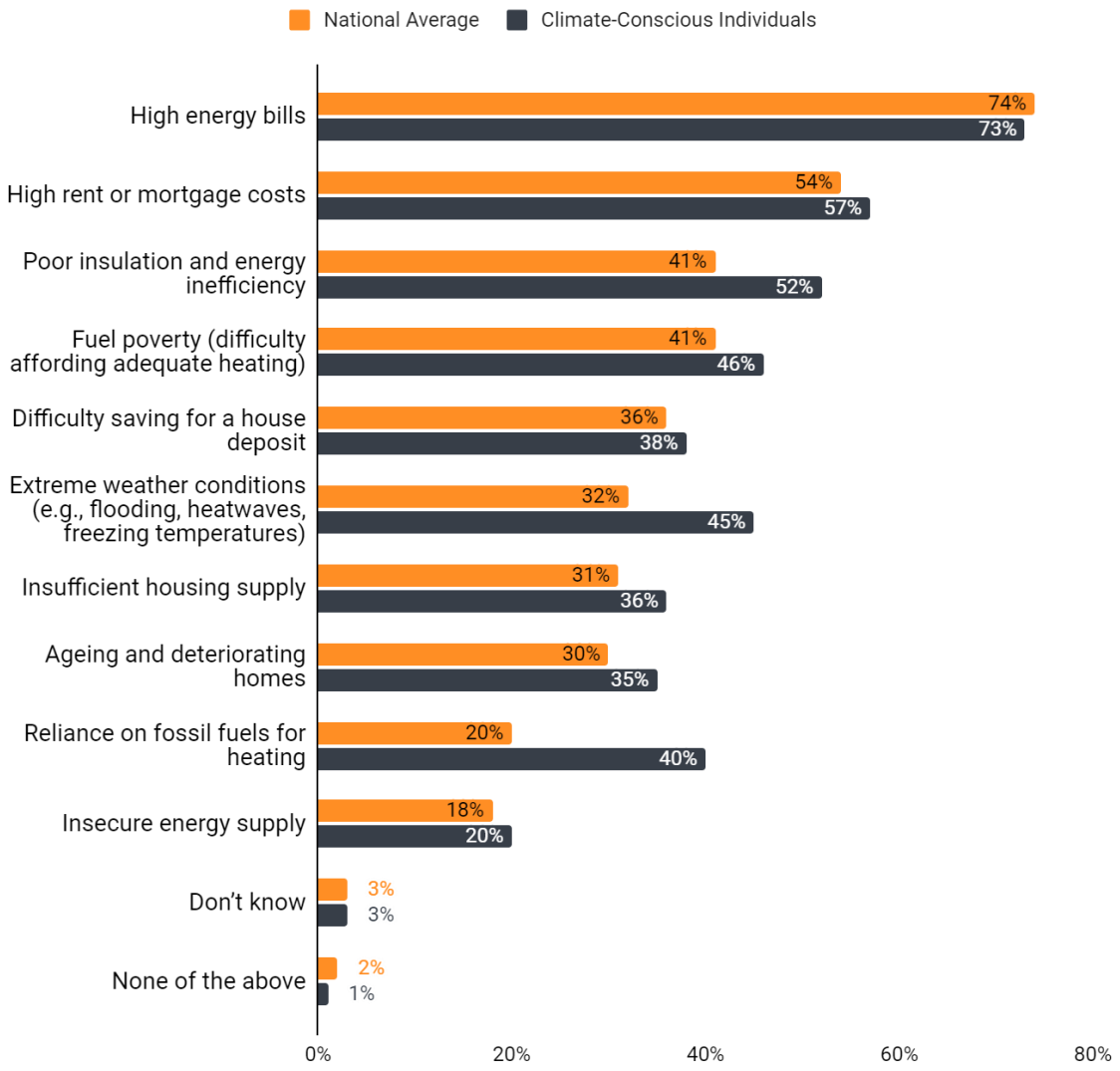
Male, 61
Social housing tenant

Appendix

5.1 Additional graphs and tables

Top British housing issue by climate conscious individuals

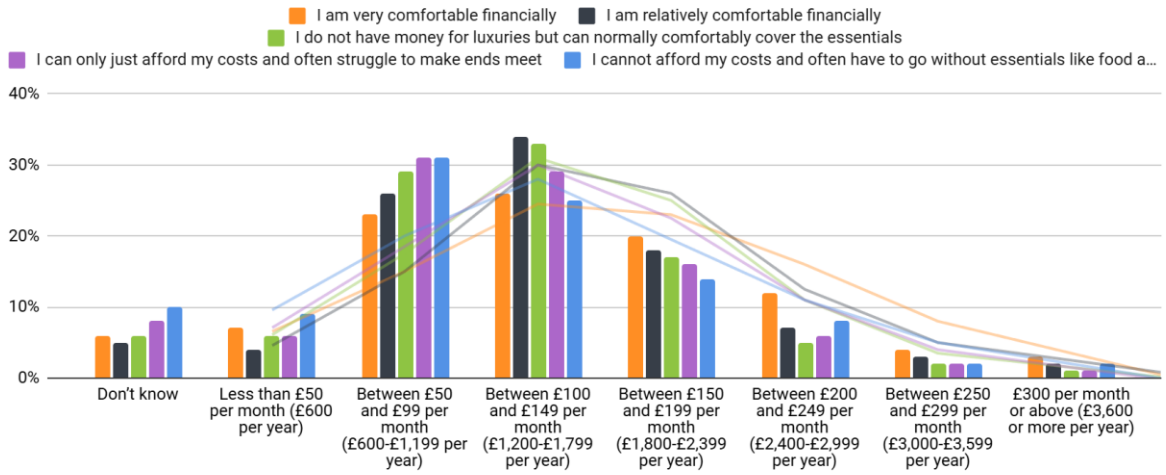
Figure 31 - Climate-Conscious Individuals prioritise energy use and decarbonisation



Survey question: In your opinion, which of the following are the most important issues currently facing British homes and housing? Select all that apply. Note: Percentages represent the proportion of respondents who selected each option. Totals may exceed 100% because respondents could select more than one option.

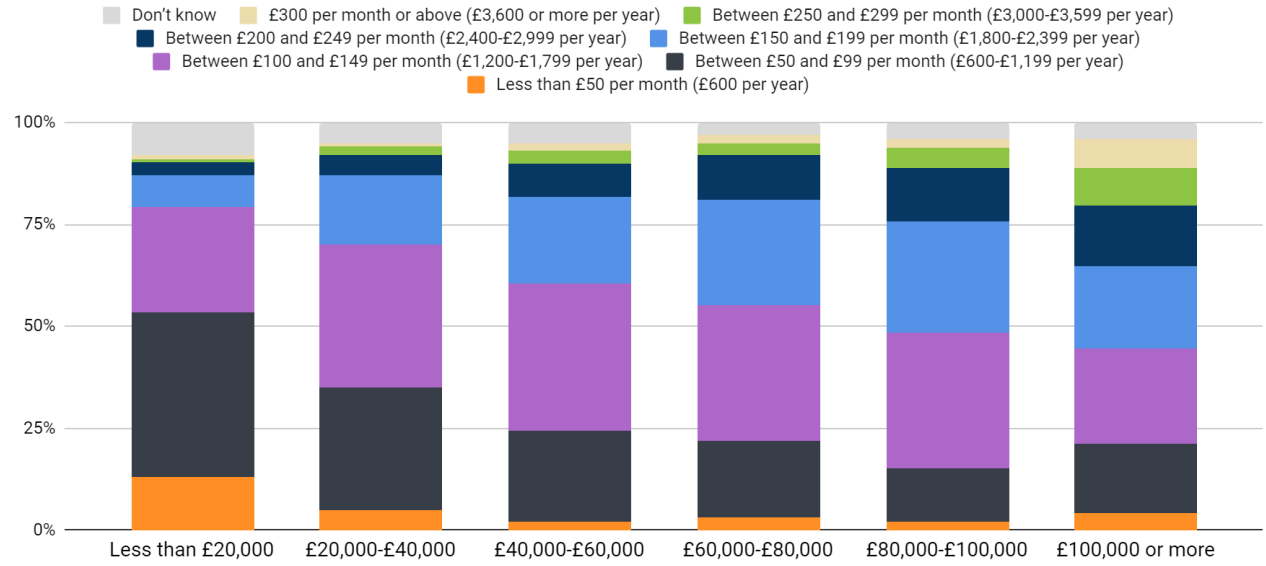
Current monthly gas and electricity bill by financial comfortability and income

Figure 32 - by Financial Comfortability



Survey question: Which of the following is closest to what you currently pay for your energy bills (gas and electricity) each month? Please give your best estimate.

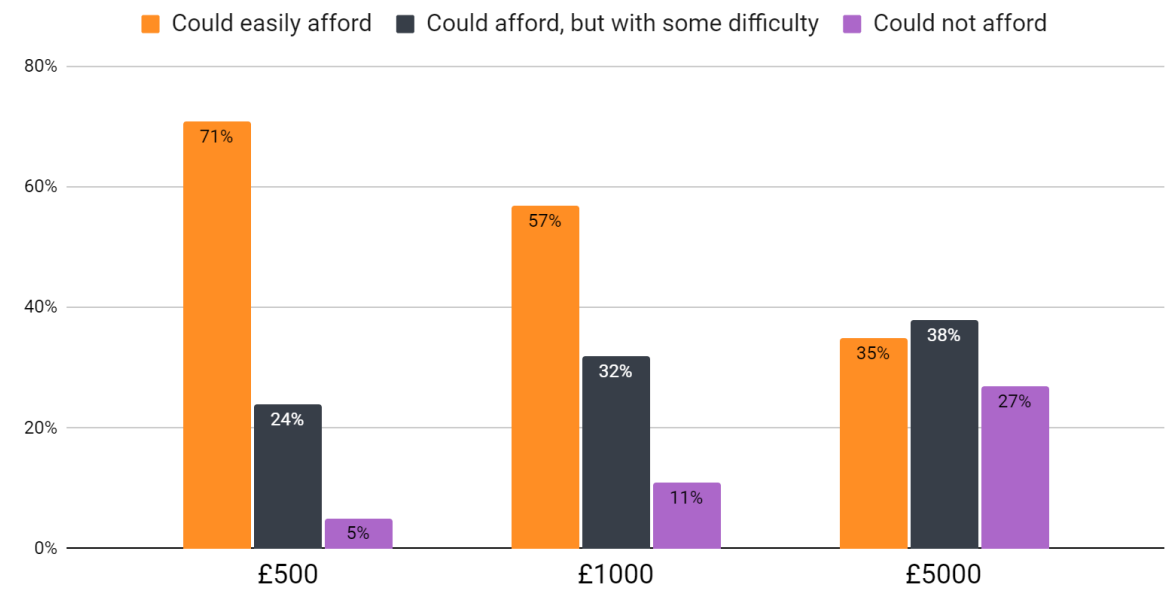
Figure 33 - by Income



Survey question: Which of the following is closest to what you currently pay for your energy bills (gas and electricity) each month? Please give your best estimate.

Financial Readiness

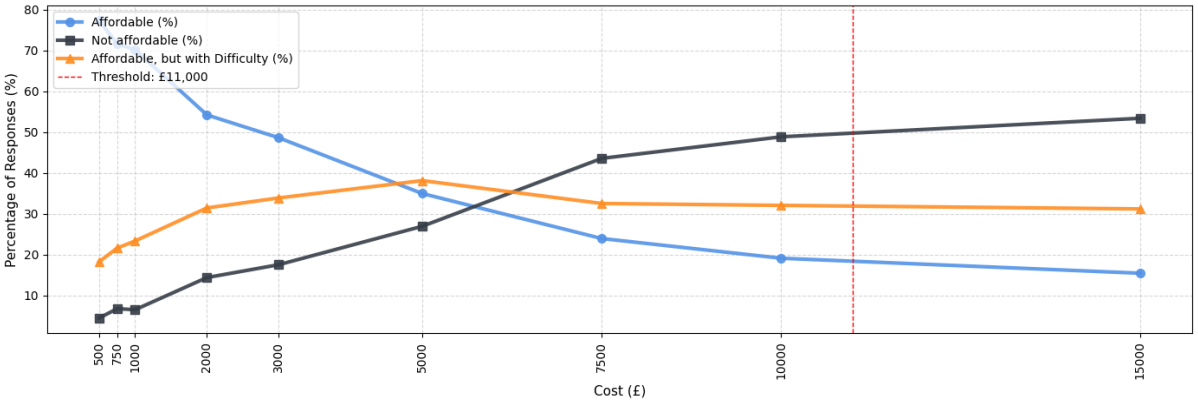
Figure 34 - by Landlords



Survey question: If your household had to find money for an unexpected emergency expense, could you afford to pay the following amounts? This might be to pay for something like urgent home or car repairs, or to deal with a health problem etc.

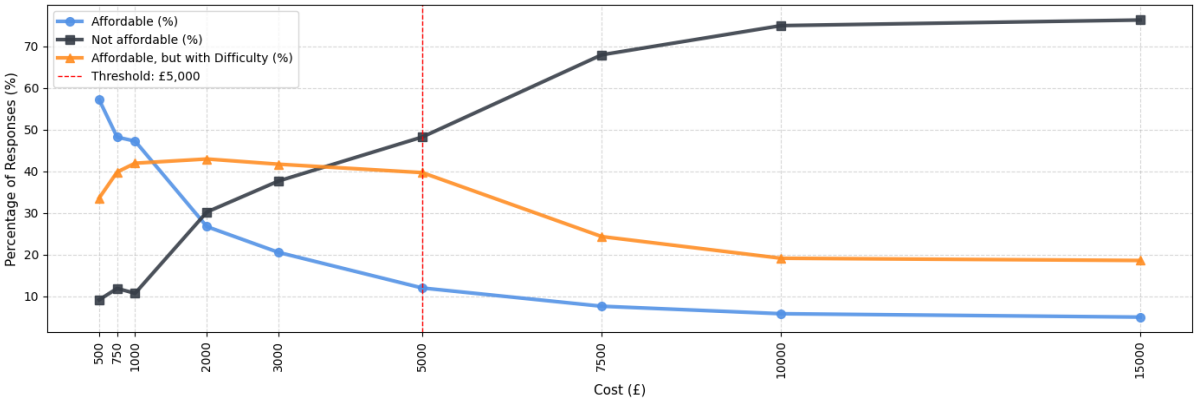
Affordability across different types of housing tenure and ownership

Figure 35 - Owned Outright



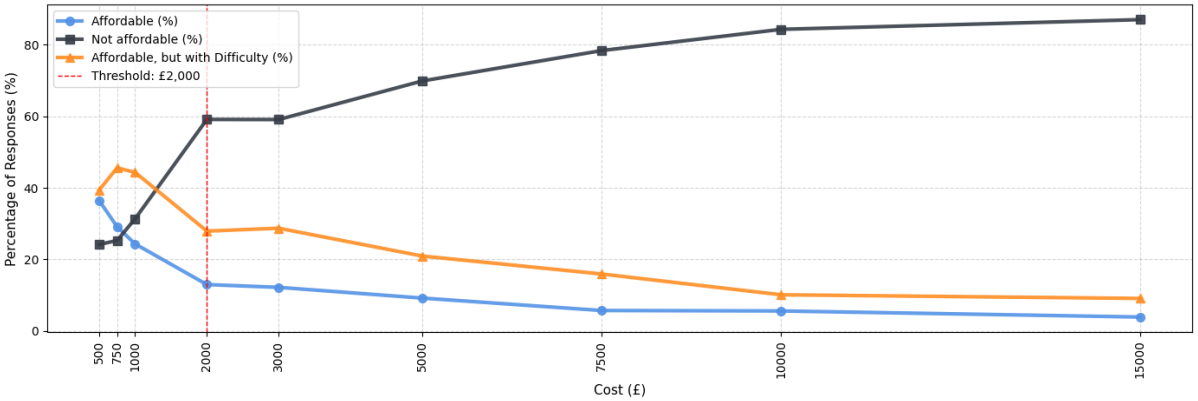
Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view?

Figure 36 - Owned with a mortgage or loan



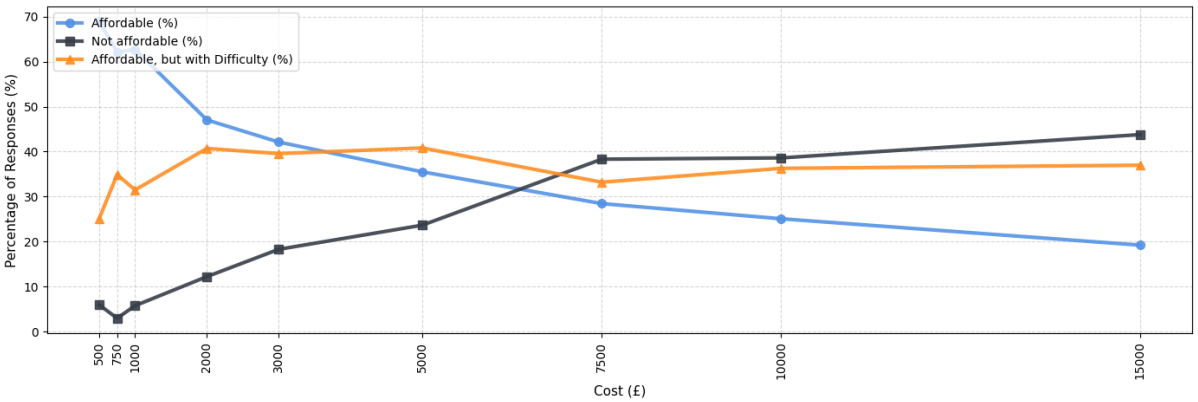
Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view?

Figure 37 - Rented from a private landlord



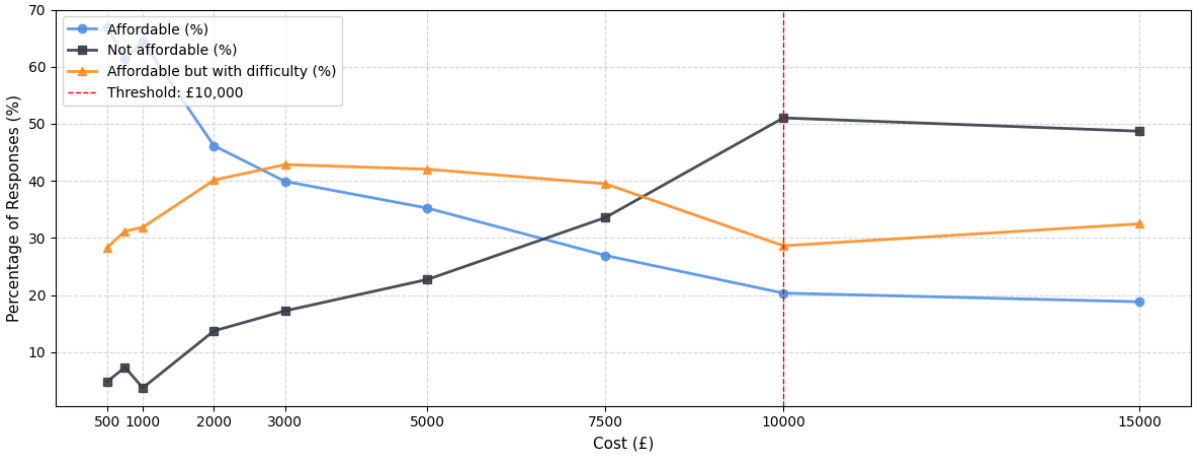
Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view?

Figure 38 - Landlords for their own property



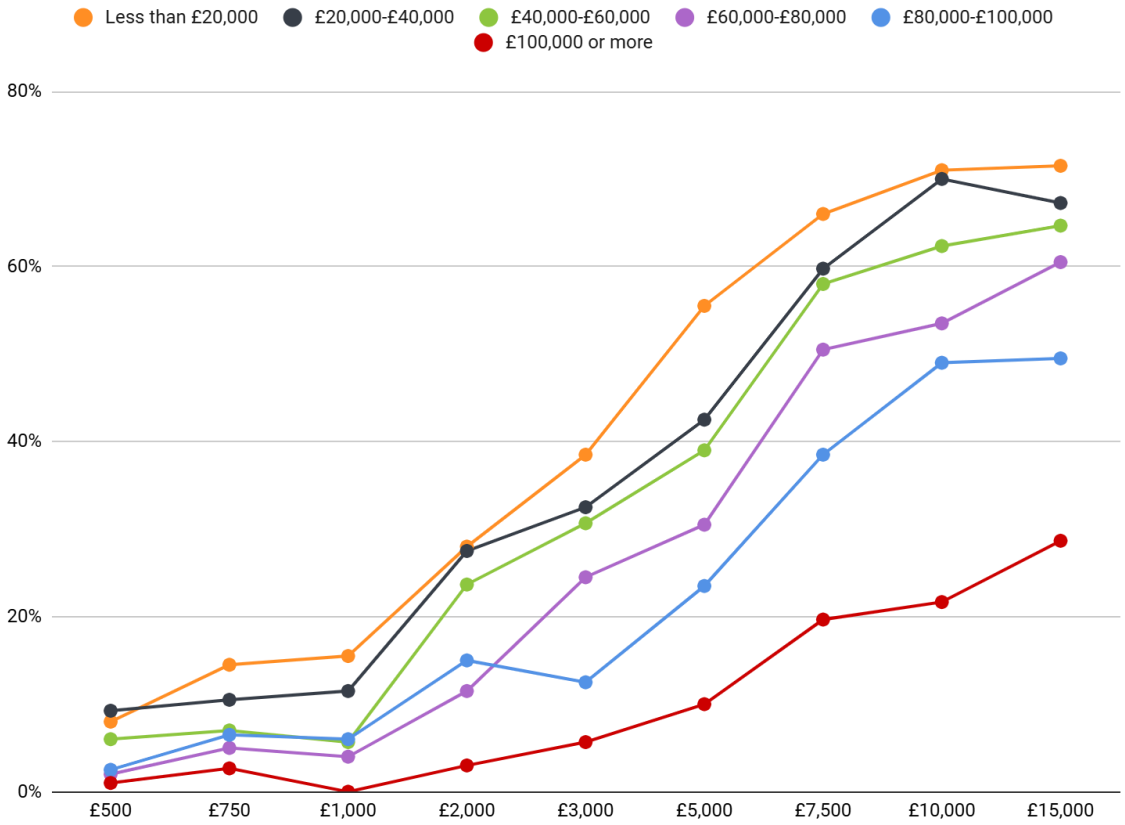
Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view?

Figure 39 - Landlords for their most recently let out property



Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view?

Figure 40- Perceived Unaffordability for upfront costs by Income for Homeowners



Survey Question: Imagine your heating system needs replacing, and the best value for money replacement you could find was £X, which of the following comes closest to your view? Note: The percentage represents the proportion of respondents who selected "I would not be able to afford this" at the corresponding price level.

5.2 Technical Report

The results detailed in this report are produced by a nationally representative sample of 9,758 GB adults, surveyed by Public First. Unless otherwise specified, all results are from this survey.

1. Sample and Sampling Approach

Public First surveyed 9,758 adults in GB online, from the 5th to the 16th December 2024. All respondents are from panels where participants volunteer to take part in research in return for incentives. Our sample aimed to be nationally representative on combined age and gender, region, and socio-economic grade. The results are weighted to ensure they are representative on these measures. The sample breakdown is as follows:

Group	Category	Sample	National Average
Gender	Male	4746	49%
	Female	4987	51%
Age	18-24	1283	14%
	25-34	1606	17%
	35-44	1627	17%
	45-54	1699	17%
	55-64	1452	14%
	65+	2091	21%
Socio-Economic Grade (SEG)	AB	2766	27%
	C1	2572	26%
	C2	2062	22%
	DE	2318	25%
Region	London	1348	14%
	South West	830	8%
	South East	1314	13%
	East of England	897	9%
	East Midlands	723	7%
	West Midlands	929	9%
	Yorkshire & The Humber	844	8%
	North East	430	4%
	North West	1097	11%
	Scotland	842	9%
	Wales	504	5%

The breakdown for other relevant categories is as follows:

Group	Category	Sample
Tenure	Own outright	3565
	Own with a mortgage or loan	2361
	Rented from a private landlord	1805
	Social Renters[11]	1669
Landlords	Private Landlords	422
	Social Landlords	534
Household Income	Less than £10,000	521
	£10,000 - £14,999	693
	£15,000 - £19,999	703
	£20,000 - £24,999	937
	£25,000 - £29,999	976
	£30,000 - £34,999	845
	£35,000 - £39,999	709
	£40,000 - £44,999	630
	£45,000 - £49,999	499
	£50,000 - £59,999	788
	£60,000 - £69,999	582
	£70,000 - £79,999	397
	£80,000 - £89,999	263
	£90,000 - £99,999	243
	£100,000 - £124,999	271

[11] In the social rented sector, for example through a local council or housing association.

	£125,000 - £149,999	156
	£150,000 or more	127
Tenure by Income	Low-income renters (below £25,000 per year)	1635
	High-income renters (above £60,000 per year)	398
	Low-income Homeowners (below £45,000)	3114
	High-income Homeowners (above £100,000 per year)	471

The margin of error on the total sample is less than 1%, and for groups of 1,000 it is +/- 3%. The size of the sample means that errors are more likely to occur as a result of question misunderstanding, misreporting, the biases inherent in surveying individuals who want to take part in research, and the minor limits in who can be reached through an online survey (i.e. those without access to internet).

The survey was designed to minimise risk of drop out, through varied questions, and clear visual display. The survey ran on mobile, tablet and desktop devices. 81% of participants who started the survey completed the survey.

2. Data Quality Checks

Public First took a number of steps to ensure the quality of the data collected. These begin before the survey fieldwork, during the fieldwork, and on the data itself.

Prior to the survey

Public First conducted a pilot survey, which allowed us to refine question wording, confirm that participants could understand the survey topics, and that everything was displayed correctly for participants on the experimental design elements. This also provided an estimate of how long the key sections would take participants to complete, to ensure that the final survey would not exceed a maximum length of 18 minutes.

The survey is designed to minimise the impact of survey bias on responses. It is impossible to completely remove these biases, but wherever possible Public First sought to leverage experimental design and randomisation to produce revealed rather than stated preference. This included:

- A Gabor-Granger exercise for CAPEX and OPEX on heating systems, which means participants can move towards a willingness-to-pay threshold through a series of cost decisions rather than report their willingness-to-pay directly.
- A Conjoint exercise for understanding new technologies. Randomised technology profiles meant that participants would need to evaluate the impact of different features of a technology compared to one another, and that through multiple trials the features which shifted views can be revealed more precisely than if participants were asked directly to say what would shift their views.

Within the survey

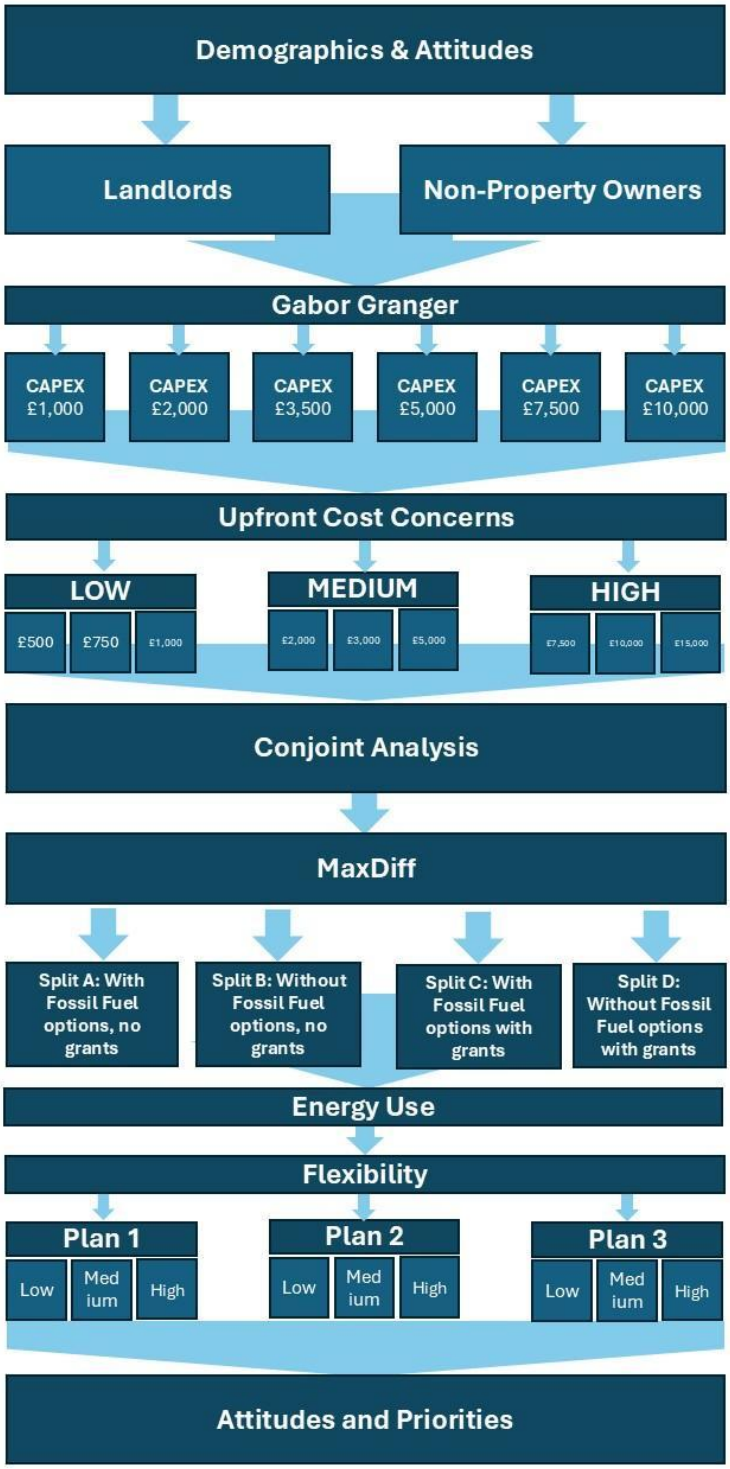
Public First implements a number of quality checks within the survey itself. This includes a ReCAPTCHA to prevent script or bot responses, as well as direct attention checks to reduce the risk of inattentive responding. Any participants failing attention checks are immediately excluded from the research.

After the survey

As a final stage data quality check, Public First evaluates open response data from the survey. These are checked for nonsense responses, unlikely duplicates (indicating scripts) and use of LLM or auto-generated text. The survey is re-fielded for new responses to replace those removed during this process.

3. Survey Flow

Figure 39 - A flowchart to outline the key stages of the poll questionnaire



4. Data Processing

Public First processed the data collected in this survey both for this report and for the purposes of feeding into NESO's wider work (including into the Future Energy Scenarios model). During this processing, Public First takes the approach of minimising any response removal; we do not remove outlier responses, for example.

We note a few key data transformations conducted for the purposes of this report:

- Socio-Economic Grade (SEG) was constructed from a question on the participants' role at work (or retirement, student, NEET status).
- Age group was categorised from an open response year of age, to make data visualisation clearer.
- The income bands were calculated using median income figures from the UK Housing Review, separately for renters and homeowners.

Further to this, there were some more specific processing requirements for elements of the survey.

Gabor-Granger Exercise

Data produced from the Gabor-Granger exercise was initially in a format that is difficult to visualise. For each individual, we have their response to varying price points of OPEX, however as the price points are randomised within a range not every participant responds to every price point (for example, we can infer acceptance of a £30 OPEX if someone accepts a £130 OPEX).

In order to interpret the results of the Gabor-Granger exercise we first calculate the implied maximum willingness to pay for each participant. In short if a participant accepted a £115 OPEX, and rejected an £130 OPEX, then this would be £115. We can then assume that this participant would accept any price point up to and including this, allowing us to plot the proportions who accept each level of OPEX more clearly.

The advantage of the approach taken to the CAPEX and OPEX willingness calculation, is that we can compare these price points to the real known price points of technologies. For example, we can calculate the implied willingness-to-accept for a gas boiler. This analysis is not provided in this report, but Public First also processed the data relative to existing technology (i.e. how many people would accept technology that pays off relative to a gas boiler after a year, 2 years).

Conjoint Exercise

For the Conjoint analysis, Public First leveraged Logistic Regression to analyse the results of the conjoint. Data was transformed as follows:

- Financial values were treated as continuous data.
- Categorical features were encoded into ordinal variables for example, indoor space ranges from compact (for example, "similar to a washing machine") to larger (for example, "floor-to-ceiling cupboard").

The continuous variables were normalised to enable comparability with other coefficients. The dependent variable is binary (either a technology is chosen, or not chosen), meaning a logistic regression must be used. Public First employed a binary logistic regression to estimate part-worth utilities for each attribute level. A constant term was added to the regression model to account for baseline choice probabilities. Part-worth utility estimates were then calculated by multiplying the coefficients by their ordinal values for categorical data, and directly from the coefficients for the continuous cost elements.

MaxDiff Exercise

Public First used a MaxDiff analysis to understand how people would rank their preference for different home heating technologies. Participants were presented with 13 sets of paired comparisons from among 9 heating system profiles (see examples below), all of which were developed by NESO in collaboration with Nesta. For heat pumps (air-to-water and air-to-air), installation costs were presented with government grants applied — for example, “£11,800 (£4,300 after government grant)”. For other technologies the prices are hypothetical or based on available data.

Figure 41 - Example of a Technology Profile used in the MaxDiff analysis

Heating System Profile Card – Air-to-water heat pump	
	
Description	Uses electricity to upgrade the heat in the air to a higher temperature and transfer it into a home via water in radiators or underfloor heating.
Ready for a low carbon future	Yes
Average installation cost	£11,800 (£4,300 after government grant)
Average running cost per year	£660 (£365 on special heat pump tariff)
Technology lifespan	15 years
Annual service cost	£100
Installation time	2-5 days
Installation disruption	Possible structural changes such as radiators replaced, pipework replaced or hot water cylinder installed.
Space required outside the home	Similar size to a washing machine.
Space required inside the home	Floor to ceiling cupboard

This technique was used for two reasons:

- To ensure that on-screen information was kept to a minimum level. Participants would only need to evaluate two technologies at once, side-by-side, rather than all possible home heating options.
- To reveal an implicit ranking to all the technologies. MaxDiff means we can identify how the full range of technologies would be ordered, rather than just a top three or top one.

Public First cross-validate the results of the conjoint analysis. To validate the Conjoint Analysis and ensure consistency with our two measures, we compared its results with MaxDiff rankings by calculating the correlation between Composite Scores and Relative Importance.

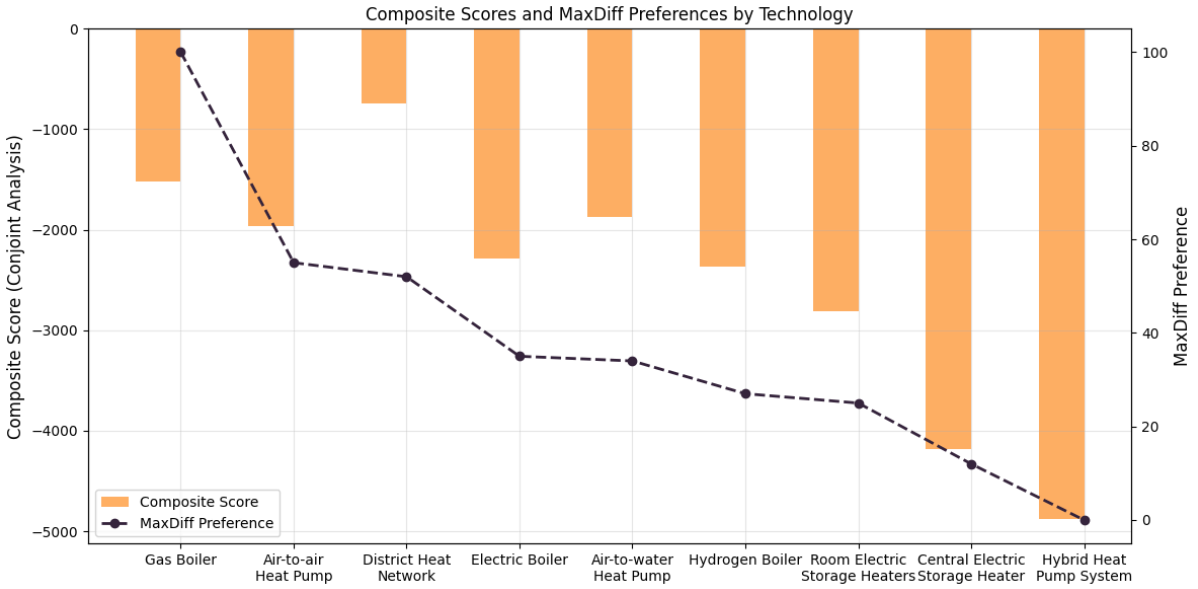
- Composite Scores: These scores measure the "overall attractiveness" of each heating technology based on its features (for example, actual costs or space requirements) and the part-worth utilities from the Conjoint Analysis.
- Relative Importance: This measures each technology's importance relative to the top-ranked option, scaled from 0 to 100.

The analysis revealed a correlation of 0.76, indicating a strong positive relationship [See: Technical Report]. This suggests that the Conjoint Analysis effectively captures the trade-offs consumers make when choosing heating technologies, as technologies with higher Composite Scores generally correspond to higher MaxDiff preferences.

Notably, some deviations were observed. For example, electric boilers had higher Composite Scores compared to their MaxDiff preferences. This discrepancy may point to external factors such as consumer familiarity or preconceived biases that influence responses in simulated real-world scenarios but cannot be fully accounted for in a technology-agnostic experiment. [See: Section 4.3 for more discussion of this discrepancy].

We find a strong relationship between the modelled composite scores for technologies, and the preference revealed through the MaxDiff.

Figure 41 - Example of a Technology Profile used in the MaxDiff analysis



Note: Scatter plot showing the correlation: The orange bars represent Composite Scores, while the purple line represents MaxDiff Preferences. A close alignment between the bars and the line demonstrates that the technologies with higher Composite Scores also tend to have on average higher MaxDiff Preferences.

A/B testing

After completing the MaxDiff exercise, where respondents were introduced to the full range of home heating technologies, Public First conducted an A/B test to assess the impact of removing fossil-fuel options on consumer choices. Participants were randomly assigned to one of four groups, allowing for a controlled comparison of decision-making based on the available options and the presence of government grants.

- Group A: Presented with both fossil-fuel and low-carbon heating options, with no mention of grants.
- Group B: Shown only low-carbon heating options, with no grants mentioned.
- Group C: Presented with both fossil-fuel and low-carbon heating options, but with grants available for certain low-carbon systems.
- Group D: Shown only low-carbon heating options, with grants for specific low-carbon systems.

5. Heating Technology Descriptions

Options without Grants

- Air source heat pump (air-to-water): (Average running: £365/year with special heat pump tariff, Average installation: £11,800) Uses outdoor air for heating and hot water. Environmentally friendly, lasts 15 years. Installation takes 2–5 days and requires outdoor and indoor units.
- Air source heat pump (air-to-air): (Average running: £552/year, Average installation: £8,200 including hot water system). Uses outdoor air for heating via air blowers in each room. Requires a separate system for hot water, can also provide cooling. Environmentally friendly, lasts 15 years. Installation takes 2–3 days and requires outdoor and indoor units.
- Gas boiler: (Average running: £683/year, Average installation: £3,000) Burns natural gas for heating. Not environmentally friendly, lasts 10-15 years. Installation takes 1 day with minimal disruption and no outdoor space needed.
- Electric boiler: (Average running: £2,227/year, Average installation: £3,000). Uses electricity to heat water. Environmentally friendly, lasts 10–15 years. Installation takes 1–2 days and no outdoor space needed.
- Electric storage heater: (Average running: £1,300/year, Average installation: £5,500 including hot water system). Stores off-peak heat for daytime use. Environmentally friendly, lasts 10–15 years. Installation takes 1–3 days with minimal disruption.
- Hybrid heat pump system: (Average running: £658/year, Average installation: £11,600). Combines a heat pump and gas boiler for efficient heating. Partially environmentally friendly, lasts 10–15 years. Installation takes 2–5 days.
- Central electric storage heater: (Average running: £1,300/year, Average installation: £9,000 including hot water system). Stores off-peak heat for daytime use to heat water. Environmentally friendly, lasts 20 years. Installation takes 1-2 days with some changes to indoor plumbing.
- District Heat Network: (Average running: £1,475/year, typically pay a service charge including in running cost rather than installation costs). Delivers heat from a shared source. Environmentally friendly, lasts 15–20 years. Connection takes weeks and needs trenches and pipes outside the home.
- Hydrogen Boiler: (Average running: £1800/year, Average installation: £3,750) Burns hydrogen for heating. Environmentally friendly, lasts 10–15 years. Installation takes 1–2 days and may need safety upgrades.

Options with Grants

For groups that were presented with grant-supported options, certain low-carbon heating systems had reduced installation costs:

- Air Source Heat Pump (Air-to-Water): Installation cost reduced to £4,300 (from £11,800) due to government grants.
- Air Source Heat Pump (Air-to-Air): Installation cost reduced to £4,300 (from £8,200, including a hot water system).
- Other options, including electric boilers, electric storage heaters, central electric storage heaters, district heat networks, and hydrogen boilers, retained their original cost structures and descriptions.

Modelling Acceptance rates for higher CAPEX levels

Public First used the data to predict acceptance rates for even higher levels of CAPEX than were asked about within the survey. To do this, we fit a logistic curve to the different categories of response for each price point (affordable, affordable with difficulty, not affordable). These are adjusted to ensure they sum to 100% across price points. With this curve, estimates can be produced for new cost levels.

This approach ensures that we can capture non-linear trends in the perceptions of affordability. This is helpful for capturing that, beyond a certain price, most people will find something unaffordable and responses will stabilise.

6. Qualitative research

The research team conducted eight focus groups with the British public, speaking to landlords, renters, homeowners and homebuyers recruited on the following specification. These demographic groups were chosen to allow us to further investigate the impact of tenure on attitudes and priorities. We also further subdivided by income band:

Group no.	Target group	Recruitment specification
1	Landlords - small portfolio	1 or 2 rental properties 1/10 the landlord pays the energy bills for their tenants 9 England and 1 Wales 5 to have at least one tenant to be receiving housing benefit
2	Landlords - large portfolio	3 or more rental properties 1/10 the landlord pays the energy bills for their tenants 9 England and 1 Wales 5 to have at least one tenant to be receiving housing benefit
3	Homeowners - mid income	Mid income (gross household income £45,000-£110,000) 8 England, 1 Wales and 1 Scotland
4	Homeowners - low income	Low income (gross household income < £45,000) 8 England, 1 Wales and 1 Scotland

5	Homeowners - mid income, new buyers	Mid income (gross household income £45,000-£110,000) State they are strongly considering or actively pursuing buying a property in the next 12 months OR have bought a property in the past 12 months. 8 England, 1 Wales and 1 Scotland
6	Renters - mid income	Mid income (gross household income £25,000-£65,000) 1/10 the landlord pays the energy bills for their tenants 8 England, 1 Wales and 1 Scotland 5 rent from social housing (council or housing association), 5 from private landlord
7	Renters - low income	Low income (gross household income < £25,000) 1/10 the landlord pays the energy bills for their tenants 8 England, 1 Wales and 1 Scotland 5 rent from social housing (council or housing association), 5 from private landlord
8	Renters - mid income, new buyers	Mid income (gross household income £25,000-£65,000) 1/10 the landlord pays the energy bills for their tenants State they are strongly considering or actively pursuing buying a property in the next 12 months. 8 England, 1 Wales and 1 Scotland 5 rent from social housing (council or housing association), 5 from private landlord

The income bands used above, and throughout the report, were calculated using median income figures from the Office for National Statistics[12], separately for renters (average gross annual household income of £43,052) and homeowners (average gross annual household income of £73,778). Low income was defined as 60% or less of the median, following standard UK thresholds. The mid-income range was then set by selecting the nearest upper end of the income brackets just above this threshold, extending up to approximately 150% of the median—capturing the central portion of the income distribution. Households with incomes above this range were classified as high income. All groups were also recruited with a balance of genders.

The groups were run online to allow for a mix of geographies in every session and make it easier for rural participants to be included. Each was moderated by the Public First team in evenings between 10 March and 18 March.

We used two discussion guides: one for the landlord groups and another for non-landlords. Both focused on heating, rather than the broader context of climate and politics. The non-

[12] ONS, The Effects of Taxes and Benefits on Household Income, UK, 2021/22 - Reference Tables, collated by UK Housing Review here: https://www.ukhousingreview.org.uk/ukhr23/tables-figures/pdf/23-038.pdf

landlord guide included flexible sections to explore in greater depth the impact of heating systems on, for example, the choice of a rental property or homebuying decision. The rest of the guide was kept constant to allow for comparison across the different demographic groups. The groups were recorded and transcribed to allow for analysis and the use of verbatim quotes, which you will see included throughout this report.

7. General note on limitations

This report is based entirely on opinion data. While many steps have been taken to minimise the impact of bias, misinterpretation, and inaccuracy on the results, we acknowledge that there are some unavoidable biases that exist within opinion data like this.

One of the key areas to note, where this bias will come into effect, is in the decision-making around home heating. A survey environment can only ever be so effective at capturing the real decision environment that a person would make these choices in. This is true in both directions: in a real decision, people may search for more pertinent information to their specific situation, or seek advice from others meaning they would have access to more information than was provided in the questionnaire; on the other hand, by putting a range of information in the questionnaire we may have encouraged people who would typically not engage with some information on a specific technology to pay closer attention to it.

We would also note that the landscape of home-heating is changing rapidly. The research was designed to be as agnostic as possible to the current technology landscape (for example, the conjoint was presented in the abstract rather than tied to the specific reality of current technology), though there are some explicit (i.e. in the MaxDiff) and implicit (i.e. through the CAPEX and OPEX price ranges used) anchors to the state of technological solutions as of December 2024.