DEPARTMENT OF ENERGY & CLIMATE CHANGE

RESEARCH REPORT

Homeowners' Willingness To Take Up More Efficient Heating Systems

By Ipsos MORI and the Energy Saving Trust

The views expressed in this report are those of the authors, not necessarily those of the Department of Energy and Climate Change (nor do they reflect Government policy).

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Executive Summary

Ipsos MORI was commissioned to conduct this quantitative and qualitative research programme by the Department of Energy and Climate Change (DECC). It explores the preferences and willingness to pay for more efficient heating options among homeowners in Great Britain.

Background, objectives and research methodology

The Strategic Framework for Heat, published in March 2012, examined how heat is supplied and used today, and how this would need to change to meet the Government's 2050 carbon emissions targets and 2020 goal of supplying 15% of UK energy from renewable sources. A critical part of this will be maximising the potential for more efficient domestic heating technologies.

This research was designed to address specific research questions developed by DECC and to inform related modelling and analysis. In particular, it explored homeowners' preferences and willingness to pay for seven more efficient heating systems:

Gas condensing boilers;

Micro-combined heat and power (micro-CHP);

Air source heat pumps (ASHPs);

Ground source heat pumps (GSHPs);

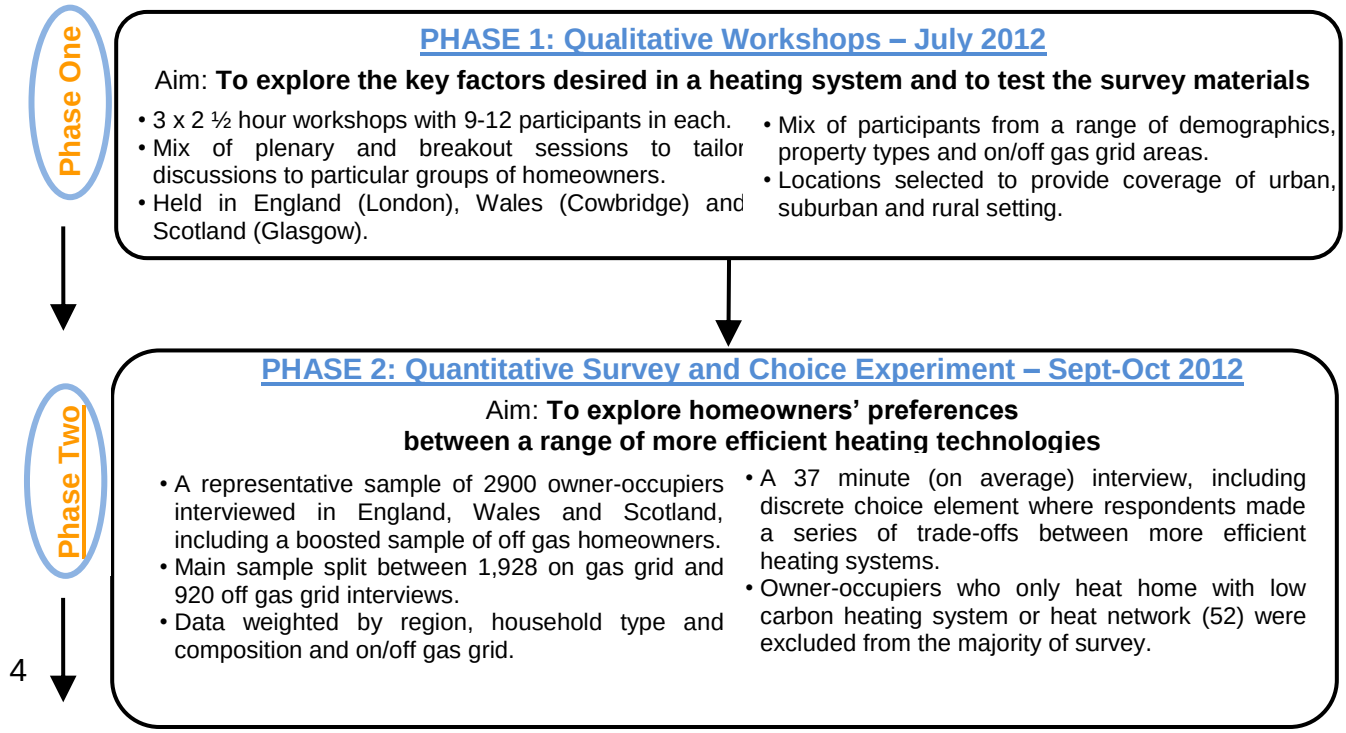
Biomass boilers;

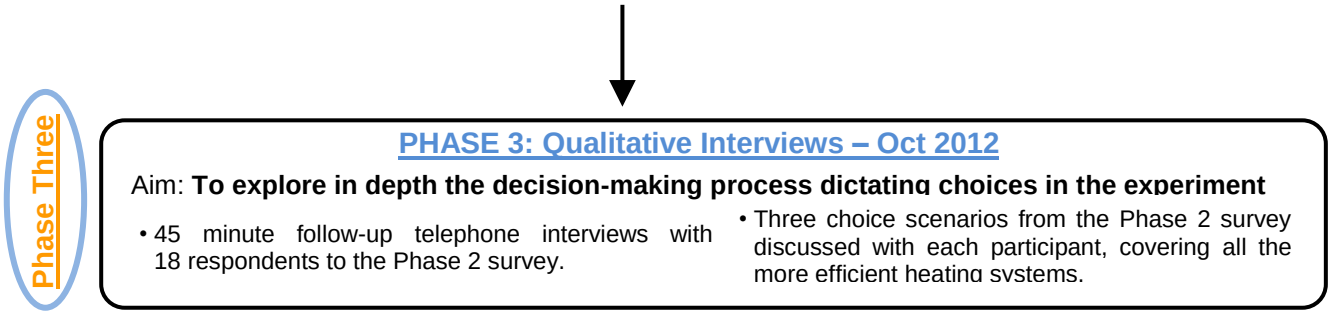
Heat networks; and

Solar thermal.

The study consisted of three phases as shown in Figure 1 below.

Figure 1: Summary of research approach





All phases of the research were conducted with owner-occupiers (including those repaying a mortgage). Homeowners who were currently heating their homes mainly through a heat network, GSHP, ASHP or biomass boiler were only asked a reduced set of survey questions at Phase 2: their awareness of more efficient heating systems, how they currently heated their home and water, and when they last replaced the heating system in their home. They were not asked their future preferences / intentions for heating systems. These homeowners were also excluded from the Phase 1 workshops.

The rest of the Executive Summary presents the headline findings from this study, drawing on all three phases. All percentages reported are from the Phase 2 quantitative survey.

Attitudes towards current heating systems

What do homeowners like or dislike about their current heating system?

The most common heating system used by homeowners was a gas boiler (80%). Many were using any form of combination boiler (67%) and the initial workshops suggested that such devices were the best regarded for heating homes – being effective at reaching the required temperature, supplying instant hot water on demand, being easy to control and compact in size and shape. They were also the preferred *future* means of heating, with 63% spontaneously saying they would next install a combination gas boiler. (This applied to 71% of 'on gas grid' homeowners and to 13% of those off the gas grid'[1]).

Off gas grid workshop participants were less satisfied with their current heating system – which was most likely an oil boiler or electric storage system. Many viewed these as very expensive, and in *urban* off gas grid areas such systems (most likely electric) were often criticised as difficult to use and poor at reaching and maintaining the desired temperature. Many off gas grid homeowners would connect to the gas grid if possible.

What are the 'must-haves' for new heating systems?

Purchase and running costs were the most important criteria, more so than effectiveness, reliability or aesthetics. Specifically, 24% said low energy bills were most important and 23% cited the system being cheap to run as most important. These were followed by low capital costs (a further 10% said the system being cheap to buy and 5% said being cheap to install was the most important).

Reliability was also a common 'must-have' and was the most likely criteria to appear in the top three important factors after low energy bills and a cheap to run system. One in ten (9%) said the most important factor for them was the system lasting a long time before breaking down.

[1] These homeowners all lived in properties which are not currently connected to the mains gas grid. This includes both properties which cannot be connected to the grid and those which could be connected but are not currently. It also includes those who do not know if it is possible for their property to be connected or not. These homeowners are referred to as "off gas grid" throughout this report.

However, analysis of the trade-offs made between heating systems in the choice experiment showed a somewhat different pattern. Here, running costs generally did not have a decisive influence over the choice of system. The key determinant was the technology itself (dictating 54% of choices) followed by the upfront grant (driving 13% of choices). These drivers of preference are discussed later in this summary.

Triggers to replace heating system

How often do homeowners consider replacing / replace their heating system?

Just under two-thirds (64%) had replaced the heating system in their current home in the past, nearly half (47%) within the last ten years and 17% within the last three years.

Just over half (58%) expected to replace a heating system at least every fifteen years, although 19% anticipated waiting more than 20 years. By contrast, 27% expected to replace their system at least every five years.

What are the triggers for homeowners considering replacing their current system?

A system breakdown was the most common reason respondents had replaced their heating system in the past (30% gave this as the main reason). 'Non-emergency' situations where their system was still working but was coming towards the end of its life were also commonly cited as the main reason, either because they were told it would not last much longer (14%) it needed repairs too often (14%) or they were told the parts would no longer be available in the future (3%). The most common reason other than actual or anticipated breakdown was as part of a wider property renovation (13% gave this as the main reason).

What would encourage homeowners to replace their heating system earlier (i.e. before it breaks down)?

Most (70%) would only consider a pre-emptive system replacement if their heating system started to need considerable repair/s. This was confirmed by the choice experiment which found that in a non-emergency scenario[2] the majority of survey respondents would opt to do nothing.

Again, running costs play some part in the decision: a third (37%) said they would be likely to replace if energy prices rose dramatically, and 34% if cheaper-to-run systems became available. Fewer (25%) would be encouraged by 'more environmentally friendly' systems. However, the choice experiment showed that in a gas price rise scenario, or when preferential tariffs were available for renewable heating systems, the majority of homeowners would still opt to do nothing in a non-emergency situation.

Lifestyle changes proved less of a likely trigger: only 12% thought that retirement would prompt a system replacement, and only 6% that extending a family would do so. One in ten (11%) felt it likely that moving home would lead them to install new equipment in their new home (down to 6% and 5% if renting out or selling an existing home). The follow-up interviews revealed that many homeowners did not believe an upgraded heating system would add value to a property, hence the lack of motivation to do so in these scenarios.

[2] Survey respondents were asked to consider a scenario where their existing heating system was still working but was perhaps coming towards the end of its life or they were considering replacing it for another reason.

In what order do homeowners consider changing their heating system alongside or separately from insulation measures or solar thermal?

The follow up interviews found often there was no clear sequence of events here; installation was generally driven by the availability of free, or heavily discounted, insulation measures. In many cases, insulation had not been actively sought, but passively accepted when offers were made.

However, most agreed with the principle of installing insulation *prior* to replacing a heating system, and 70% said they would be willing to do so in order to receive financial assistance towards a more efficient heating system. Most (67%) expected to reduce their energy bills by installing energy efficiency measures, and 57% expected this to make their home warmer and more comfortable.

Too few of the respondents had installed solar thermal to draw any conclusions on the sequence of these changes.

Decision making process

What processes do homeowners go through when deciding whether to replace their heating system?

Homeowners in all phases of this study had gone through a similar process. First of all, there generally needed to be some trigger to start considering it. As noted, this was usually either a complete breakdown, or signs that the system was coming to the end of its life (needing frequent repairs, starting to make noise, not reaching the desired temperature as quickly). For a smaller proportion, the trigger was making wider property renovations.

In non-emergency breakdown situations (i.e. not complete breakdown), the next key consideration for most was the age of the heating system. If it was less than ten years old, and not displaying any signs of breaking down, it was very unlikely that the homeowner would replace it. The availability of finance for the new system was also critical, and was often balanced against the urgency of replacement.

Among homeowners who had replaced the heating system in their current property, some (42%) had consulted their boiler serviceman for advice on what type of heating system to install, while 24% had consulted a friend (especially if that person had technical knowledge of heating or plumbing). Others consulted their energy supplier or a builder (14% each). These were all trusted sources of advice, but more so for energy companies if it was delivered face-to-face via a serviceman, rather than by generic printed or online information.

Once homeowners had decided to replace their heating system, most (68%) did so within a year, with two in five (39%) doing so within three months. By contrast, one in five (18%) waited longer than one year. The workshops and follow-up interviews revealed various reasons for postponement, ranging from specific family circumstances such as serious illness, to temporary moves away from the property for work. However, a common theme was saving up to pay the upfront costs.

What heating options would homeowners consider installing (unprompted)?

Gas boilers were the clear favourite for future installation. When asked spontaneously which heating system they would consider in the future, 90% of on gas grid respondents said a gas boiler (71% specifically a combination gas boiler). An oil boiler was most commonly mentioned by off gas grid homeowners (40%, with 25% specifically mentioning a combination oil boiler).

Few mentioned any other type of heating system: between 2% and 3% cited one of the more efficient heating systems *other* than a gas condensing boiler. This likely related in part to lower awareness of

other such systems (with only 27% aware of micro-CHP, against 86% for gas condensing boilers). The second most commonly recognised of the seven systems covered was solar thermal (83% had heard of this, although the workshops suggested this may often be confused with solar PV).

The next best known more efficient systems were the GSHP and biomass boiler (both heard of by 47%). A significant minority had heard of ASHPs (32%) or heat networks (31%).

Preferences for more efficient heating systems

Which more efficient heating systems do homeowners find most attractive?

Homeowners in all phases of the research were shown one page factsheets providing basic information on each of the more efficient heating systems which were feasible for their home. (At this stage, no cost information had been given about the options).

For those connected to mains gas, the most appealing technology at this stage was a gas condensing boiler (80% were positive and only 5% negative about this technology). This was considered a familiar, proven and trusted technology needing minimal maintenance and space. The second most appealing was micro-CHP (46% positive), which was liked for similar reasons to the gas condensing boiler, although relative lack of familiarity counted slightly against it.

The other systems had significantly less appeal. Two in five (38%) of those with private outside space were positive about GSHPs, with off gas grid homeowners the most positive (53%). The concept of using a readily available source of free energy from the ground appealed to many, but particularly to this group who often felt they had the space to make it viable.

A third (34%) of all homeowners were positive about heat networks, and more so still among those living in very high density areas (43%). They found the concept of a community network appealing both at an emotional and practical level, as they felt it increased the efficiency of generation and would therefore reduce household bills.

However, more homeowners felt negatively than positively towards ASHPs and biomass boilers. Both were felt to be visually unattractive, which reduced their appeal for many. The biomass boiler was considered as too much ‘hassle’ by many due to the regular fuel deliveries and maintenance. The ASHP lacked credibility as a reliable technology among some homeowners (particularly those living in colder parts of Great Britain) as they did not believe it would work at low temperatures.

On balance, the survey respondents were more positive than negative about using a solar thermal system to heat their water. Approaching half (45%) were positive whilst a third (32%) were negative. This is more favourable than reactions to the other renewable heating systems (GSHP – 38%, ASHP – 28%, biomass boiler – 26%), similar to micro-CHP (46% positive) but substantially lower than for gas condensing boilers (80%). However, when making these comparisons it should be noted that the solar thermal system was assessed by respondents having seen factual and cost information[3] whereas the other technologies were rated based only on the factual information contained in the factsheets and no cost information.

[3] The cost information shown included the upfront installation cost, the estimated annual fuel saving and maintenance cost. It also detailed the financial assistance available either in the form of a one-off upfront grant or as an annual tariff payment.

What information would homeowners want about potential suppliers of more efficient heating systems and financial mechanisms to help pay for them?

Workshop and follow-up interview participants felt that the information provided on the one page factsheets was important and useful in helping them assess the appeal of each technology. In particular, homeowners wanted to see information about the space required inside and outside the property, including for the system itself and any fuel storage, and whether a hot water tank was required. The information on the level of responsibility to maintain, clean and fuel the system was also critical for many. Some focused on the expected lifetime of the system, but few wanted to know the installation time.

In addition to the information provided, a few homeowners would seek information about the proven reliability of the technology, by which they meant the expected time before needing repairs, length of warranty, any weather conditions which would prevent effective operation, and how widely used the systems were in domestic British properties. This information was particularly requested for air source heat pumps and micro-CHP.

Many homeowners with lower incomes, or limited savings, would need information on the financial assistance available to pay upfront installation costs. For those with available capital, who tended to be aged 55 and over, the key information was about any *ongoing* financial assistance to help reduce annual running costs. Such homeowners were particularly keen to know the new systems' expected annual fuel bill.

Homeowners did not mention needing information about the suppliers of heating system technologies. They would trust the advice of a boiler serviceman or heating engineer, and would also follow word-of-mouth recommendations from friends and neighbours.

How likely are homeowners to take up more efficient heating systems, in emergency and non-emergency situations? (results of the choice experiment)

Homeowners were asked to make a series of trade-offs between more different efficient heating systems – being given financial information to help them make a decision. For each trade-off they were asked to indicate the option they preferred, and then to rate how likely they would be to actually install their selected technology in a non-emergency scenario (where their existing heating system was still working but was either coming towards the end of its life or they were considering replacing it for another reason).

In this non-emergency scenario, the majority of homeowners involved in this research would not make a replacement (81% would do nothing in a 'base scenario' where heating systems were priced at their current market value and no financial incentives were available[4]). The choice experiment found there were considerable barrier costs to these homeowners replacing their current heating system with a more efficient system in this situation. The barrier costs represent the economic value homeowners would need to be compensated by to address their concerns about the new technology (whether due to perceptions of it being disruptive to install, a hassle to maintain etc). The barrier costs were calculated by examining the sensitivity of each choice made by respondents to the total installation cost of the technology[5].

Among the on gas grid homeowners who would make a non-emergency replacement, the most popular option would be a gas condensing boiler, with 15% choosing this in a 'base scenario', compared to 80% who would do nothing. The most popular renewable option (from a biomass boiler, GHSP or ASHP)

[4] This scenario did not offer a one-off upfront grant or an annual tariff payment on the gas condensing boiler, heat network, GSHP, ASHP or biomass boiler. It did, however, include a feed-in-tariff payment for micro-CHP.
[5] Further information on the barrier costs calculated using the choice experiment results will be published separately.

would be a GSHP – although this was only opted for by 1%[6] of survey respondents. Indeed, even if gas prices increased by 40% and other fuel prices stayed at 2012 levels, the gas condensing boiler would be installed by the majority of homeowners.

Among off gas grid homeowners who would make a non-emergency replacement, the most popular option was a heat network (although 5% opted for a heat network this is unlikely to be a feasible option currently for most off gas grid homeowners). The proportion of homeowners likely to install one of the renewable options was similar for a biomass boiler, GSHP and ASHP (between 1% and 2%), and 91% would not make a replacement. Taking away the heat network as an option for off gas grid homeowners did not lead to a large rise in likely uptake of one of these renewable systems however. Instead, the share of respondents who had selected the heat network was spread across a 'do nothing' response and the other available heating systems.

Homeowners would be more likely to make a replacement in an emergency situation, when their heating system had broken down and they were without heating. However, in this situation the majority of on gas grid homeowners would only consider installing a gas condensing boiler with a small minority likely to install any of the other more efficient heating systems. Off gas grid homeowners were equally likely to be willing to install a heat network and a GSHP (34% likely) with slightly fewer likely to install an ASHP or biomass boiler (31% and 29%). These findings closely reflect those for a non-emergency scenario where the heat network and GSHP were also the most popular options[7].

How is the likely take-up of more efficient heating systems affected by the balance of upfront, running and maintenance costs?

The key determinant of choices between more efficient heating systems was the technology itself, rather than how much it cost to install or the financial incentive available. Analysis of all the choices made by all the survey respondents showed that this explained 54% of the trade-off decisions during the survey choice experiment (as shown in Figure 2). All the ways in which homeowners assessed the technologies could not be uncovered by this research, however, the workshops and follow-up interviews suggested that two key ways in which they did so were to assess how appropriately sized the system was for their particular property, and, at an intuitive level, how credible it sounded as a heating system which would be effective in a colder climate such as Great Britain.

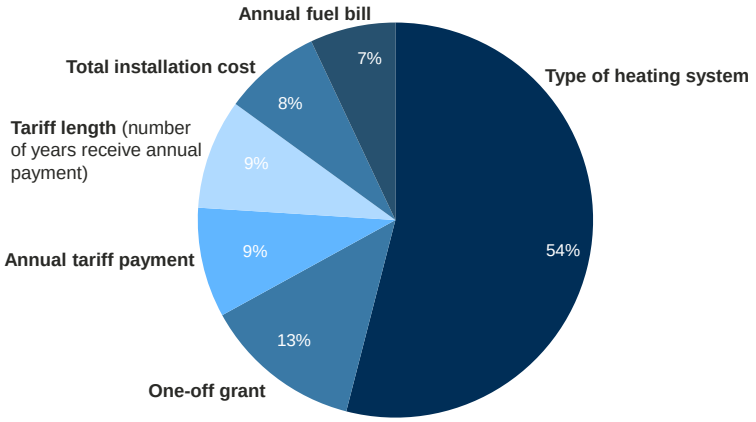
The upfront grant proved more influential in affecting homeowners' choice than did the upfront installation cost, annual fuel bill or annual tariff payments. The grant drove 13% of the choices made, while the tariff amount and length each explained 9%, and the installation cost 8%. Finally, the estimated annual fuel bill explained 7% of the choices made.

[6] Please note this is not intended to be a market forecast. Estimates are a short term measure of uptake based on the same offer being available to everyone at one point in time. Survey respondents received basic and unbiased information about each heating system. In reality there are a variety of other factors that could influence uptake e.g. marketing activity.

[7] Please note that no 'like-for-like' replacement option was offered to off gas grid respondents (e.g. an oil boiler). These respondents were only asked to consider their likelihood of installing a GSHP, ASHP, biomass boiler or a heat network connection in an emergency situation.

Figure 2: Drivers of preferences between more efficient heating systems

Relative importance of attributes in driving trade-offs in survey choice experiment



Base: All respondents who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

The provision of an upfront grant for renewable heating technologies (biomass boilers, GSHPs and ASHPs) would encourage uptake of these in a non-emergency situation among both on and off gas grid respondents. The choice experiment results showed that as the value of the grant increased, the likely uptake of these systems also increased, and led to a greater share of homeowners opting for a renewable system rather than micro-CHP or a heat network. A 100% grant led to an overall shift of +2.4% opting for renewable heat. The majority of this shift towards renewables came from respondents opting for one of these rather than a heat network (especially among off gas grid respondents). However, no additional uptake was created by raising the grant from 100% to 130% of the installation cost. The table below summarises the impact of a 100% upfront grant on interest in the three renewable heat technologies when compared with a base scenario where no financial incentive was offered.

Figure 3: Impact of 100% upfront grant on appeal of renewable heating systems in non-emergency scenario

SUMMARY OF SIGNFICANT CHANGES UNDER 100% UPFRONT GRANT *(available for GSHP, ASHP or biomass boiler)*
Figures based on all respondents, in non-emergency scenario

	% opting for technology under base scenario (no financial incentive for any heating system)	% opting for technology with 100% upfront grant	**Relative change in % share opting for technology under 100% upfront grant**
GSHP	0.8%	2.0%	**+ 1.2%**
Biomass	0.5%	1.1%	**+ 0.6%**
ASHP	0.2%	0.8%	**+ 0.6%**
Any renewable heating system	**1.5%**	**3.9%**	**+ 2.4%**

The provision of an annual tariff, but no upfront grant, for renewable heating technologies would also encourage a shift in the share of homeowners likely to install these heating systems in a non-emergency. As shown in the table below, the proportion of respondents selecting a GSHP increased by 1.1% with the availability of a seven year 'RHI 2012 consultation' tariff level[8] (from a base scenario where no financial incentive was offered). The overall change in the percentage share likely to take up any renewable heat option (GSHP, ASHP or biomass boiler) was +1.9% in this scenario.

Figure 4: Impact of seven year tariff on appeal of renewable heating systems in non-emergency scenario

SUMMARY OF SIGNFICANT CHANGES UNDER 'RHI 2012 CONSULTATION' TARIFF LEVEL *(available for GSHP, ASHP or biomass boiler for 7 years)*
Figures based on all respondents, in non-emergency scenario

	% opting for technology under base scenario (no financial incentive for any heating system)	% opting for technology under 'RHI 2012 consultation' tariff level	**Relative change in % share opting for technology under 'RHI 2012 consultation' tariff level**
GSHP	0.8%	1.9%	**+ 1.1%**
Biomass	0.2%	0.6%	**+ 0.4%**
ASHP	0.5%	0.9%	**+ 0.4%**
Any renewable heating system	**1.5%**	**3.4%**	**+ 1.9%**

Homeowners were presented with different tariff scenarios where an annual payment was made for either 3, 5, 7, 12 or 20 years. The monetary value of tariff payments increased in nominal terms as the payment length increased, but remained the same in real terms, using standard discounting. However, the results showed that a tariff paid over 20 years was more attractive than any of the other time periods. This suggests that respondents were not making discounted cash flow calculations themselves. The positive reaction to the 20 year tariff suggests a psychological rather than economic trigger. Under a scenario offering a 20 year tariff for renewable heating, the share of respondents opting for a GSHP (2.3%) overtook the share opting for micro-CHP (0.8%) and the heat network (1.6%).

Overall the analysis shows that the provision of financial assistance, whether in the form of a tariff or a grant, led to a statistically significant increase in the proportion of respondents opting for a renewable heating system compared to the base scenario. However, the difference between the figures for the 'most-preferred' tariff and grant are not significant and so it cannot be concluded that one form of finance is more or less effective than the other.

[8] The domestic RHI consultation document launched in September 2012. The 'RHI 2012 consultation tariff level' was used to set the tariff ranges in this research. More information about the consultation is available here: https://www.gov.uk/government/consultations/renewable-heat-incentive-proposals-for-a-domestic-scheme

The table below summarises the proportion of survey respondents opting for any one of the three renewable technologies (GSHP, ASHP or biomass) during the choice experiment under three different scenarios[9]:

- **Base scenario**: no financial incentives available for renewable heating systems;
- **20 year RHI central tariff**: annual tariff payment made on GSHP, ASHP and biomass boiler for 20 years (tariff amount set to 'RHI 2012 consultation' tariff level); and
- **100% upfront grant**: one-off payment equivalent to installation cost made on GSHP, ASHP and biomass boiler. No tariff payment offered.

Figure 5: Summary of impact of financial assistance on appeal of renewable heating systems in non-emergency scenario

Scenario	**All survey respondents**	**Off gas grid survey respondents**	**Off gas grid survey respondents with heat network removed as option**	**Significance testing**	
	Proportion opting for one of renewable heating systems (adjusted shares)			*Significant*	*Not significant*
1) Base scenario (no financial incentives)	1.5%	4.2%	7.9%		
2) 20 year RHI central tariff	4.2%	6.5%	9.1%		
3) 100% upfront grant	3.9%	6.7%	9.2%		

How likely are homeowners to take up solar thermal, alongside their current heating system or in combination with another more efficient system? (results of solar thermal model)

The appeal of solar thermal was tested separately to the main choice experiment discussed above. As it is a system which only provides hot water and not heating it is difficult to compare on a like-by-like basis with the other technologies.

At current costs (without grant or tariff), the interest in solar thermal appeared low. Less than 1% would install it alongside their current heating system. However, the probability of respondents installing solar thermal increased significantly as the value of the upfront grant increased (up to 17% if a 100% upfront grant was offered). Any set-up of tariff payment also increased the proportion of respondents likely to

[9] In all three scenarios the micro-CHP costs included a feed-in-tariff payment.

install solar thermal alongside their current system – in particular if they were offered a higher annual payment for a short period i.e. over three, five or seven years as opposed to over 12 or 20 years (10.5% said they would install solar thermal with a three year tariff, compared to around 5% if it was spread over 12 or 20 years).

It should be noted that extreme care should be taken when comparing the appeal of solar thermal in different grant scenarios and the appeal of the other more efficient heating technologies. This is due to the different ways in which respondents were asked about these technologies. Respondents were asked directly how likely they would be to install a solar thermal system or not, whereas they indicated their relative preference between a choice of two heating systems in the main experiment. Although the models have been developed on the same principles, ultimately one model is based on a decision where the homeowner needs to have at least some form of heating system, whereas the other is based on a discretionary decision. Comparisons should only be made where the full context of both choice situations are understood.

Survey respondents were also asked to imagine they already had one of the more efficient heating systems installed in their home (if they did not already) and how likely they would be to install solar thermal alongside this system to provide them with hot water. Homeowners would be most likely to combine it with a gas condensing boiler, but the majority would be unlikely to install solar thermal alongside any type of more efficient heating system. No one of the renewable heating systems was felt to more or less suitable for combining with solar thermal than the others.

1. Background and methodology

This study explored potential domestic demand, and willingness to pay, for more efficient heating options. Ipsos MORI and the Energy Saving Trust were commissioned to conduct this quantitative and qualitative research by the Department of Energy and Climate Change.

1.1 Research background

In March 2012, DECC published a 'Strategic Framework for Heat'. This examined how heat is supplied and used today, but also considered how this would need to change in the future to meet the Government's 2050 carbon emissions targets and 2020 goal of supplying 15% of UK energy from renewable sources . The Framework noted that, to drive this change, a market for low carbon and renewable heat needed to be built.

Initiatives have already begun to support the initial take-up of renewable heating technologies, particularly in areas not served by mains gas (off gas grid areas). For example, the Renewable Heat Premium Payment Scheme which provides a one-off financial incentive to take up renewable heat technologies. Upcoming schemes such as the Renewable Heat Incentive Scheme have also been planned, following consultation from September to December 2012.

As well as the renewable heat technologies (air and ground source heat pumps, biomass boilers and solar thermal) encouraged in the Renewable Heat Premium Payment Scheme, DECC is also exploring the potential of heat networks as part of its 'Strategic Framework for Heat'. These networks will offer to supply heat directly to homes and businesses through a piped network, rather than supplying the fuel for people to generate heat on-site within their homes. In addition to these renewable options, the efficiency of domestic gas boilers in the short and medium term needs to be maximised, and also the potential for domestic micro-CHP to replace gas boilers.

A key factor in achieving the UK's renewable and carbon targets is consumers' willingness to convert to more efficient heating options.

1.2 Research objectives

Understanding consumers' attitudes, behaviours and preferences is key to recognising how Government can achieve the desired change towards low carbon and renewable heating options.

Research was needed that quantified the preferences for more efficient heating options, and that qualitatively understood consumers' decision-making processes and preferences. The overall aim of this study was therefore to provide robust evidence on householder preferences for more efficient heating options, by addressing the research questions listed overleaf (see section 1.2.1). In turn, the work was intended to update and build on studies that have begun to explore the actions and choices of consumers (such as the Element Energy and Keeping FiT studies).

The study presented here explored the research questions in relation to seven more efficient heating technologies:

- Gas condensing boilers;
- Micro-combined heat and power (micro-CHP);
- Air source heat pumps (ASHPs);

- Ground source heat pumps (GSHPs);
- Biomass boilers;
- Heat networks; and
- Solar thermal.

The research explored homeowners' reactions to a range of heating option characteristics, such as financial (including upfront, running and maintenance costs) and non-financial (e.g. requirements for maintenance or fuel deliveries), as well as providing estimates of 'barrier costs' to help inform analysis of the domestic Renewable Heat Incentive (RHI).

1.2.1 Research Questions

Attitudes towards current heating system:

- What do homeowners like or dislike about their current heating system?
- What characteristics are 'must-haves' for any new heating system (e.g. reliability, ease of use/control)?

Triggers to replace heating system:

- How often do homeowners consider replacing/replace their heating system?
- What are the triggers/reasons for considering replacing/replacing their current system?
- What would encourage them to replace their heating system earlier (i.e. before it breaks down)?
- Do homeowners consider changing heating system alongside or separately from insulation measures, and solar thermal (and, if separately, in what order?)

Decision-making process:

- What process do homeowners go through to decide whether to replace their heating system?
- Who and what factors influence their decision?
- What information would they want to receive about potential suppliers, financial mechanisms, technologies?
- Where do homeowners go for advice, if at all, and whose advice do they trust most?
- What heating options would they consider (unprompted)?

Preferences based upon range of alternatives:

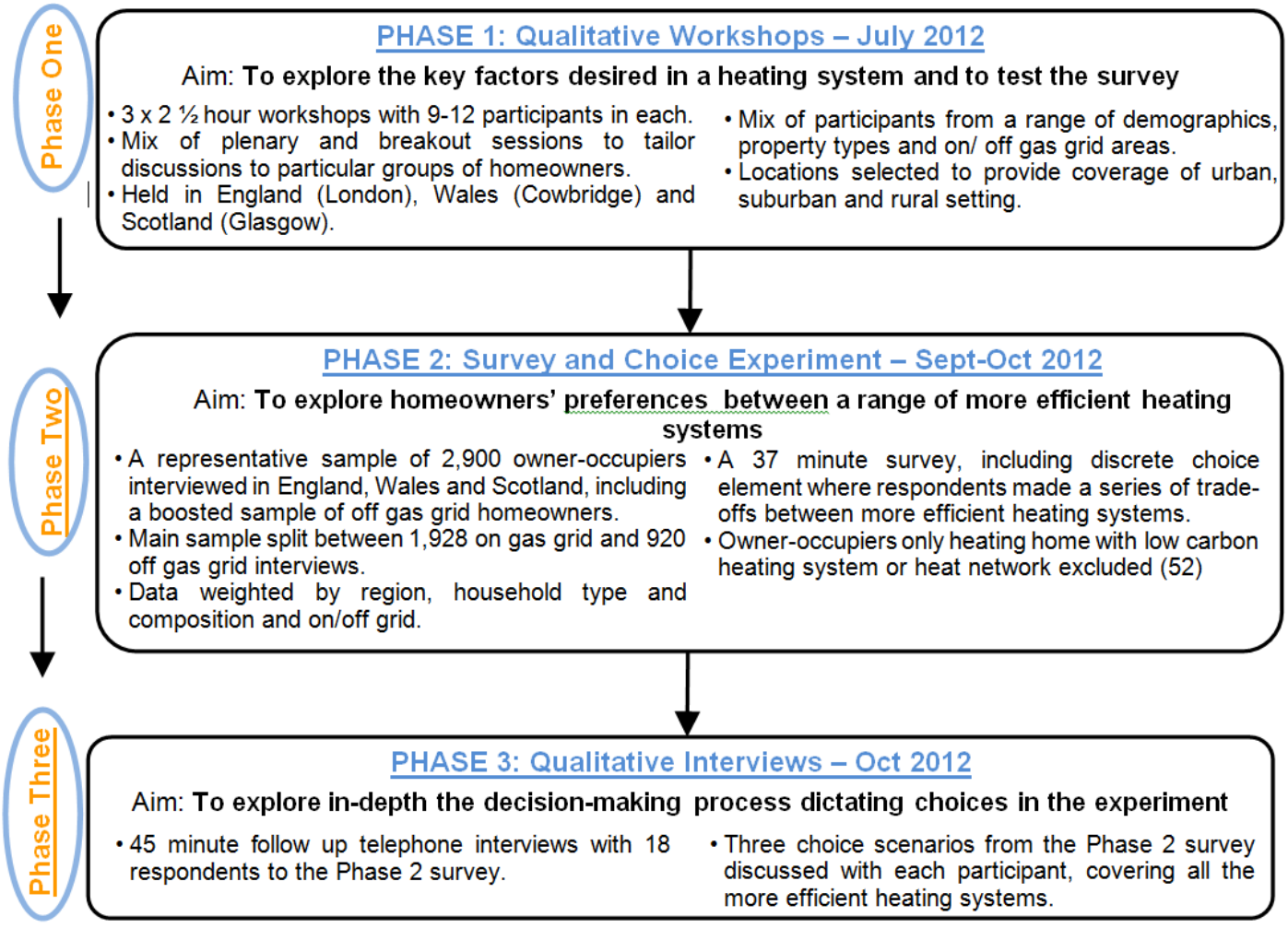
- If given basic information about the range of options feasible for their home, which option would they now consider and why? Which would be most attractive?
- How much would they be willing to pay (or need to be subsidised by) to take up each alternative technology, compared to a default cost of replacing their current heating system with the same type?

- How is likely take-up affected by the balance of upfront, running and maintenance costs?

1.3 Research methodology

The research consisted of three distinct phases which built on one another to answer the research questions set out above. An overview of the stages is presented below in Figure 6. These phases are detailed in full in the following section.

Figure 6: Summary of research approach



1.3.1 Phase 1: Qualitative Workshops

The Phase 1 workshops were an essential first stage to this study. The qualitative in-depth discussions with homeowners started to explore many of the key research objectives, such as the 'must-haves' for a heating system, reasons for having replaced/not replaced a heating system, and what triggers might prompt this in the future. During the workshops homeowners were also presented with basic information about the seven more efficient heating systems and asked to discuss the level of appeal of each.

Critically, this workshop phase also informed the Phase 2 quantitative survey by exploring key issues around low carbon heating options, and by helping to develop the approach for the 'choice experiment'.

Two key outputs from the workshops were cognitively tested: factsheets about each of the more efficient heating systems[10] and the template for the choice card to be used in choice experiment[11]. The workshops explored the key pieces of information (attributes) which needed to be included on the choice card, the order in which they should be presented, and the most appropriate language to use to describe them. This was a critical stage to ensure the choices presented to the Phase 2 survey respondents were meaningful and useful.

Phase 1 Sample design and recruitment

Three workshops were held in July 2012, one each in England (London), Wales (Cowbridge) and Scotland (Glasgow). The workshops lasted 2.5 hours with 9 to 12 (local) participants attending each. The recruitment process screened out those employed in market research, non-homeowners, those with a specific interest or stake in low carbon issues, people who have experienced a 'distress purchase' scenario in the last three months, early adopters, and those with no responsibility for household decisions.

By setting quotas for particular characteristics, each workshop comprised a mixture of homeowners across:

- ***Social-demographic factors:*** Notably in terms of age, gender and social class;
- ***Dwelling type:*** A mix of flats, terraced and detached/semi-detached housing, as well as those living in pre-1944 housing stock and those living in post-1945/pre-1990 housing; and
- ***Availability of space:*** Some participants were specifically recruited because they had outdoor private space or because they owned their own roof. This was so that GSHPs and solar thermal could be discussed with homeowners living in properties appropriate for these.

Prior to arriving at the workshops, the homeowners were requested to complete a homework exercise. This was designed to capture their thoughts about their current heating system, and the types of system they would consider in future, prior to being potentially influenced by discussions at the workshops.

The workshops involved a mixture of 'plenary' sessions (involving all 9 to 12 homeowners as one group), and smaller breakout groups which enabled those living in the same types of property, or types of area, to discuss the issues most relevant to their situation. Homeowners were divided into smaller groups as follows:

- **London**: one group of homeowners living on the gas grid, and one group for off gas grid homeowners;
- **Scotland**: all homeowners were on gas grid so the groups were divided according to property size – one group for owners of detached or semi-detached homes, and one group for owners of a flat or terraced home; and
- **Wales**: all homeowners were off the gas grid so the groups were divided according to property size – one group for owners of detached or semi-detached homes, and one group for owners of a flat or terraced home.

[10] All the factsheets tested at Phase 1 are provided in the Technical Annex and the final factsheets used in Phase 2 are presented in section 4.3 of this report.
[11] This is presented in section 1.3.2 and the initial template tested at Phase 1 is presented in the Technical Annex.

1.3.2 Phase 2: Quantitative Survey and Choice Experiment

Sample design and fieldwork details

The Phase 2 quantitative survey was designed to provide robust statistical data on the attitudes of owner-occupiers towards their current heating system and their previous system replacement history. It also explored relative preferences between, and likely uptake of, more efficient heating systems in both emergency and non-emergency situations. This was achieved through a 37 minute (average length) survey of a nationally representative sample of owner-occupiers (including both those who owned their property outright and those re-paying a mortgage).

Those who already used a biomass boiler, ground source heat pump, air source heat pump or heat network as the primary means of heating their home were screened out after a few questions about when they last replaced their heating system.

Homeowners were included in the complete survey if they used any of these technologies only as a *supplementary* way of heating their home, or if they had a gas condensing boiler, micro-combined heat and power, or solar thermal system installed. The rationale for including these homeowners was that they could still make worthwhile heating improvements to their home.

The first stage of Phase 2 was a pilot survey of 21 homeowners. This was conducted across four different sample points between 15 and 21 August 2012 to test whether the survey questions were understood by homeowners, to provide an accurate timing for the survey and to gauge the likely response rate. Some of the pilot interviews were observed by the project team so that they could see first-hand how the survey worked in practice. Following the pilot, all members of the project team and the interviewers held a de-brief to discuss their observations and to agree the changes required ahead of the main fieldwork stage.

The main fieldwork was carried out across Great Britain between 28 August – 14 October 2012. It used a random location sampling approach[12]. The interviews were conducted face-to-face in respondents' homes. The fieldwork was split between a nationally representative sample and a second sample which was 'boosted' to achieve more interviews in off gas grid areas. Quotas were set at a localised level to ensure a representative sample across key household and individuals characteristics. These focused on a few key variables to ensure the fieldwork could be completed within the time available, and due to the challenges of accessing owner-occupier demographic profiles.

The quotas were set on:

- Whether the property was on or off the mains gas grid;
- A minimum target for interviews with homeowners aged 18-34; and
- A minimum target for interviews with flat owners.

Other demographic factors, such as gender, social grade, work status and ethnicity were allowed to fall out naturally across the sample.

In all, 2,900 owner-occupiers, aged 18+ and at least jointly responsible for household decisions, were interviewed across England, Scotland and Wales.

[12] A random location sampling approach means that survey areas (at a double output area level) were selected and quotas were set within these areas on the types of respondents to interview. The random location approach is more rigorous and controlled than a standard quota survey which allows interviewers to conduct interviews in a much wider area.

In total, 52 of these homeowners were classified as 'early adopters' of more efficient heating systems (and so excluded from most of the questions), leaving 2,848 as the main sample for this research. The number of interviews achieved in each nation, and by on and off gas grid, is presented in Figure 7 below.

Figure 7: Breakdown of Phase 2 survey interviews by nation and on/off gas grid

	England	Scotland	Wales	Total Sample
On gas grid[13]	1,492	283	153	1,928
Off gas grid	563	152	205	920
Column Totals	2,055	435	358	2,848

The data presented in this report has been weighted by a number of different demographic and geographic variables to ensure the findings are representative of the homeowner population based on the best available data with known correlations with home ownership. The data was weighted by:

- Region to ensure it reflected the population size of the former nine Government Office Regions in England and the total population of Scotland and Wales;
- The known profile of household type and household composition across Great Britain; and
- Whether the property was currently connected to the mains gas grid or not.

More information about the sample design and weight specification is included in the Technical Annex.

Phase 2 Questionnaire design

The questionnaire was designed to answer the key research questions listed in section1.2.1.

The questions were developed using the findings from the Phase 1 workshops, and refined following the pilot survey. Both of these helped develop the terminology used in the questions and the range of answer categories offered to survey respondents. The interviewers used CAPI (Computer Assisted Personal Interviewing) laptops to show the questionnaire to participants and to collect their responses. This enabled interviewers to show stimulus material about the more efficient heating systems and allowed homeowners to enter responses to sensitive questions (e.g. household income) directly into the CAPI laptop without interviewer involvement.

This system also enabled the questionnaire to be routed and administered correctly, minimising the possibility of interviewer error. To ensure greater accuracy of the CAPI scripts, both 'hard' checks (where the interviewer will be required to correct values that were definitely wrong) and 'soft' checks (where potentially incorrect values are brought to the attention of the interviewer for confirmation or correction) were carried out.

The full Phase 2 survey questionnaire is included in the Technical Annex.

[13] Fourteen of the Phase 2 homeowners said they did not know if they were on or off the gas grid. This was split between 12 in England and 2 in Scotland. For the purposes of the table above, and the choice experiment conducted during Phase 2, these homeowners were considered as being on the gas grid.

Choice experiment design

The Phase 2 questionnaire included a 'choice experiment' which was selected as the best method of measuring the attractiveness of more efficient heating systems relative to each other.

A discrete choice-based approach was used, presenting homeowners with information about different heating systems and asking them to make a choice between them. This required homeowners to trade-off the different benefits associated with the different options and so uncovered their priorities and views towards each of the technologies. Homeowners were asked to make up to eight choices between pairs of more efficient heating systems. The more efficient heating systems included in the choice experiment were:

- Gas condensing boiler (only shown to those connected to the gas grid);
- Micro-combined heat and power (only shown to those connected to the gas grid);
- Ground source heat pump (only shown to those with private outside space);
- Air source heat pump (shown to all);
- Biomass boiler (shown to all); and
- Heat network (shown to all).

Although heat networks are currently only likely to be available in high density urban areas, they were shown to all homeowners during the choice experiment to future proof this research.

Homeowners were asked to make their choice on the premise of a non-emergency situation where their current heating system still worked but was possibly coming towards the end of its life, or that they wanted to replace it for another reason. The approach mimicked, as closely as possible in survey research, the real life decision situation homeowners would go through and the information they would use to make their decision.

The outputs from the choice experiment were used to explore the share of the population likely to take up one type of more efficient technology over another in a range of cost, grant and tariff scenarios. The analysis provides an order of preference between different heating systems when homeowners were in the scenario of considering replacement of their current heating system.

It is important to note that the choice experiment does not offer a market forecast. It was based on homeowners receiving basic and unbiased information about each system – and there are a variety of other factors that could influence uptake. These include marketing activity by providers, reputation, word-of-mouth, whether the homeowner is at a key 'trigger point', tailored advice, competitive activity and government awareness-raising activities.

Estimates are a short term measure of current appeal, based on the offer being available to everyone at one point in time. The results offer a snapshot based on homeowners' current financial, economic and household situation.

Figure 8 sets out the stages in the survey which led up to the choice experiment. Further information about the choice experiment methodology is presented in the Technical Annex.

Figure 8: Sequencing of Phase 2 survey and choice experiment

Asked **level of awareness** of lower carbon technologies – based only on name of technology, with no information given

Shown **factsheets with basic information** about each technology. – only shown options suitable for their property type. Asked **how positive/negative** feel about each. **See Figure 9**

Shown **list of attributes and given explanation** of each one e.g. annual payment **See Figure 10**

Asked to **consider scenario where they had decided to replace existing heating system** - not emergency, still works but maybe coming towards end of its life or want to replace for another reason

Told **cost info they were about to see was based on a property of a similar type** to theirs. If had **no radiators told it included cost** of installing radiator system if required.

Shown pairs of choices between lower carbon technologies and asked to select the one they would prefer to install in their home. **See Figure 11**

Figure 9: Example factsheet shown to survey respondents

Air Source Heat Pump

Air source heat pumps extract heat from the outside air. The heat is circulated using radiators or underfloor heating. They provide all your heating, and all or some of your hot water.

Key Facts

- Estimated to last 20 years.
- Typically takes 0.5 -1 day to install.
- Space needed on the outside wall.
- Needs little maintenance.
- Uses renewable fuel source and electricity.
- Emits some noise outside of the building.
- Space is needed for a hot water tank

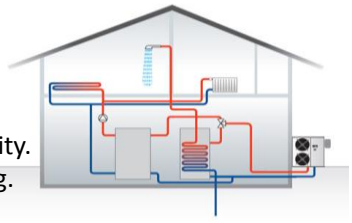
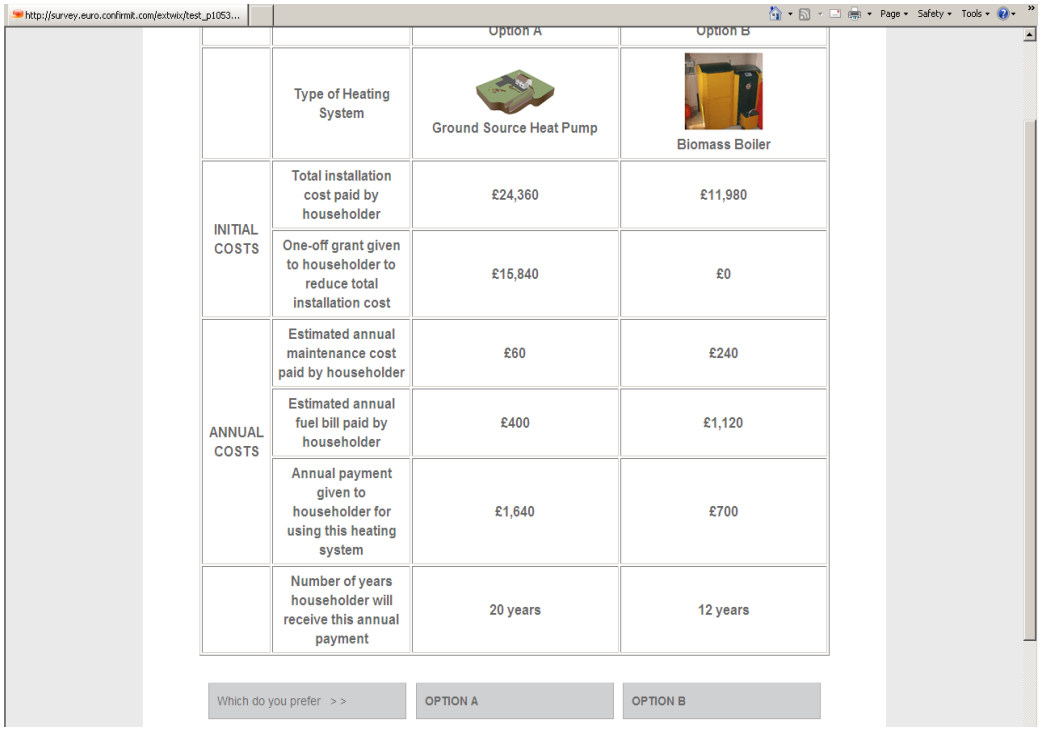


Figure 10: Attribute definition sheet shown to survey respondents prior to the choice experiment

DEFINITIONS OF ATTRIBUTES

Attribute	What does this mean?
Total installation cost paid by householder	The total cost you would pay to have the heating system installed, including the cost of the equipment and the labour costs. This cost covers the work needed to leave the home and garden tidy but does not include the cost for redecoration of a room or re-landscaping of a garden. This does not include the cost of buying and installing a hot water tank if needed.
One-off grant given to householder to reduce total installation cost	The amount you would be given to help you pay for the equipment and its installation. This grant could come from a number of different sources. For example, the Government, your local authority, a private company or your energy supplier. Anyone installing this heating system would be eligible for this payment.
Estimated annual maintenance cost paid by householder	The amount you are likely to pay each year for services and repairs. This does not include the price of parts.
Estimated annual fuel bill paid by householder	The amount you are likely to pay each year to your energy company for your heating and hot water using this heating system.
Annual payment given to householder for using this heating system	The amount you would be given each year by the Government, your local authority, a private company or your energy supplier for using this heating system. This is being introduced to encourage people to generate their heat using more energy efficient systems. This would be a free payment which you do not need to pay back or pay any interest on. This incentive would be available to everyone.
Number of years householder will receive this annual payment	This is the period of time over which the Government, your local authority, a private company or your energy supplier would commit to make this payment to you.

Figure 11: Example choice screen shown to survey respondents during the choice experiment



The values presented next to each of the attributes shown in Figure 11 varied between choice screens. This enabled the choice experiment to test the trade-offs made by homeowners in a very large number of cost scenarios. Figure 12 below shows the range of levels assigned to each attribute.

Figure 12: Range of attributes shown to survey respondents during the choice experiment

Attribute	Level 1	Level 2	Level 3	Level 4	Level 5
Total installation cost	Large decrease	Medium decrease	Current	Medium increase	Large increase
One-off grant (as proportion of installation cost)	0%	10%	65%	100%	130%
Annual maintenance cost	Fixed variable – single figure for each technology				
Annual fuel bill	Large decrease	Medium decrease	Current	Medium increase	Large increase
Annual payment given to householder	0% of RHI consultation tariff level	35% of RHI consultation tariff level	65% of RHI consultation tariff level[14]	100% - RHI consultation tariff level	135% of RHI consultation tariff level
Number of years householder receives annual payment	3 years	5 years	7 years	12 years	20 years

[14]The domestic RHI consultation document launched in September 2012. The 'RHI 2012 consultation tariff level' was used to set the tariff ranges in this research. More information about the consultation is available here: https://www.gov.uk/government/consultations/renewable-heat-incentive-proposals-for-a-domestic-scheme. The tariff amounts can be tested with any tariff length as the model incorporates a discount as the tariff value is spread over an increased number of years.

During the choice experiment homeowners were not able to give a neutral or 'don't know' answer. They were however asked a follow-up question after each choice screen. This asked:

- How likely they would be to actually install their selected technology in their current property in a non-emergency situation when their existing heating system still works but was maybe coming towards the end of its life (or they wished to replace it for another reason).

Where the results of the choice experiment are discussed in this report, the preference results between the technologies have been adjusted to account for likely over claim. This has been done using homeowners' stated likelihood of installing their selected technology which has been converted into a probability of uptake using an average down-weighting variable. This down weighting variable has been created by Ipsos MORI and is frequently used in customer and brand loyalty research to adjust consumer claims about purchasing high price ticket products or switching services.

The results of the choice experiment were also used to calculate a 'barrier cost'. That is the critical price or discount (the 'tipping point') at which homeowners would be persuaded to switch from their current heating system to a more efficient option[15].

Likely uptake of solar thermal was tested separately to the main choice experiment, as a solar thermal system would only provide hot water and not central heating. It could not therefore be compared like-for-like with the other systems. The appeal of solar thermal, and the relative likelihood of installing it, was only explored with homeowners who owned the roof on their building. Respondents were again presented with a one page factsheet about the technology and its allied costs.

1.3.3 Phase 3: Qualitative Follow-up Interviews

Phase 3 involved 18 qualitative in-depth telephone interviews with homeowners who had already completed the Phase 2 survey and were willing to be re-contacted for further research. Each interview lasted approximately 45 minutes.

The purpose of these interviews was to provide a deeper understanding of decision-making, influences and preferences dictating answers in the earlier choice experiment. Wider issues were also covered – such as how homeowners would finance a new heating system, their reasons for postponing installation in the past, and to understand in greater detail the related decision-making process. The interview guide used in these discussions is included in the Technical Annex.

Two or three choice scenarios from Phase 2 were discussed in detail during each telephone interview. This ensured that each technology was discussed with at least six homeowners.

The demographic details of the follow-up interviewees are also given in the Technical Annex. As a qualitative exercise, this was not designed to be representative of all owner-occupiers, but rather reflective of the range of views expressed in Phase 2.

The fieldwork took place between 15 and 26 October 2012.

[15] Further information on the barrier costs calculated using the choice experiment results will be published separately.

1.4 Presenting the findings

1.4.1 Report structure

This report draws on all three phases of the research to answer the research questions stated in section 1.2.1. The evidence is clearly referenced to the appropriate phase of the research throughout and where views varied either between phases, or between different groups of homeowners this is clearly stated.

The main body of the report consists of the following chapters:

Chapter 2: Attitudes towards current heating systems – Examines the heating systems currently being used by homeowners and the extent to which they are meeting household needs.

Chapter 3: Attitudes towards replacing heating systems – Examines the frequency with which homeowners have replaced their heating systems – and reasons for not doing so. It also discusses the expected future replacement of systems.

Chapter 4: Future preferences for heating system – Discusses the level of appeal of more efficient heating technologies. It presents the relative preference between these technologies and the key drivers affecting likely uptake. It also explores homeowners' reactions to financial assistance in the form of either a one-off upfront grant or an ongoing tariff payment.

Chapter 5: Conclusions – Draws together the findings presented throughout the report to reach overall conclusions about the likely uptake of more efficient heating systems, key barriers and triggers.

1.4.2 How generalisable are the findings from this research?

Throughout this study, each phase has been designed to produce high quality and robust results. The workshops and follow-up interviews draw upon qualitative research designed to reveal the breadth of views that exist across the owner occupier population. However, as with any qualitative research, it is not possible from these phases to determine what proportion of the population hold each of these views. The initial workshops and follow-up telephone interviews were used to shed light on why homeowners express particular views, rather than how many hold those views (provided by the Phase 2 survey). The results from the workshops and interviews are therefore intended to be illustrative rather than statistically reliable.

Representative data on the attitudes and behaviours of owner-occupiers is provided by the Phase 2 survey and choice experiment. This provides representative results across Great Britain. The data has been weighted to be balanced by region, however, the results for Scotland or Wales alone are not representative of these nations.

As a sample of homeowners, rather than the entire population, was interviewed the results are subject to sampling tolerances which means that not all differences between results are statistically significant. For example, for a question where 50% of the respondents in a weighted sample of 1,000 respond with a particular answer, the chances are 95 in 100 that this result would not vary more than plus or minus three percentage points from the result that would have been obtained from a census of the entire population (using the same procedures). Indications of approximate sampling tolerances for the Phase 2 survey, and for surveys of smaller groups of respondents, are provided Figure 13. As shown, sampling tolerances vary with the size of the sample and the size of the percentage results. This survey used a quota sampling approach. Strictly speaking the tolerances applied here apply only to random samples with an equivalent design effect. In practice, good quality quota sampling has been found to be as accurate.

Figure 13: Confidence intervals for Phase 2 survey

Size of sample on which survey result is based	Percentage point difference required for significance at or near these percentage levels		
	10% or 90%	30% or 70%	50%
100 interviews	+/- 6	+/- 9	+/- 10
200 interviews	+/- 4	+/- 6	+/- 7
500 interviews	+/- 3	+/- 4	+/- 4
800 interviews	+/- 2	+/- 3	+/- 4
900 interviews	+/- 2	+/- 3	+/- 3
1,000 interviews	+/- 2	+/- 3	+/- 3
2,900 interviews	+/- 1	+/- 2	+/- 2

The Phase 2 survey results allow robust comparisons in the findings for particular groups of homeowners. For instance, the attitudes of homeowners living off the gas grid about air source heat pumps can be compared robustly with the views of this technology held by those living on the gas grid. A difference in the findings for two groups of homeowners needs to be of a certain size in order to be statistically significant however. The difference in results must be greater than the values provided in Figure 14 below. Again, strictly speaking the sampling tolerances shown here apply only to random samples with an equivalent design effect. In practice, good quality quota sampling has been found to be as accurate. Where differences in the Phase 2 survey results between particular groups of homeowners are discussed in this report these are statistically significant differences at the 95% confidence interval.

Figure 14: Interpreting Phase 2 subgroup findings

Size of sample on which survey result is based	Percentage point difference required for significance at or near these percentage levels		
	10% or 90%	30% or 70%	50%
100 and 100	+/- 8	+/- 13	+/- 14
200 and 200	+/- 7	+/- 10	+/- 11
200 and 500	+/- 5	+/- 8	+/- 8
500 and 500	+/- 4	+/- 6	+/- 6
1,928 and 920 (on and off gas grid)	+/- 2	+/- 4	+/- 4

The figures produced by the Phase 2 choice experiment are probabilities rather than mean scores or percentages and so it is not generally appropriate to conduct significance testing on these estimates.

However, a rule of thumb to guide interpretation of the choice experiment results is presented below. Three findings from the model are presented as examples of the difference in results needed to consider the variation significant.

Figure 15: Interpreting Phase 2 choice experiment findings

Adjusted share percentage	Confidence interval at 95% level (i.e. possible range this finding could fall within)
1% of all survey respondents (2,848) opting for a ground source heat pump	+/- 0.13
1.5% of all off gas grid survey respondents (906) opting for an air source heat pump	+/- 0.31
15% of all on gas grid survey respondents (1,911) opting for a gas condensing boiler	+/- 0.68

1.4.3 Terminology used in the report

Throughout this report the evidence being discussed is clearly referenced back to the appropriate phase of the research using the following terminology:

- Phase 1 homeowners are referred to as workshop participants;
- Phase 2 homeowners are referred to as survey respondents; and
- Phase 3 homeowners are referred to as follow-up interview participants.

Where this distinction is not made it is because the finding being discussed applied to homeowners from several phases of the study.

Where the report presents percentages these are all taken from the Phase 2 survey. As stated in section 1.4.2 above, it is not possible in qualitative research to provide percentages of respondents who gave one view or another. However, where possible this report does provide a sense of how prevalent views were in the workshops and follow-up interviews. Terminology such as 'most homeowners felt….' is used to indicate that a view was widely shared. Where the report refers to 'most' homeowners this indicates that this view was held by nearly all the homeowners involved in the Phase. 'Many' homeowners refers to a significant proportion of homeowners, while 'some homeowners' will usually refer to a particular group of respondents who held one view in contrast to another group holding a different view.

The report does also include the views expressed by only a few workshop or follow-up interview participants. These could be considered minority views but are still pertinent to include if they were strongly held views by a small number of individuals, or if they represented emergent discourses. The report therefore sometimes refers to 'a few' or 'a couple' of homeowners to illustrate the presence of important minority views. Any quantification such as this used in the reporting should always be considered indicative, rather than exact. Verbatim comments have been included in this report to illustrate and highlight key points, whether they are key because they are shared by a large number of homeowners or because they reflect the strong views of a smaller subset.
This report uses a number of abbreviations as explained below:

The term 'renewable heating systems' refers to biomass boilers, GSHPs and ASHPs. When the term 'more efficient heating systems' is used this also includes gas condensing boilers, micro-CHP and heat networks.

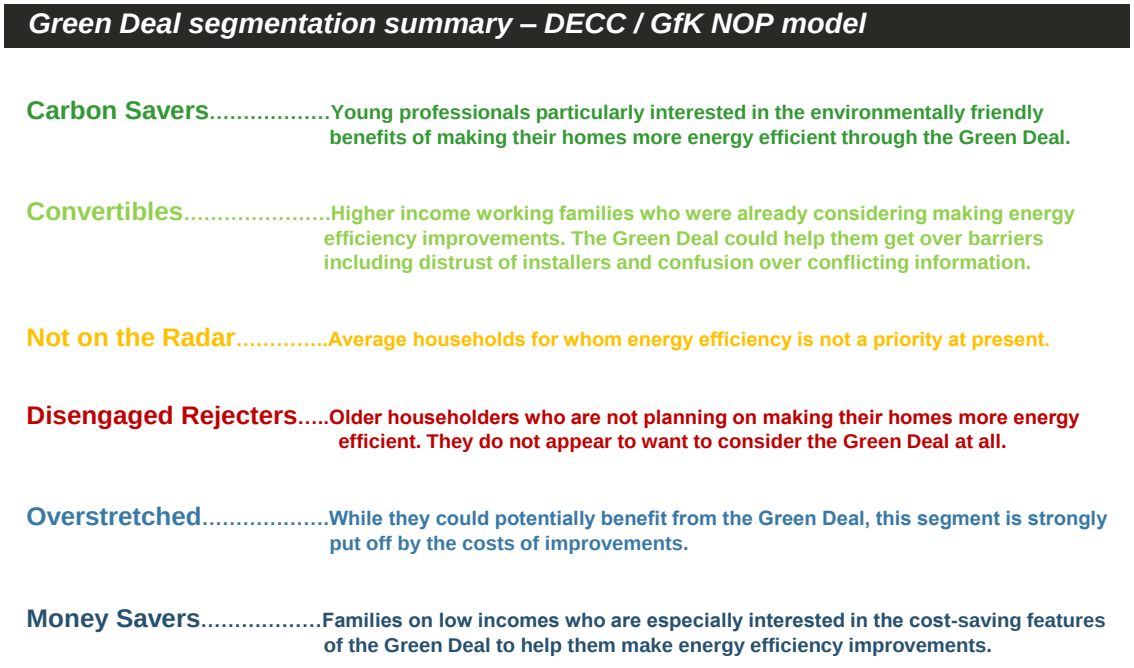
This report considers how the views of homeowners towards heating differed by demographic profile, area and property type and previous behaviour. It also considers responses from low income, vulnerable groups who are more likely to be in or at risk of fuel poverty. Where a group of homeowners is described as 'low income and vulnerable' this refers to survey respondents with a total household income before tax of less than £16,000 per annum, and in one of the following circumstances:

- Living in a household with children under the age of 16, and/or receiving child tax credits;
- Living in a household with residents aged 65 and over and/or in receipt of pension credit; or
- Living in a household with a resident with a long-standing illness, disability or infirmity, or receiving working tax credit or Disability Living Allowance.

Where homeowners are referred to as living off the gas grid this includes any homeowners who do not currently use gas within their homes. This includes both homeowners living in properties which cannot be connected to the gas grid and homeowners living in properties which could be connected but are not at the present time. The full data tables for Phase 2, which accompany this report, provide a breakdown of all the results by these different types of off gas grid homeowners.

The findings have also been analysed in relation to the six Green Deal segments developed by DECC[16]. Where these segments are referred to in the report, they describe the groups of homeowners set out in Figure 16.

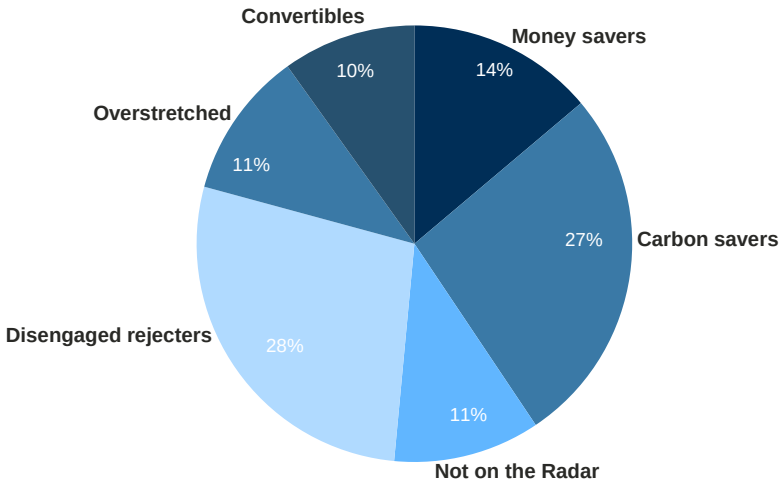
Figure 16: Green Deal segmentation summary



[16]GfK NOP and Kantar Research, 2012, *Green Deal Segmentation,* DECC. Available at http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/green-deal/7057-research-report-green-deal-segmentation.pdf

Figure 17: Survey respondents broken down by Green Deal segmentation

Proportion of Phase 2 survey respondents in each of the Green Deal segments



Base: All respondents who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

2. Attitudes towards current heating systems

Key observations

- The most common heating system used was a gas boiler (80% overall) – with 67% of respondents using any type of combination boiler and 51% using any type of condensing boiler. By contrast, only 2% overall were using a heat network, GSHP, ASHP or biomass boiler.
- Nearly all respondents were using the same system for heating and hot water. Only 6% used a different system, most commonly an electric immersion coil.
- Among workshop participants, those using a combination gas boiler were the most satisfied and the least satisfied were those in off gas grid areas, particularly in *urban* off gas grid areas where many were using electric heating systems they described as expensive and ineffective. These homeowners may be the most receptive to alternative heating methods.

2.1 Which heating systems are currently used?

The most common heating system used by survey respondents was a gas boiler (80% overall and 92% among on gas grid homeowners). In off gas grid areas oil boilers were widely used (52%), while others used electric storage heaters (15%) or another type of boiler, such as LPG or bottled gas (12%).

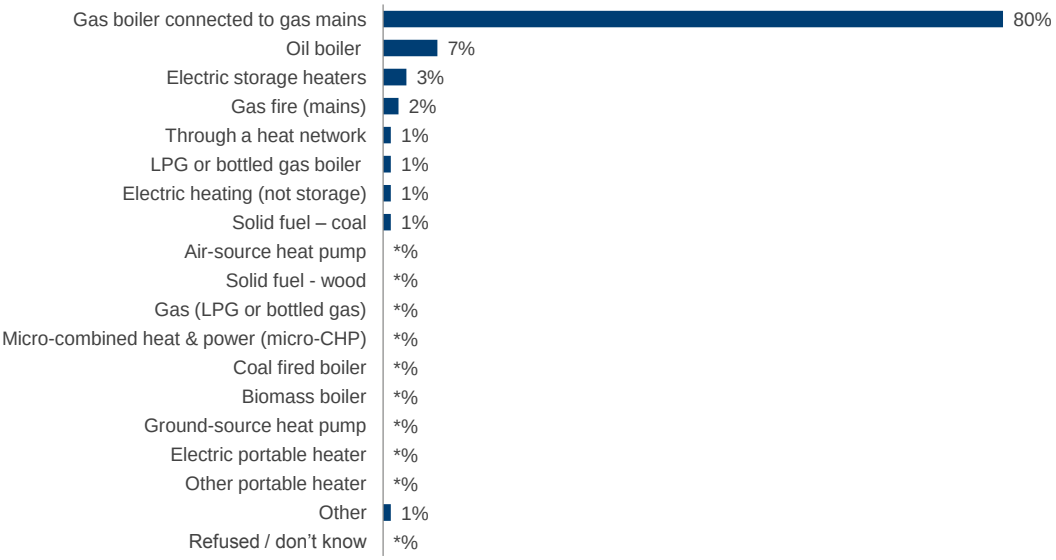
Only 2% of survey respondents overall were currently heating their home using a heat network, GSHP, ASHP or biomass boiler (see Figure 18 for full breakdown).

These results match fairly closely with national statistics. The English Household Survey records 84% of households using mainly a gas boiler, 4% an oil boiler and 1% LPG or bottled gas (compared to 80%, 7% and 1% in our survey). While these figures are based on all households across England (rather than owner-occupied properties in Great Britain), it suggests the respondents to this survey were fairly representative.

Figure 18: Main heating system used by survey respondents (single response given)

Please look at this list and tell me whether you heat your home in any of the following ways? And which of these is the main way that you heat your home?

% describing this as main heating system



Base: All respondents (2,900), 28th August to 14th October 2012

Source: Ipsos MORI

Most who use gas, LPG or oil boilers to heat their homes have a combination boiler (67%) – but somewhat less so among those aged 55+ than aged 18-54 (60% vs 73%). Combination boilers were also more commonly used in properties built after 2002 (78%), and in flats (87%).

Most of the gas, LPG and oil boilers were reported to be condensing boilers (51%). These were more prevalent among high income homeowners (58% of those with total household income of £50,000+) than less affluent groups (45% of those with income of less than £20,000).

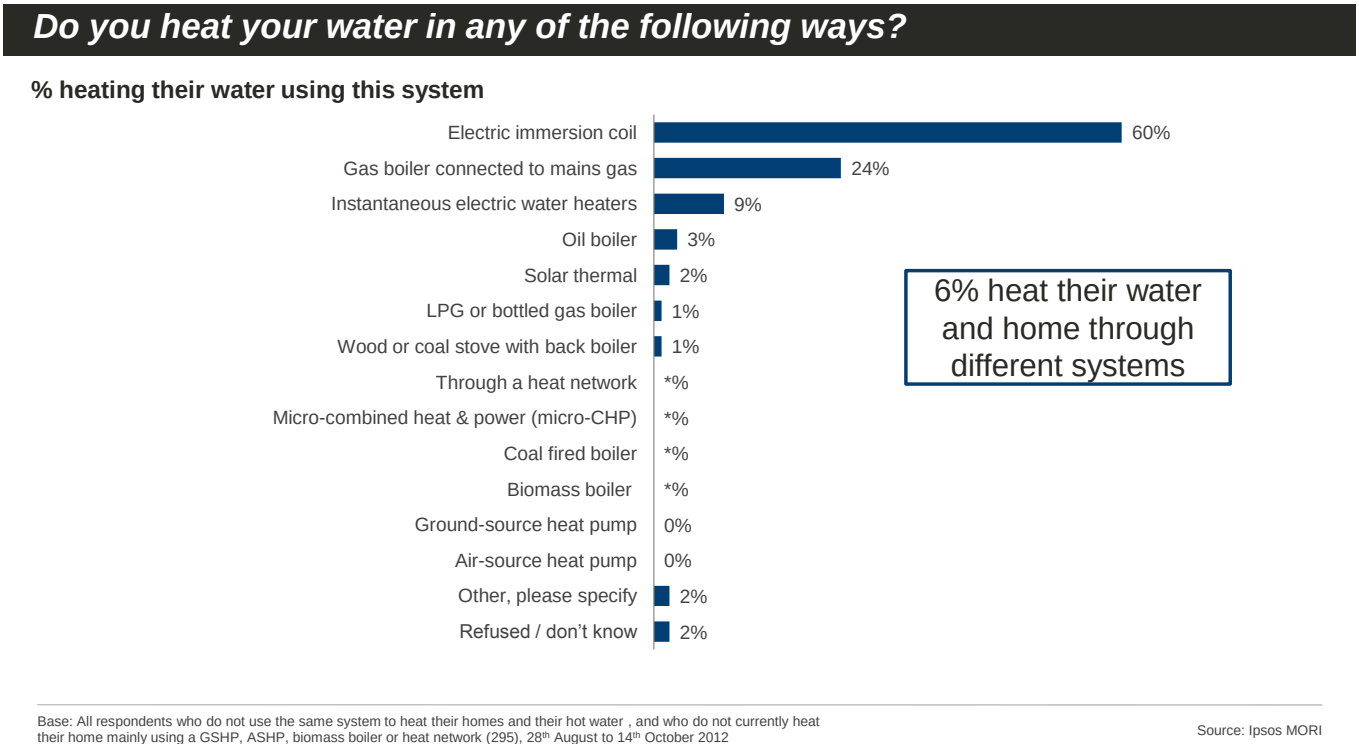
One in ten (10%) did not know whether their boiler was condensing or not – rising to 15% of those in Green Deal Segment Two "Not on radar", and those who had never heard of any of the more efficient heating systems (22%). Figures were more consistent in terms of respondent age, income and nations.

Almost all (93%) were using the *same* system to provide their hot water and heating. Among the 6% using different methods[17] (Figure 19), the most common method was an electric immersion coil (60%), followed by a gas boiler (24%).

National statistics suggest that these findings are fairly accurate. While there is not an exact comparable measure in the English Household Survey, it can be estimated that around 97.5% of homes use the same fuel for both heating and hot water. (Again, this is based on all households in England rather than owner-occupied properties across Great Britain).

[17] The remaining 1% either refused to state whether they used the same system for space and water heating or said they did not know.

Figure 19: Hot water system used by survey respondents who heat their homes and water in different ways (multiple response given)



Nearly half the survey respondents (47%) were using more than one heating method. The two most common additional systems were mains gas fires (8%) and electric portable heaters (5%). Open fires or enclosed stoves, fuelled by either wood or coal, were also being used by some.

The workshop and follow-up interviews revealed that supplementary heat sources were being used for various reasons including to[18]:

- Heat particularly cold parts of the house;
- Provide heat while waiting for the main heating system to reach the desired temperature; and
- Enable the main heating system to be switched off so as to just heat the room being used.

"I've got an open fire and a wood burner, so we tend to use them quite a lot to keep the gas bill down."
Follow-up interview participant, off gas grid homeowner, rural, large property, female, resp. 16

[18] The workshops did not explore how often these supplementary heating systems were being used.

2.2 How well do current heating systems meet homeowners' needs?

2.2.1 Homeowner assessment of current heating systems

Those in the initial workshops used a wide range of heating systems, including those discussed above: gas boilers, oil boilers and electric storage heating. None of these homeowners were using a more efficient heating system or solar thermal in conjunction with another heating system.

The workshop participants (though not the survey respondents) were asked to what extent their current heating system met their household needs. The criteria they used are listed below – with the most-commonly raised listed first.

- Most immediately discussed the size of fuel bills, and whether this was increasing over time either due to the heating system becoming less efficient or the price of the fuel going up;
- Most referred to the effectiveness of the system in heating the whole home to the required temperature;
- Many considered the availability of instant hot water on demand, as opposed to having to wait for a hot water tank to heat up;
- Some thought about the ease with which the system could be controlled to provide heat at certain times or in certain areas of the home; and
- A few assessed the aesthetics of the system and whether it was in keeping with the style of the rest of their home.

Differences between groups of homeowners

Workshop participants with a combination gas boiler were most likely to feel their current heating system met their needs. Their heating system was rated effective in heating their home, as easy to use, and to give them flexibility through hot water being available on demand.

> *"I have a combi system. It's very convenient, I love it. I can have every room set to a temperature I want, the hot water comes on demand."*
> Workshop participant, on gas grid homeowner, urban, male

The availability of *instant* hot water was particularly missed by those without a combination gas boiler. Many said they disliked hot water tanks due to the space taken up and the inflexibility of having to plan when to heat water. This view was expressed most strongly by those in small properties and urban areas, although shared by many others.

Workshop participants in on gas grid properties were generally more satisfied with their heating systems – but many still rated them partly inadequate due to the high fuel bills incurred.

In off gas grid areas (especially *urban* such areas) dissatisfaction often centred around electric heating systems' difficulty of control and high running costs.

> *"I do not believe my current heating system is energy efficient. It runs on electricity only which can be very expensive."*
> Workshop participant, off gas grid homeowner, urban, female – pre-task exercise

In contrast to the urban off gas grid homeowners, there was a higher level of satisfaction with the heating systems used by workshop participants from rural off gas grid properties. These respondents used a wider variety of heating systems, including LPG, oil, wood stoves and Agas to meet their needs rather than just one central system. Although overall the rural off gas grid homeowners seemed to be

more satisfied than urban off gas grid homeowners, there were still a few who felt their current system was expensive and ineffective. Overall, homeowners living in on gas grid areas were the most satisfied with their current heating systems than off gas grid homeowners.

> *"I wish I had gas. I find electric inefficient, expensive, cumbersome and not reactive to my heating needs."*
> Workshop participant, off gas grid homeowner, rural, small property, male – pre-task exercise

> *"We currently use oil and this has become very expensive."*
> Workshop participant, off gas grid homeowner, rural, large property, male – pre-task exercise

3. Attitudes towards replacing heating systems

Key observations 1 – past replacement behaviour

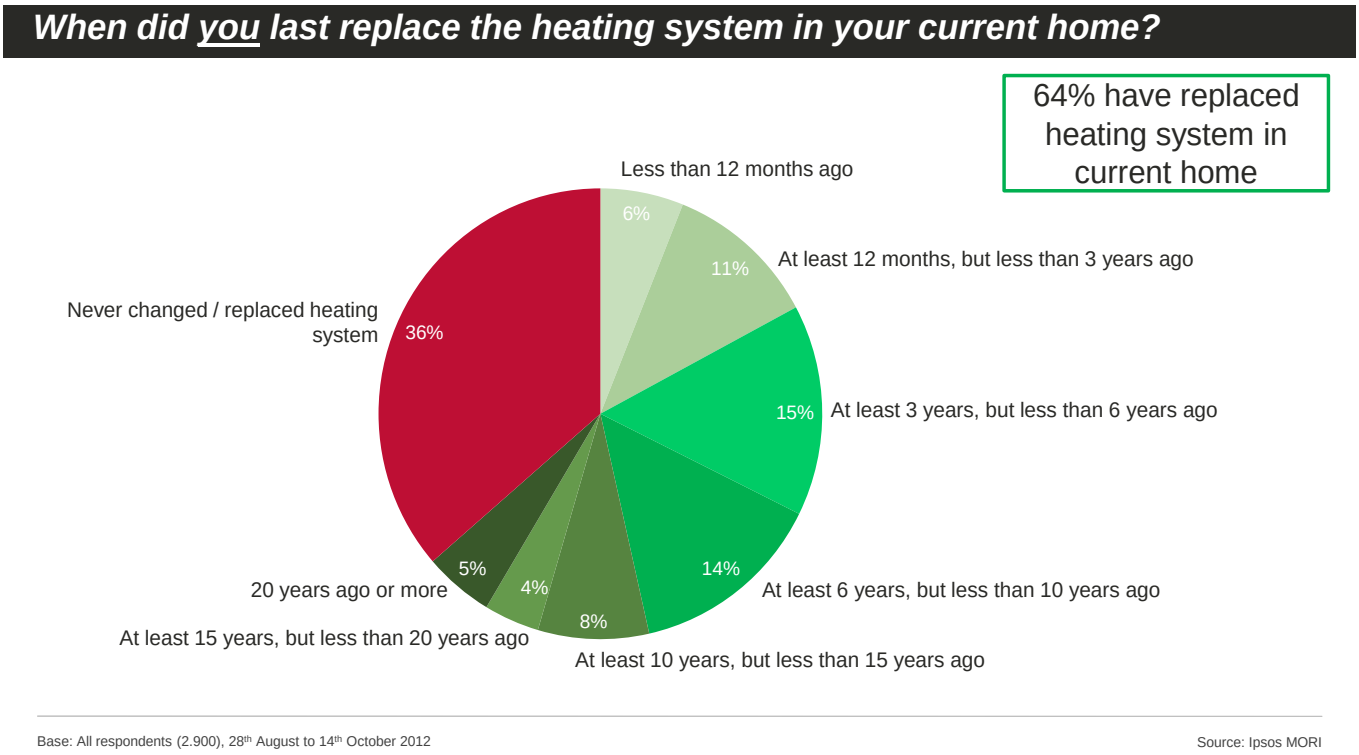
- Two thirds (64%) of homeowners surveyed had replaced their heating system in the past – nearly half of all respondent (47%) had done so within the last 10 years. Out of those who had replaced their heating system, 68% had done so within a year of first considering it.
- Delays in installation were most often due to the need to raise initial capital.
- Replacements were most often prompted by existing heating systems breaking down (30% gave this as the main reason). Non-emergency situations were also commonly cited as the main reason, either because they were told the heating system would not last much longer (14%), it needed too frequent repairs(14%), or as part of wider property renovation (13%).
- Most who had not replaced their system had also never considered doing so (68%). Over half (57%) explained that this was due to their current system still working, and a further 25% *explicitly* said they would only replace a system once it had broken down. Financial factors also played a part: a lack of available capital, or the assumption that a new system would be unaffordable, accounted for 22% in total. While providing upfront financial assistance may help overcome these financial barriers, a significant challenge will be that most homeowners do not anticipate replacing their heating system until it actually breaks down.
- Individual people (repairmen, engineers and friends) are the most trusted sources of advice – even if they represent organisations such as energy companies which may *corporately* be less trusted.

3.1 How many homeowners have replaced their heating systems – and why?

3.1.1 How many have replaced their systems?

Approaching two thirds (64%) of homeowners surveyed had replaced the heating system in their current home – while 36% had never done so (Figure 20). Nearly half of all respondents (47%) had done so within the last 10 years, a third (32%) within the last six years, and 17% within the last three years.

Figure 20: Heating system replacement (single response given)



The Phase 2 survey identified the following groups as **most likely to have replaced their system**:

- Those **living in their property for more than 10 years**: 81%.
- Those living in **properties built before 1965**: 72%.
- Those **connected to the mains gas grid:** 66%, compared to 55% in off gas grid areas.
- **Detached or semi-detached owners**: 67%, compared to 43% of flat owners.
- Those **aged 55 or over**: 75%. The pattern was the same for households where the chief income earner was retired (75%, compared to 59% of those employed), and where there was an occupant with a long-term illness, disability or infirmity (72%, compared to 63% of households where this did not apply).

A statistical model of the household behaviour was developed to determine an estimated **Decision Making Frequency** function. This is a calculation for each household which represents the probability of the household deciding to replace the heating system within the current year.

The most important variable in the model is the age of the boiler. Over 80% of the variation in the likelihood to consider replacing the heating system is driven by the age of the system. The analysis shows that households with systems older than 20 years are five times more likely to consider replacing than the average (10% vs. 2%), while households with systems younger than three years are close to zero chance.

Other demographic variables which appear to be significant are total household income and the size of the property (although it is likely these are related to one another):

- Respondents living in detached properties are 45% more likely to consider replacing than those living in flats; and

- Upper income groups (with a total household income of £30K+) are 31% more likely than lower income groups (with a total household income of <£30K) to be considering replacing their heating system.

3.1.2 Why have systems been replaced?

Most often, a replacement is prompted by a system breakdown (30% in the survey said this was the main reason for replacement – but also the most prevalent reason in the other Phases).

> *"The boiler broke down and I was forced to change."*
> Workshop participant, on gas grid homeowner, urban, male – pre-task exercise

> *"Old one just wore out"*
> Follow-up interview participant, on gas grid homeowner, suburban, small property, male, resp. 7

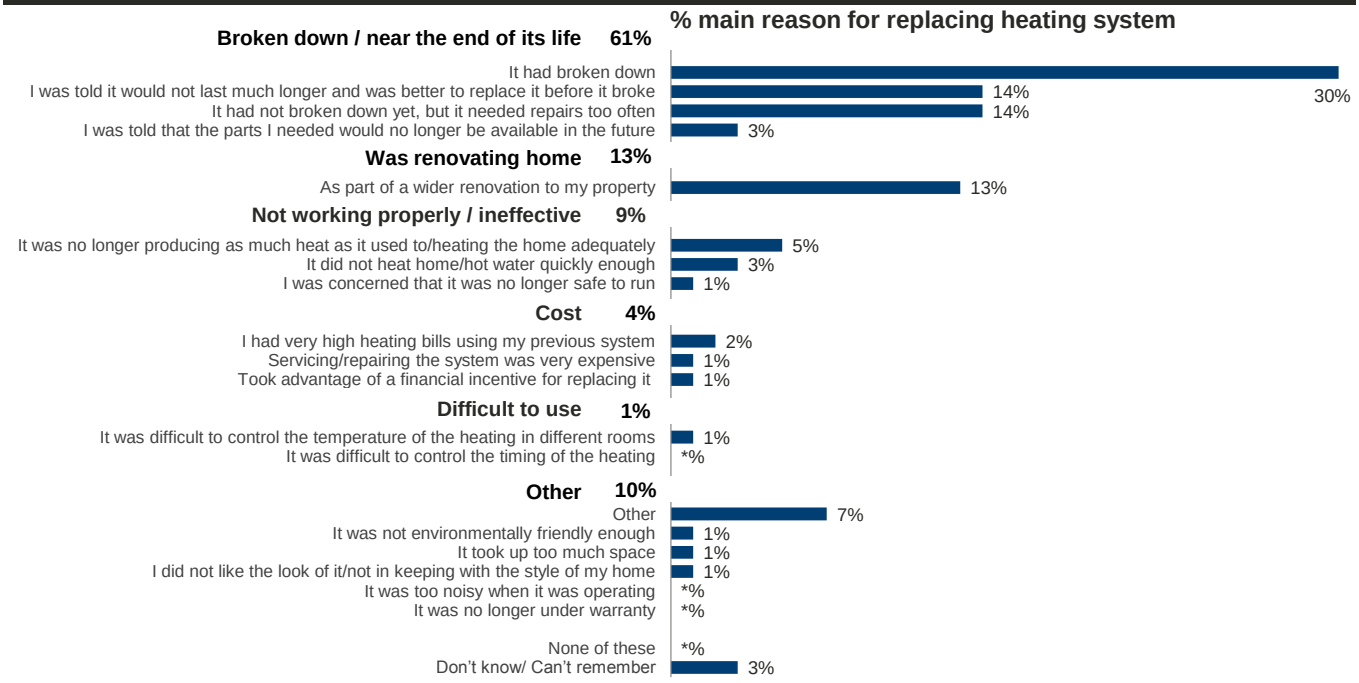
Anticipated breakdown due to system reaching the end of its life was also commonly given as the main reason for replacement: either the homeowner being told the system would not last much longer and better to replace it before it broke (14%), or it needing frequent repairs (14%) or being told the parts would no longer be available in the future (3%), as is the system not working properly or being ineffective (9%). A range of these reasons had often contributed to the decision to replace a heating system among workshop participants who had done so in the past.

> *"Well the old boiler was making quite a racket and it was getting quite expensive to run and the heating wasn't very good anyway; it wasn't heating the house up very well. We'd had it in for about 22 years or something, so we decided to get a new boiler and we got a combi boiler."*
> Follow-up interview participant, off gas grid homeowner, urban, small property, female, resp. 4

The most common reason to replace a system *other than* actual / anticipated breakdown was as part of a wider property renovation (13%). This was more prevalent among high income (£50,000+) households, at 23%, but less so among the Green Deal 'Disengaged Rejecters' (8%). The latter ties in with the key characteristics of this group, who were older, not planning to make energy efficiency improvements, and not interested in the Green Deal offer.

Figure 21: Why have systems been replaced (single response given)

Did you replace the heating system in your home for any of the following reasons? Which of these do you think was the most important reason leading you to replace your heating system?



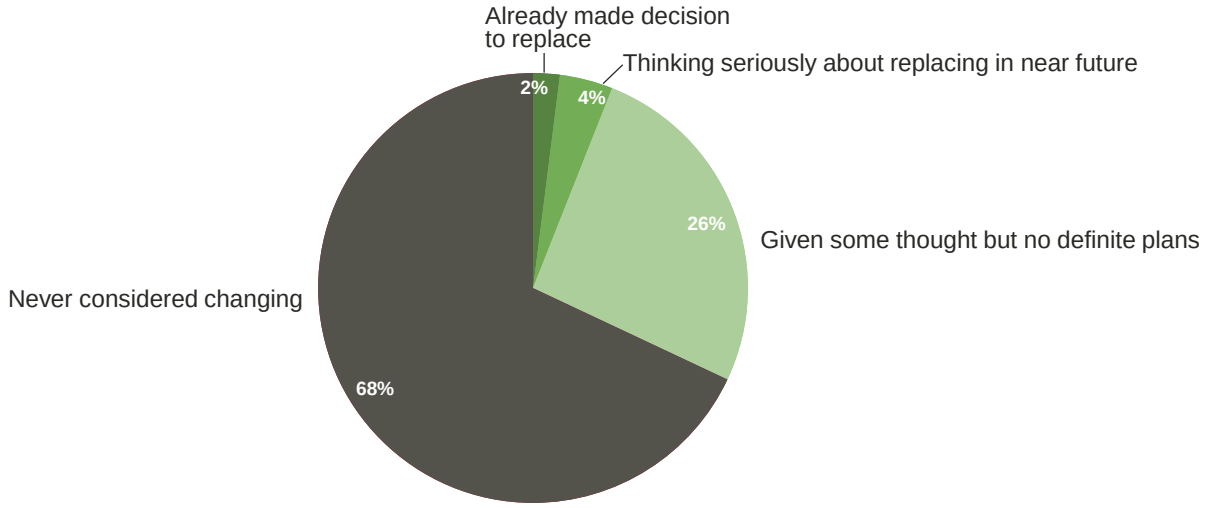
Base: All who have replaced their heating system in the past , and who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network (1,807), 28th August to 14th October 2012

Source: Ipsos MORI

Most who had <u>not</u> replaced the heating system in their current home said they had never considered doing so (68%). Around a quarter (26%) had given it some thought – but with no definite plans - and a very small minority said they were seriously considering it (4%) or had already decided to replace (2%).

Figure 22: Future plans among those who had not replaced the system in their current property (single response given)

Which of the following best describes what you are likely to do with your heating system in the future?



Base: All respondents who have never replaced their heating system , and who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network (1,041), 28th August to 14th October 2012

Source: Ipsos MORI

Among those who were reportedly *considering* a system replacement, the most common reasons again centred around the system breaking down or being close to doing so or a wider property renovation. See Figure 23.

However, two other factors were also emphasised a little more than by those already having installed a new system: 11% reported high energy bills as the main reason for considering replacement and 7% the current system not being environmentally friendly enough. The latter was most often cited by those aged 35 to 54 (12%).

Figure 23: Why are homeowners considering replacing a heating system (single response given)

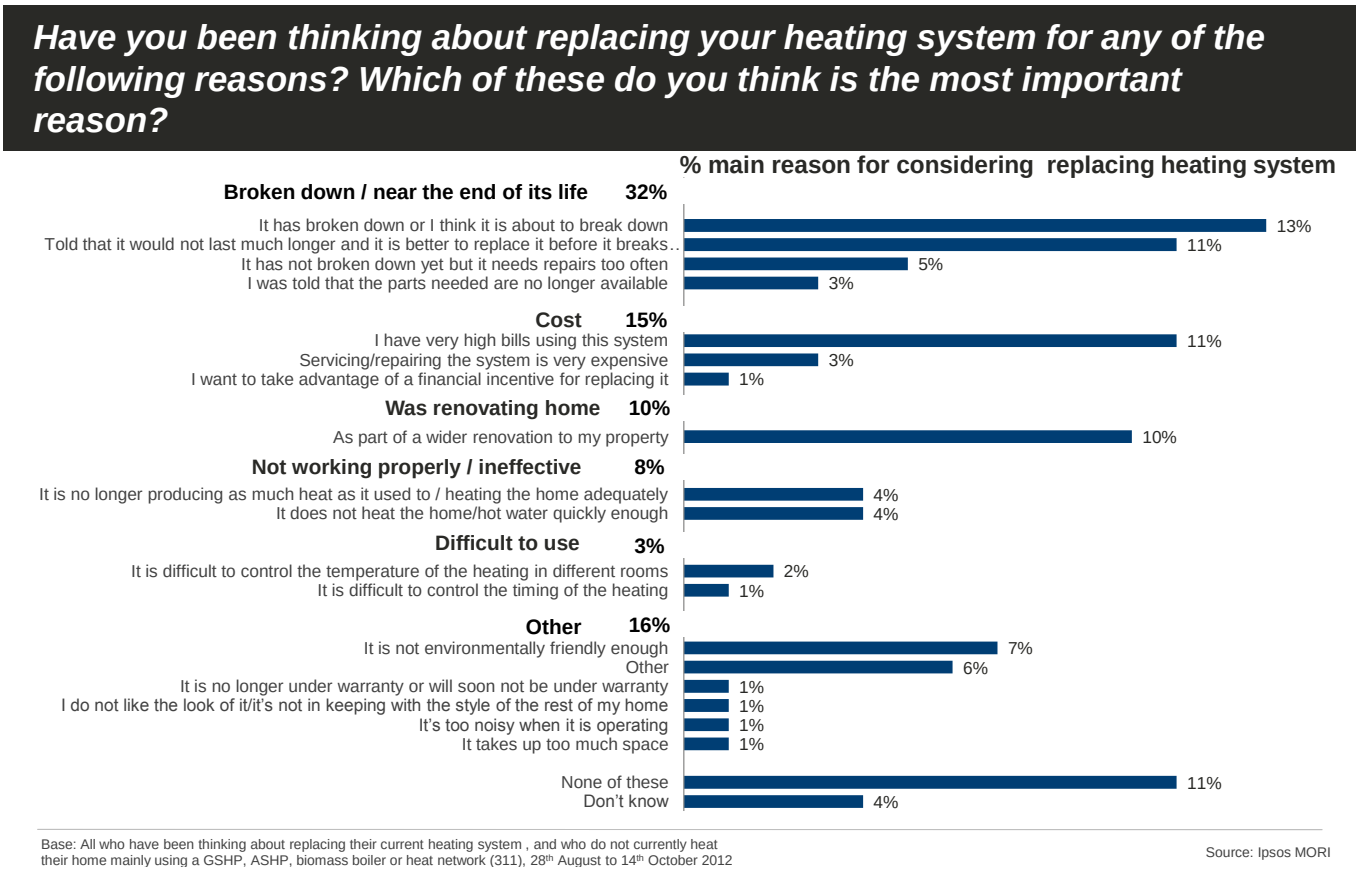


Figure 24 below shows the sources of advice consulted by survey respondents when they replaced a system. Two in five (42%) asked a boiler repairman for advice, and friends, family and colleagues were also widely consulted (24%). According to the workshops it is likely that these were often 'technical friends' who had some knowledge or expertise in heating or plumbing.

> *"A friend who is Corgi registered."*
> Workshop participant, on gas grid homeowner, suburban, large property, male

Those in off gas grid areas (particularly rural) cited word-of-mouth advice from other residents as an important source. This advice was felt valuable and trusted as it came from people with similar heating needs and circumstances.

A few of the workshop participants had consulted online sources of information as had 6% of survey respondents. Specific websites cited included mybuilder.com and which.co.uk, though most could not recall the name of a specific website and had used a search engine to find independent websites.

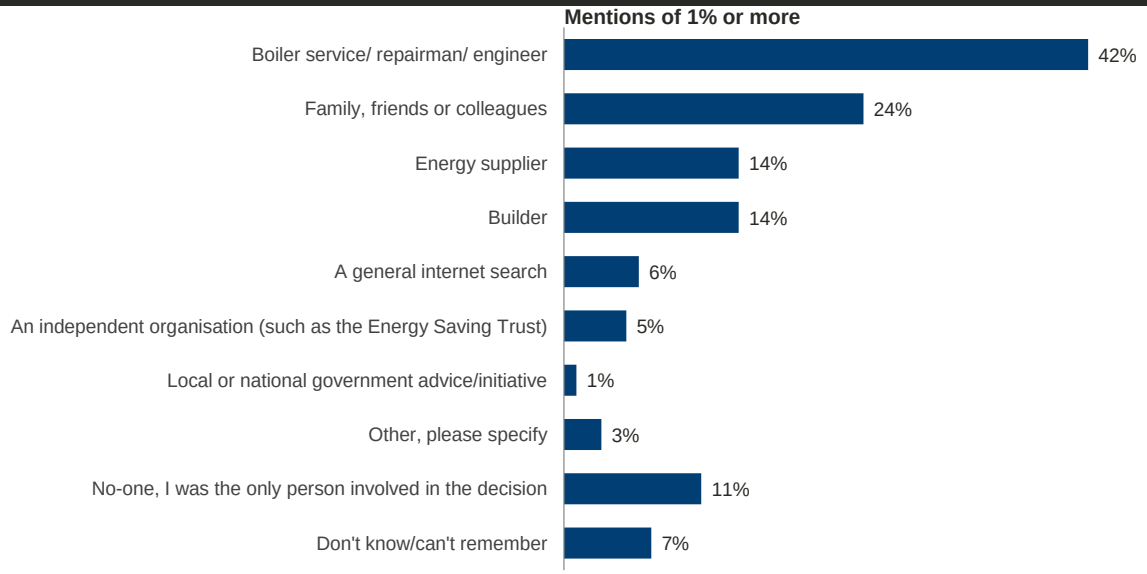
The latter were used by a few homeowners to verify information they found elsewhere, for example on an energy company website or on materials distributed by their energy company. Generally, information advertised by energy companies was less trusted by workshop participants than were independent sources or word-of-mouth. However, the energy company, and in particular the boiler serviceman or engineer, was cited as a common trigger for looking for further information, especially among on gas grid homeowners.

Despite some lack of trust in the energy company as a whole, these homeowners were trusting of the information delivered to them face-to-face by a serviceman who they considered an expert.

"It was the gas fitter guy that was coming in and looking round the place and he recommended a particular type of boiler, something I'd never heard of but now I have it."
Workshop participant, on gas grid homeowner, suburban, large property, female

Figure 24: Sources of advice when homeowners replaced their heating system (multiple responses given)

Which, if any, of the following did you consult for advice to decide which type of heating system to install?



Base: All who have replaced their heating system in the past , and who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network (1,807), 28th August to 14th October 2012

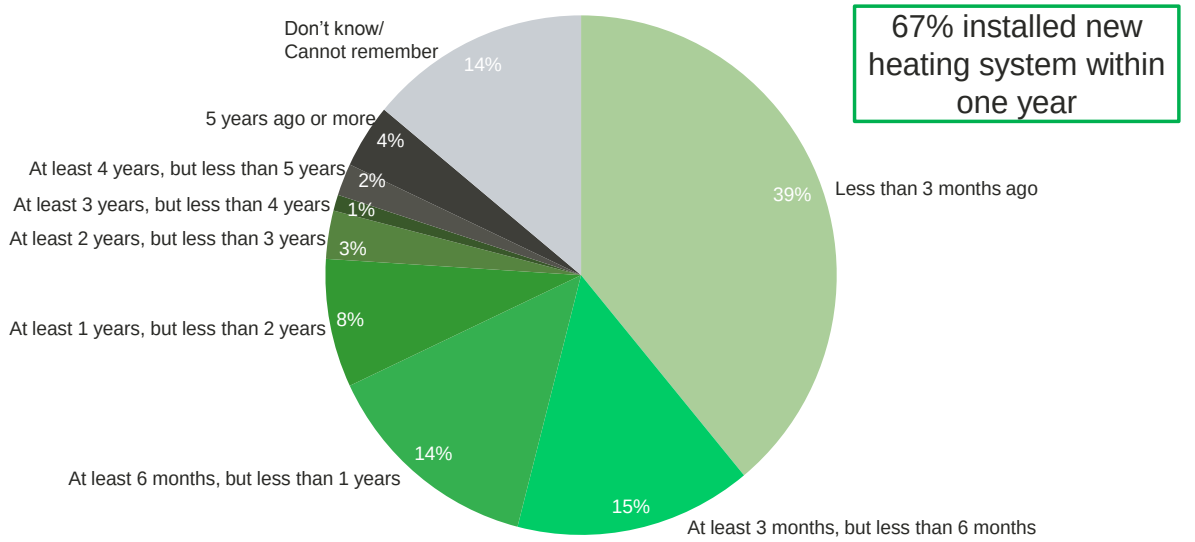
Source: Ipsos MORI

3.1.3 Reasons for delaying installation of new heating system

Most who had replaced the heating system in their current home did so within one year of first considering it (68%). Some were even faster: installing within the first three months (39%). By contrast, one in five (18%) waited one year or more, and 4% waited 5 years or more.

Figure 25: Period of delay among those who had replaced their heating system (single response given)

How long was it roughly between the time that you first started considering replacing your heating system, and the time when you actually had a new system installed?



Base: All who have replaced their heating system in the past , and who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network ((1,807), 28th August to 14th October 2012

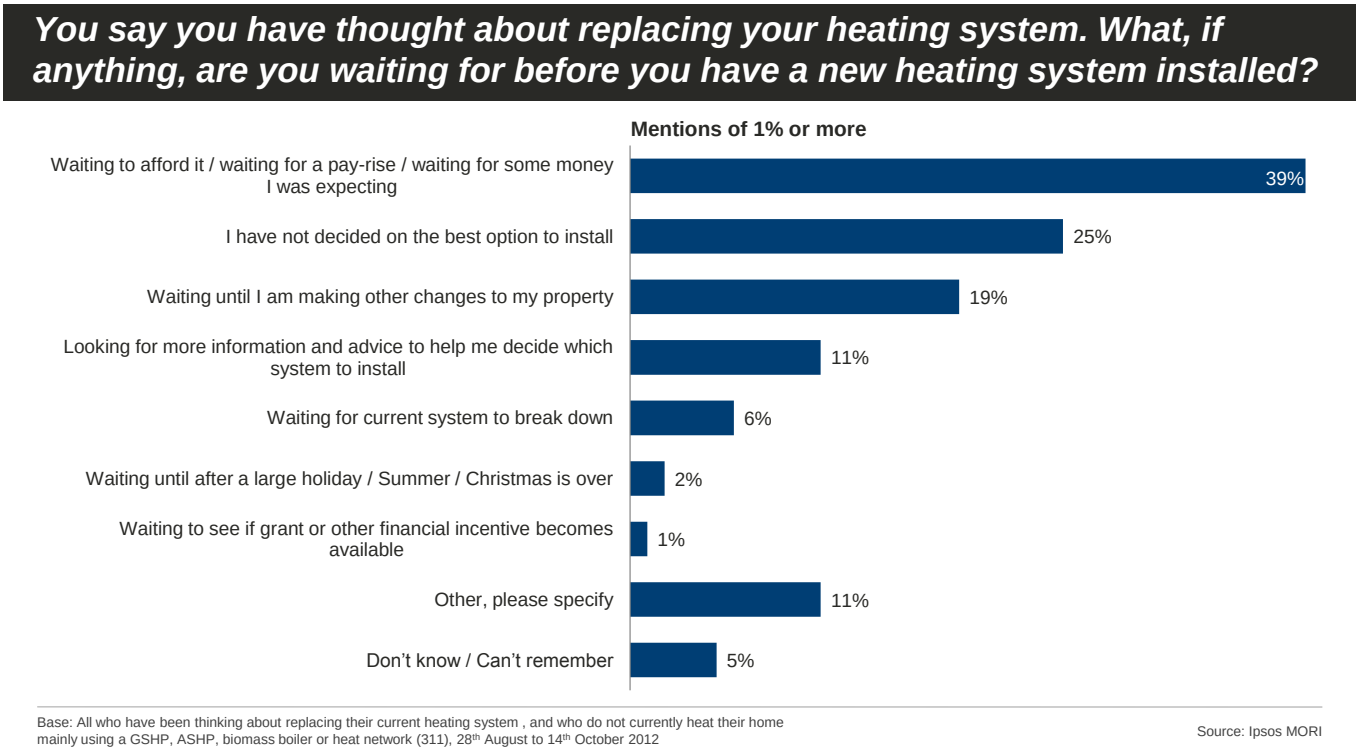
Source: Ipsos MORI

There were no particular groups more likely to postpone instalment than others. The survey, as well as the workshops, uncovered a broad range of reasons across the board.

Among homeowners who have been thinking about replacing their heating system (but not yet done so), the most common reason was to allow time to save capital for the upfront cost. As Figure 22 shows, this applied to two in five (39%) of 'postponers'. Some had not decided on the best option to install (25%) or were looking for more information and advice (11%).

Another common factor was wider property work: 19% reported waiting to coincide with this. For example, a few workshop participants said they waited until updating their whole kitchen – while a few follow-up interviewees wanted to combine a new and *relocated* heating system with other decoration plans.

Figure 26: Why survey respondents are currently postponing installation (multiple responses given)



A few workshop participants were also waiting pending a decision about property moves.

> *"I was thinking whether I was going to live there any length of time, I was thinking if I lived there a couple of years I shan't bother but if I'm going to live there five or six years or more then it was worth the effort."*
> Workshop participant, off gas grid homeowner, urban, female

For a couple of the workshop participants there was no specific reason for the postponement, other than their disorganisation and lack of time to have the installation arranged sooner.

> *"I'm quite slow at doing things actually, so it took me about a year to get my act together I suppose."*
> Workshop participant, off gas grid homeowner, urban, male

3.1.4 Reasons for not replacing heating system

Most of the survey respondents who had not replaced their heating system said that this was something they had never considered doing (68%). This view is even more prevalent among those aged 75+ (84%), and also the following:

- Households where the **chief income earner was classified as social grade D or E**[19] (77%) or was **retired** (86%).
- Those with **low interest in making improvements to their property** (80%).

[19] A social grade of D refers to a household where the Chief Income Earner works in semi or unskilled manual labour. A social grade of E refers to a household where the Chief Income Earner is not working or is retired with a state pension.

In most cases, people had not considered a replacement simply because their current heating system was working fine (57% of those giving the matter no thought). Another quarter (25%) said they would only replace their heating system when it broke down. Some workshop participants explained that they felt it wasteful to stop using a functioning system.

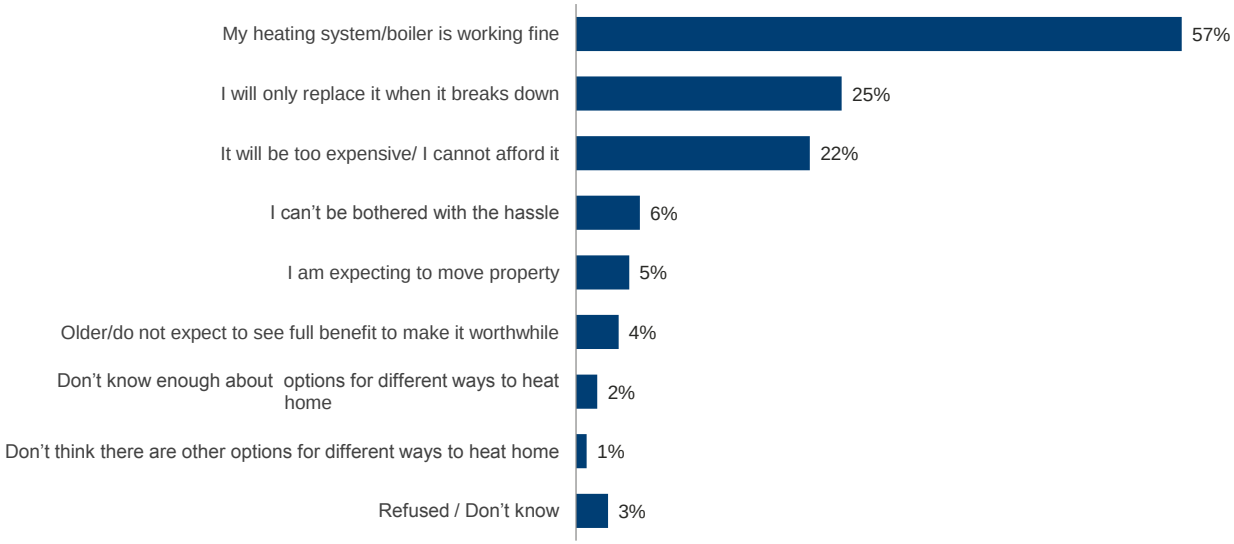
> *"It's working so I'm not looking to replace it until it breaks."*
> Workshop participant, on gas grid homeowner, urban, female

There was also some reluctance among a few workshop participants to change to a new system in case any teething troubles emerged. A few felt it was too much stress and hassle to change unless absolutely necessary. The follow-up interviews identified older homeowners as potentially the most concerned about this (6% of all survey respondents said they had not considered replacing their system because they could not be bothered with the hassle).

> *"At my age I don't think I would be interested in it all. If the thing works don't fix it as they say. No I wouldn't consider that unless I am left without heating obviously I would need to re-consider, but I would hope not to come to that point as I couldn't be bothered."*
> Workshop participant, on gas grid homeowner, suburban, large property, female

Figure 27: Reasons survey respondents have never considered replacing heating system (multiple responses given)

Why have you never considered changing or replacing your current heating system?



Base: All who have never considered replacing their current heating system , and who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network (730), 28th August to 14th October 2012

Source: Ipsos MORI

As shown in Figure 27 above, the Phase 2 survey identified that one in five (22%) had not replaced their heating system as they felt it would be too expensive / unaffordable. Many in the workshops linked this to not replacing their system until it had broken down as they wanted to maximise its use.

> *"It's on its last legs so you try and get as much life out of it before spending out another £1,500."*
> Workshop participant, off gas grid homeowner, urban, male

For many of the workshop and follow-up interview participants, a change of heating system was not considered a priority household improvement or financial expenditure. Homeowners listed many things they would prioritise for spending over a new heating system, including holidays and a new car.

> *"There is always something else that seems to be more important like a new car or a holiday".*
> Workshop participant, on gas grid homeowner, suburban, large property, male

> *"No, because of the cost and the finances. While our current system works all right, with all the other things we've got going on it wouldn't be a priority in the current economic situation."*
> Follow-up interview participant, off gas grid homeowner, suburban, large property, female, resp. 15

As discussed in section 2.2 many homeowners felt their current heating system did not meet their needs. However, few in this situation had replaced their system – again most often due to lack of finances to pay for the parts and installation.

> *"It's a bit impractical having the boiler on the wall in the living room but to get it moved will cost thousands. So will a combi boiler - so we have to just live with it. It takes ages for the water to heat up."*
> Workshop participant, on gas grid homeowner, urban, male – pre-task exercise

One in twenty (5%) who had never considered replacing their system said this was because they were expecting to move property. The follow-up interviews uncovered an opinion, shared by many of the 18 homeowners involved, that a new heating system would not add value to their property and so was not worth investing in.

A further barrier for *some* workshop participants was a perceived lack of choice of alternative heating systems. This was particularly so among workshop and follow-up interview participants in off gas grid areas, especially those in urban areas. Although many of these people had aspirations of a different heating system, they generally believed their current electric system was the only possible solution for their property and area type.

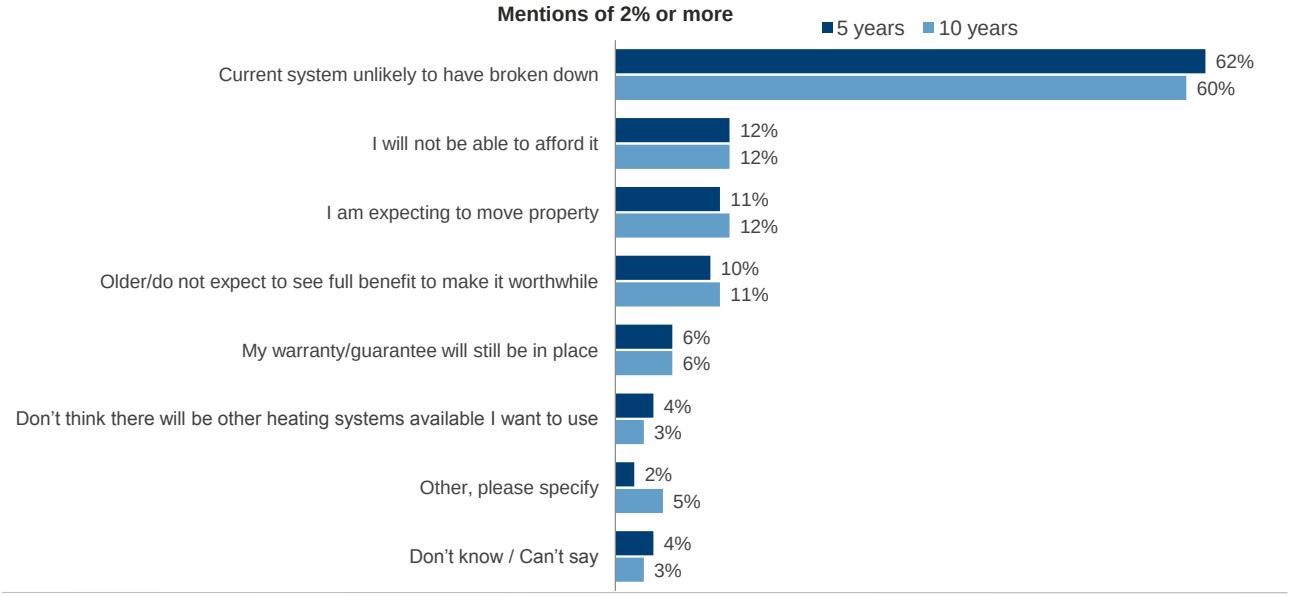
This was not as common a response among survey respondents (only 2% said lack of knowledge of options was a barrier to considering replacement, and 1% were prevented as they believed no other options were available).

> *"I don't think we really have a choice in what to have, because nothing suits."*
> Follow-up interview participant, off gas grid homeowner, rural, large property, female, resp. 16

Homeowners were also asked in the survey whether they would be likely or not to replace their heating system in the next five or ten years. Among those who said not, the most common reason was again that their current heating system was unlikely to have broken down (62% considering next 5 years and 60% considering next 10 years). Other key factors were that they would not be able to afford it (12% for both 5 years and 10 years), because they were expecting to move property (11% for 5 years, 12% for 10 years) and because they were older and did not expect to see the full benefit to make it worthwhile (10% for 5 years, 11% for 10 years). It is notable that the 5 and 10 year figures are very similar – perhaps because both were perceived as hypothetical and a distant issue.

Figure 28: Why would respondents be unlikely to replace their heating system in next 5 or 10 years (multiple responses given)

Why do you say are you are unlikely to change or replace your heating system in the next 5 years / 10 years?



Base: All who are unlikely to change their current heating system in the next 5 (2,121) / 10 years (1,662), , and who do not currently heat their home mainly using a GSHP, ASHP, biomass boiler or heat network. 28th August to 14th October 2012

Source: Ipsos MORI

3.2 How often do homeowners expect to replace their heating systems – and why?

Key observations 2 – expectations for future replacement

- Typically, homeowners expect heating systems to last up to 15 years and also expect to replace them within this time period. Homeowners may therefore be most likely to engage with information about new heating systems when their current system is around 15 years old.
- The most likely triggers for replacement are practical: the system breaking down, being apparently *about* to break down, or becoming uneconomical / difficult to repair. Therefore, heating system engineers conducting service or repair visits are potentially a critical intervention point.
- By comparison, rising energy prices are a somewhat less powerful driver of change – though there is a sense that this will change in future. More overtly 'environmental' factors are less often a prompt for heating systems to be replaced.

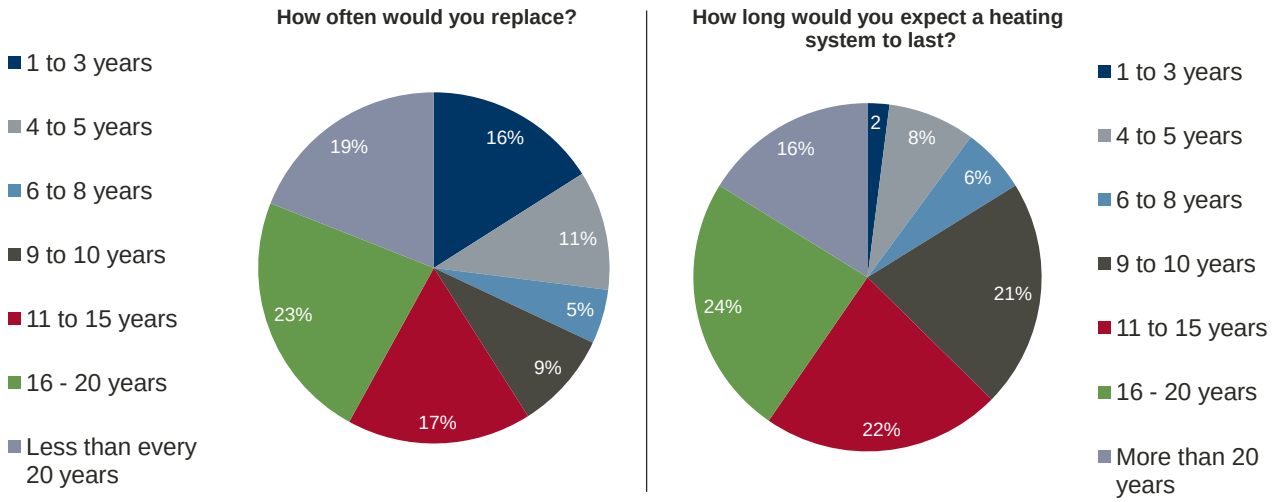
3.2.1 Expected frequency of replacing heating system

Most (58%) anticipated having to replace their heating system at least every 15 years – reflecting perceptions of heating system lifetimes (59% expected a heating system to last between one and 15 years).

There was, however, a significant proportion (19%) who anticipated replacing their heating system less frequently than every 20 years – with 16% expecting a system to last more than 20 years.

Figure 29: Expected replacement frequency and system lifetime among survey respondents (single response given)

Generally, how often would you expect to replace your heating system? How long would you expect a heating system to last before it broke down?



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

The following groups of homeowners were potentially the **least frequent replacers of heating systems (percentages shown are for those who expected to replace less than every 20 years)**:

- Homeowners **aged 65+**: 23% compared to 16% overall and 14% of those aged 18-34.
- Households with total annual **income of less than £20,000**: 23% compared to 11% of those with £50,000+.
- Homeowners **in rural areas**: 25% compared to 13% in suburban areas and 9% urban areas.
- Homeowners currently **using a non-gas boiler**: 37% compared to 14% of those with any type of gas boiler.
- Homeowners **currently using any form of electric heating**: 34% compared to 16% overall.
- Homeowners in Green Deal segments '**Not on the radar'** and '**Money savers'**: 23% and 21% compared to 16% of 'Carbon savers' and 15% of 'Convertibles'.

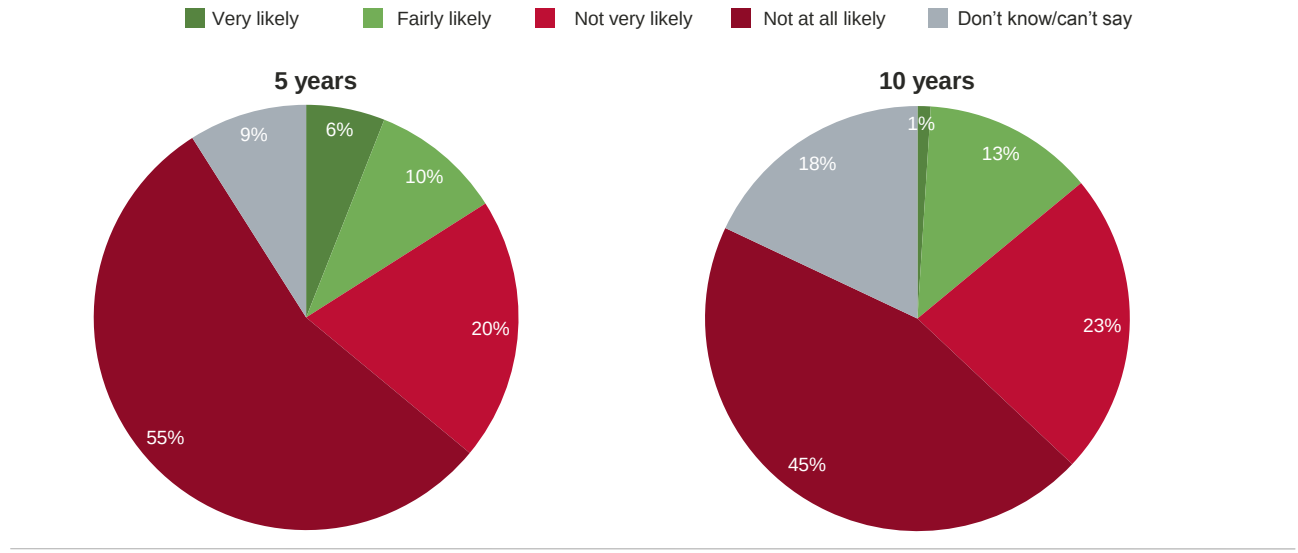
These same groups of homeowners were among the most likely to expect a heating system to last more than 20 years before it broke down.

The heating system used appeared to have a marked bearing on their expected frequency of replacement. Those with a gas boiler were significantly more likely to expect a replacement at least every 3 years (19%) compared to just 4% among those using a non-gas boiler or any form of electric heating (5%).

Survey respondents were also asked outright to consider their likelihood of making a replacement in the next five or ten years. Results are shown in Figure 30.

Figure 30: Likelihood of replacing heating system in next five or ten years (single response given)

How likely, if at all, do you think you are to replace your heating system in your current property in the next 5 years? In the next 10 years?



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848)

The Green Deal **'Convertibles'** and **'Money Savers**' were most likely to say they would probably replace their heating system in the next five years (23% and 21% compared with a total of 16%). Both these groups were interested in making energy efficiency improvements to their home through the Green Deal according to the DECC study[20].

The **'Not on the radar'** homeowners were conversely least likely to expect a replacement in the next five years (78% said it was not likely, compared with 71% of 'Money Savers' and 69% of 'Convertibles'). This pattern was similar in regard to a 10 year scenario. The DECC Green Deal study found **'Not on the radar'** homeowners were the least interested in the Green Deal, and did not consider energy efficiency a priority. **'Disengaged rejecters'** were also found by the Green Deal study to have no interest in the scheme, and in this survey were among the most likely to say they would not replace their heating system in the next ten years (73%).

Perhaps surprisingly, '**Carbon Savers'** were also more likely to say they would not replace their heating system in the next five years (78%).

[20] GfK NOP and Kantar Research, 2012, *Green Deal Segmentation,* DECC. Available at http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/green-deal/7057-research-report-green-deal-segmentation.pdf

3.2.3 Likely triggers for replacing heating system

The survey presented homeowners with a series of heating system scenarios, market changes and lifestyle events and asked each respondent how likely they would be to replace their heating system in that situation. The results are presented in Figure 31, Figure 32 and Figure 33.

Of the situations tested, the most likely to trigger a replacement would be the current system requiring lots of repairs and servicing (70% likely to replace), breaking down (69%) or requiring parts which would soon not be available (57%). These reflected the reasons given in the workshops and were also the main prompts for previous or already-considered system replacements.

> *"They told me that they can't get parts for it anymore. It's becoming obsolete so if something major goes wrong with it I will need to replace."*
> Workshop participant, on gas grid homeowner, suburban, large property, male

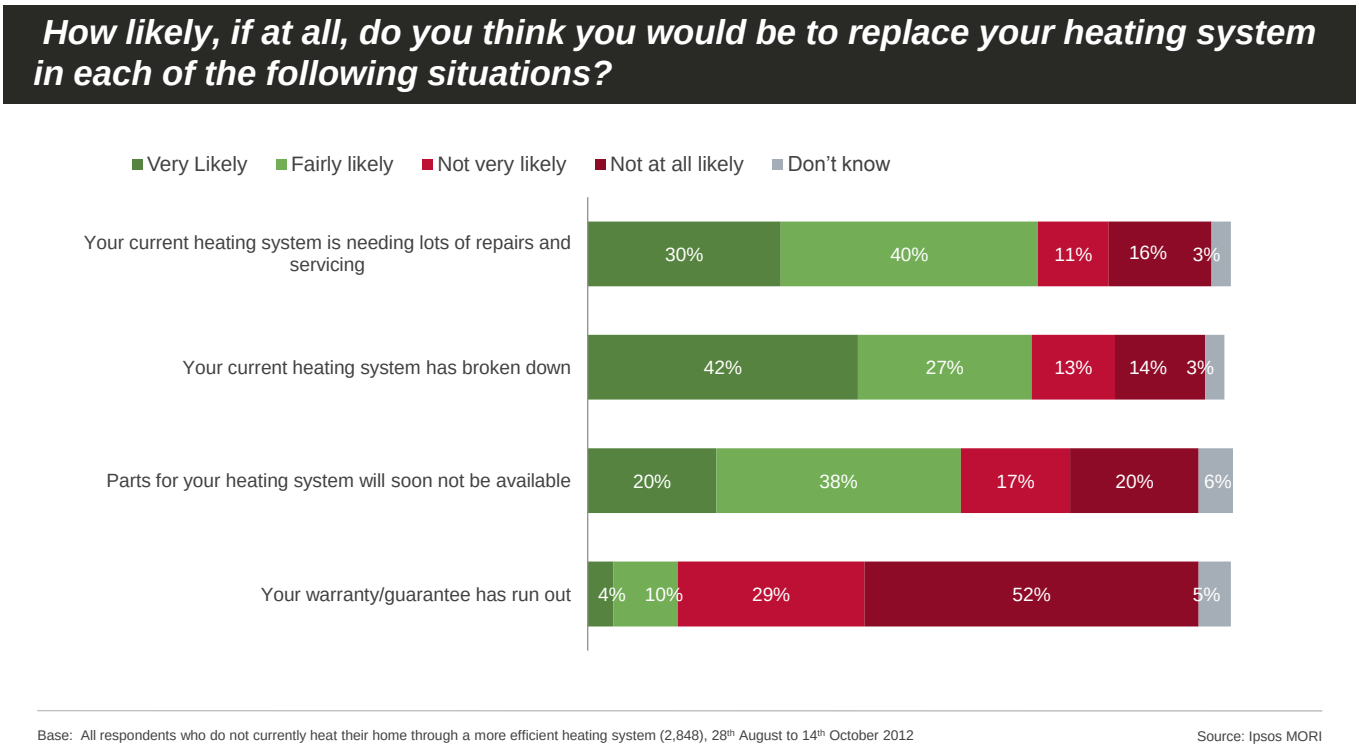
In addition, many workshop participants would consider replacing their system if it became noisy or less effective, or needed turning on for longer to reach the same temperature. These would be interpreted as signals that the system was close to breaking down.

The age of the system was also a trigger for some of the workshop participants. Generally, they expected their system to last around 10 to 15 years (similar to survey respondents) and, around this time, a few anticipated they would replace their old system prior to it actually breaking down to ensure it was reliable over future cold periods.

> *"It is still working at the moment - working perfectly - but because it's really old and I don't want the similar problem coming back in the wintertime that's why I want to do it before winter starts."*
> Workshop participant, off gas grid homeowner, urban, male

> *"It would be a situation that needs must…that it's now come to the end of its life it's going to cost more to keep trying to fix…so then you would go and borrow the money or somehow pay for a new system otherwise you wouldn't bother, because it just costs too much money and it's not a priority. But when you're forced into it you haven't got a choice have you."*
> Follow-up interview participant, off gas grid homeowner, rural, large property, female, resp. 16

Figure 31: Likelihood of survey respondents replacing heating system (single response given)



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

Among the Green Deal segments, it was **'disengaged rejecters'** who were consistently more likely to say they would not replace their heating system in any of the scenarios above.

In all the market situations shown (Figure 32), most said they would be unlikely to replace their current heating system. The relatively most powerful drivers were dramatically increased energy prices (36% feel this would likely prompt a change) or availability of cheaper-to-run systems (34%) – both also cited in the workshops.

> *"The big issue here is how much gas is going to continue to go up and that would be a massive factor in changing people's minds because it's getting to the point now where gas and electric, particularly the gas heating, is just becoming horrendously expensive. Most people aren't going to be able to afford it so then I think people would look very seriously at these other options."*
> Workshop participant, on gas grid homeowner, suburban, large property, female

> *"If costs of running the system have gone up considerably."*
> Workshop participant, off gas grid homeowner, urban, female

> *"If it is costing you a horrendous amount of money because it's not working properly and it's using more fuel than it should be."*
> Workshop participant, on gas grid homeowner, suburban, large property, female

'**Convertibles'** were the homeowners most likely to say they would replace their heating system if energy prices increased dramatically (51% compared with 36% overall).

While 25% said they would be likely to replace their heating system if a more environmentally friendly one became available, only 5% said they would be *very* likely, which is perhaps a more robust indication of real intention. Seven in ten (71%) said they would be unlikely, with nearly two in five (37%) *not at all likely* to do so.

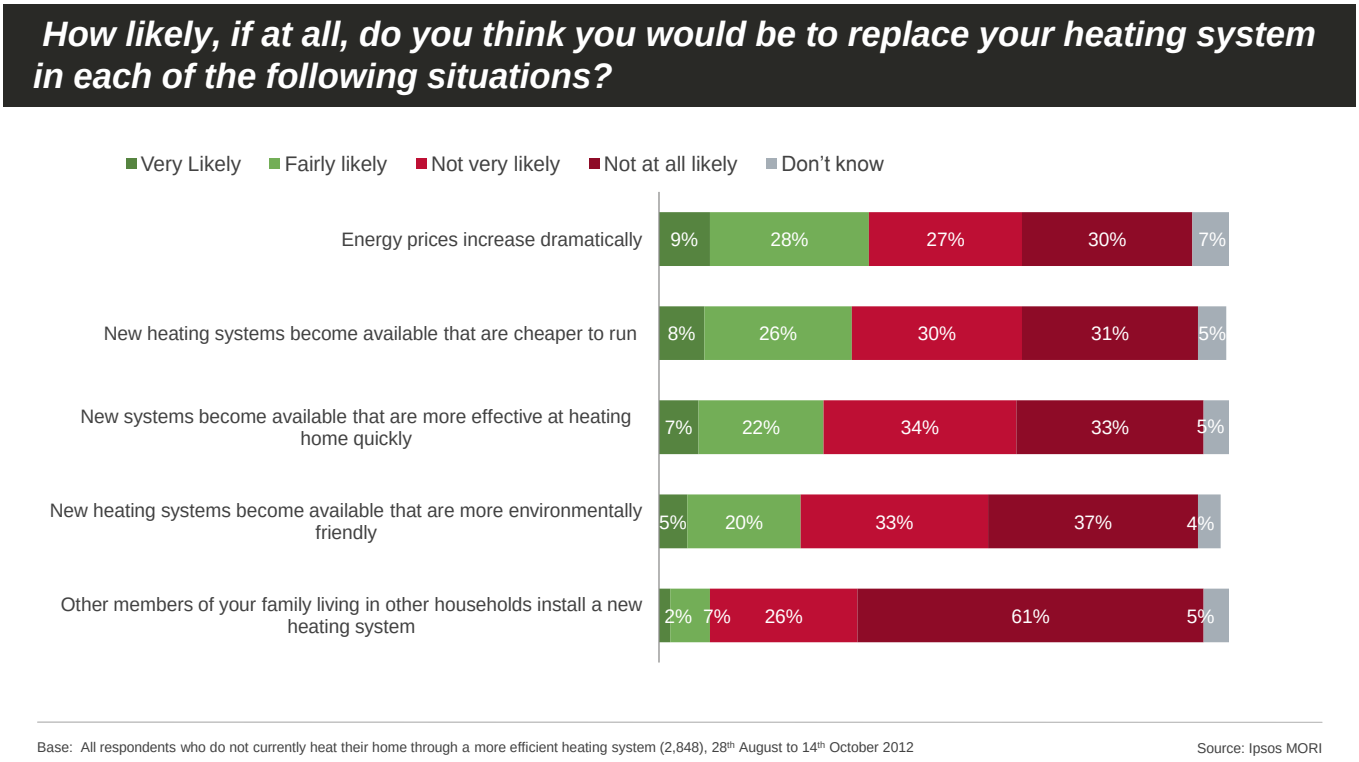
Environmental factors were generally not a key factor for workshop participants – though a few did spontaneously mention the potential trigger of a *more efficient* heating system. Systems fuelled by renewable sources were spontaneously linked with greater energy efficiency and lower bills: a major

reason for their appeal. One homeowner also believed such systems would be subsidised by the government, which made them financially appealing to install.

> *"The only way I would do it would be if you are changing it to something that was using renewable energy. You were maybe making a lump sum payment potentially with assistance from a government scheme…and that your bills were going to dramatically drop, I would definitely do it."*
> Workshop participant, on gas grid homeowner, suburban, large property, male

> *"Something that really is cost-efficient and eco-friendly because I mean we are all going down that road now where we have to try and use greener energy…I think in the next five or ten years there will be massive changes and more options for renewable energy."*
> Workshop participant, on gas grid homeowner, suburban, large property, female

Figure 32: Likelihood of survey respondents replacing heating system in range of market change situations (single response given)



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

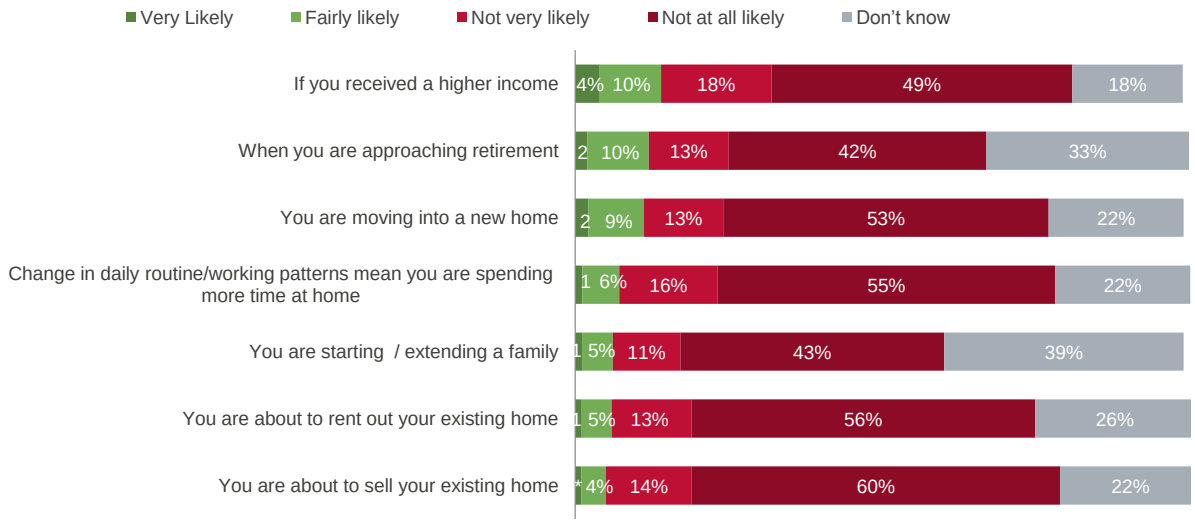
Figure 33 shows that in most cases, survey respondents felt less likely to replace their system in reaction to a lifestyle change than to a heating system scenario or market change.

Most would be unlikely to replace their heating system if they were approaching retirement (55% unlikely), starting/extending a family (55%), moving into a new home (66%) or renting out their home (68%). Less impactful still were changes in routine resulting in spending more time at home (71% unlikely) or selling a home (74%). This fits with a perception in many of the follow-up interviews that a new heating system would not add market value to a property.

Despite lack of capital being cited as a key barrier to replacing systems, only 14% said they would be likely to do so given a higher income. Indeed, two thirds (67%) said they would be unlikely to do so in this circumstance.

Figure 33: Likelihood of survey respondents replacing heating system in lifestyle change scenarios (single response given)

How likely, if at all, do you think you would be to replace your heating system in each of the following scenarios?



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

During the workshops, some homeowners suggested the following as situations in which they may consider replacing their heating system:

- if the system started to look old-fashioned and out of keeping with the style of the home;
- if they were planning a refurbishment and so were already undergoing 'hassle' and financial cost to make home improvements; and
- if upgrading (as those in urban off gas grid properties saw it) to mains gas where possible. This attitude was less prevalent among rural off gas grid homeowners.

> *"Maybe in the next couple of years when I carry out a refurbishment of my flat."*
> Workshop participant, off gas grid homeowner, urban, male

In all the above situations, even if the motivation was there, the availability of capital to pay for the installation would reportedly be the decisive factor for many workshop participants.

4. Future preferences for heating systems

Key observations 1 – important criteria for heating systems and awareness of more efficient options

- When asked directly, running or purchase costs were considered the most important factors for a heating system. Running costs comprised low energy bills (24% rated this as the most important factor) and being cheap to run (23%). Purchase costs covered the system being cheap to buy (10%) and to install (5%). However, in the 'choice experiment' a different set of priorities emerged: the most influential factor was the technology itself, followed by the upfront grant available. Both were more critical here than low running costs.
- Gas boilers were the clear favourite for future installation. When asked spontaneously which heating system they would consider installing in the future, 90% of on gas grid respondents said a gas boiler (with 71% specifically stating a combination gas boiler). The most commonly mentioned system by off gas grid homeowners was an oil boiler (40%, with 25% specifically mentioning a combination oil boiler). This suggests that many homeowners may automatically opt for the most up-to-date version of their current system without considering alternatives.
- Awareness levels of the more efficient heating technologies studied ranged from the 86% having heard of gas condensing boilers to only 27% for micro-CHP. The second most commonly recognised was solar thermal (83% claimed to have heard of this) followed by a GSHP and biomass boiler (both 47%). ASHPs recorded 32% and heat networks 31%. The low level of awareness of some of these heating systems is likely to be a significant barrier to uptake.

4.1 'Must-haves' for a future heating system

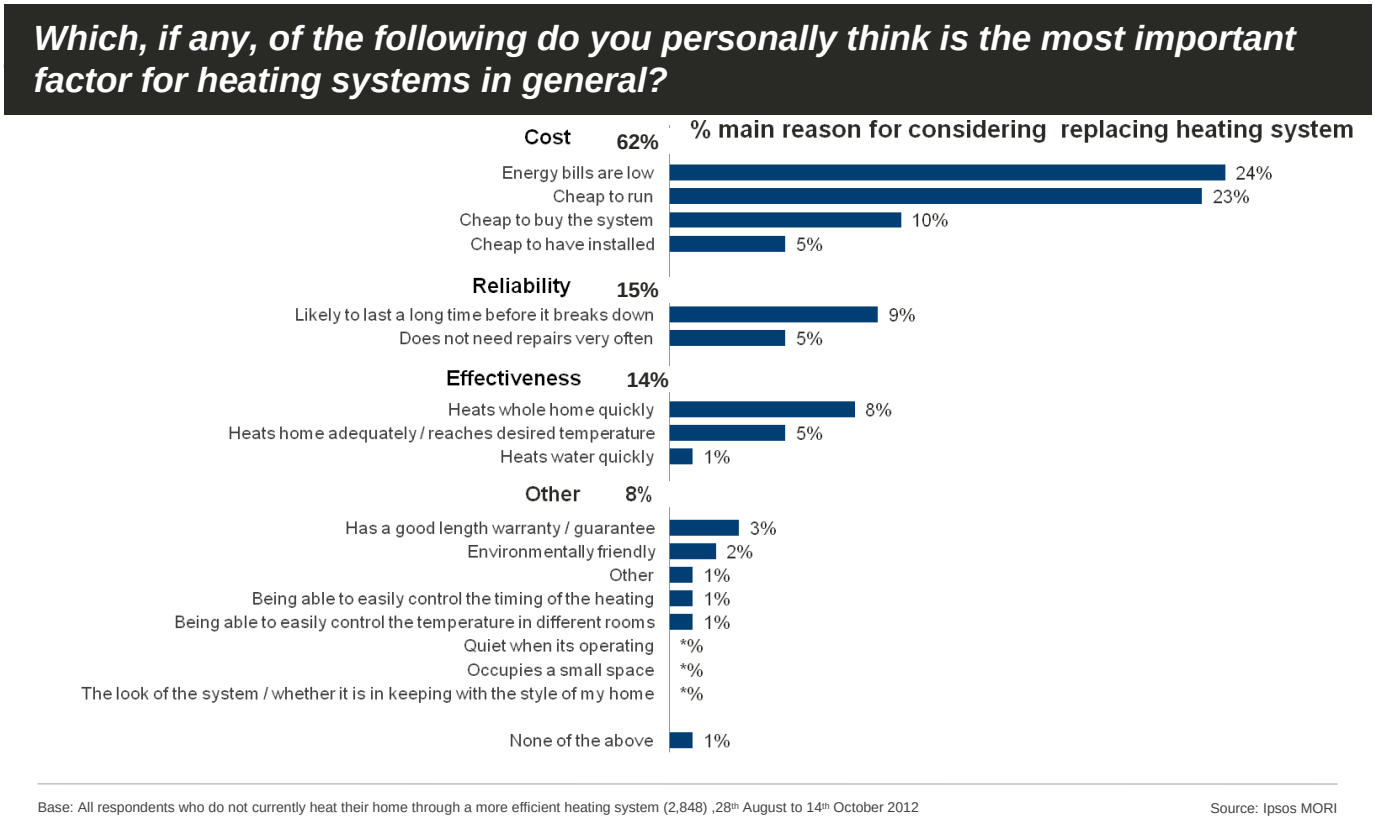
Building on work from the initial workshop discussions, survey respondents were asked to identify the three most important criteria for a heating system. Figure 34 shows that low energy bills were rated most important by a quarter (24%) and the system being cheap to run by 23%. It was also important that the system was cheap to *buy* and to have installed (10% and 5%).

The reliability of the system was also an important factor. One in ten (9%) felt the most important factor for any heating system was that it lasted a long time before it broke down, and 5% said it was most important that it did not need repairs very often.

The follow-up interviews with survey respondents highlighted that this was likely to also be related to costs; homeowners wanted a long-lasting heating system not only to reduce the inconvenience of having a new one installed or on-going repairs and servicing, but also to prevent the need for further capital outlay for a new system.

Size and aesthetics of the heating system were not rated among the top three most important factors, but were discussed at length by workshop participants in relation to their own system. Workshop participants also focused on the provision of hot water whereas the survey did not identify this as a critical factor (just 1% selected 'heats water quickly' as the most important factor). These other aspects are discussed in more detail below.

Figure 34: Most important criteria for heating systems for survey respondents (single response given)



The survey identified the following groups as **most likely to consider overall cost the most important factor** (either low energy bills, being cheap to run or cheap to buy):

- **Low income and vulnerable households[21] with children aged under 16**: 88% compared to 62% overall.
- **Homeowners using a non-condensing boiler**: 66% compared to 47% of those using a condensing boiler.
- **Homeowners in Green Deal segment 'Overstretched'**: 66% compared to 59% of 'Carbon Savers'. The 'Overstretched' group were those put off the Green Deal by the cost of improvements (reflecting that cost is the most critical factor for them in regard a heating system). 'Carbon Savers' were more likely to cite 'reliability' (17%) as the most important factor than were the 'Overstretched' (10%).

Low upfront costs in particular were of most importance to homeowners aged 18-34. Almost one in five (18%) said so, compared to 10% overall.

Those aged 75+ and over were the most conscious of the system's reliability and effectiveness. One in five (19%) prioritised a factor relating to reliability - compared to 11% of 18-34 year olds – and one in five of the 75+ group cited effectiveness, compared to 10% of the younger group.

[21] Phase 2 homeowners with a total household income, after tax, of less than £16,000 per annum and living in a household with children under the age of 16, and/or receiving child tax credits.

However, the order of importance placed on the various factors was not borne out in the choice experiment which followed these survey questions.

In the choice experiment, the type of technology used proved the most powerful determinant, followed by the upfront grant available. The annual fuel bill or annual tariff payment available (both of which would contribute to low running costs) were less influential.

The results of the choice experiment, and the drivers of these, are discussed in section 4.5.1.

4.2 Which heating systems are homeowners considering for the future?

During the survey homeowners were asked which types of heating system they would consider installing if they were to replace their current system. (This was asked prior to any information about the more efficient systems which this study focused on).

A gas boiler was the overwhelming first choice across all survey respondents (80%) – with almost two thirds (63%) specifying a combination boiler (Figure 35). This was even higher among on gas grid respondents (90% mentioning any form of gas boiler and 71% specifically naming combination gas boiler). One in six (16%) off gas grid homeowners also mentioned a gas boiler suggesting a desire to connect to mains gas in the future (the differences between on and off gas grid respondents are shown in Figure 31b)

A small proportion (16%) of off gas grid homeowners chose a gas boiler as their preferred system, suggesting they have aspirations to join the mains grid. The most popular system for this group was an oil boiler (34%), with most of these stating an oil combination boiler specifically (25%).

The workshop participants living in on gas grid properties tended to assume a replacement would be with an upgraded boiler. This was seen as the default option, and many did not think there were any alternatives. While these new boilers were described as ‘more efficient’, homeowners did not specifically use the term ‘condensing’ until prompted. Many workshop participants did specifically name a combination boiler however. This was common vocabulary and was a desirable future option for providing instant hot water.

> *“A combi boiler would be ideal so that I wouldn't need a boiler and a water tank.”*
> Workshop participant, on gas grid homeowner, male – pre-task exercise

> *“ A combi boiler… instant water, instant heat, it’s a no-brainer.”*
> Workshop participant, on gas grid homeowner, urban, male

A few of these homeowners were aware of different solutions to their heating needs, but preferred to stay with a gas boiler as a familiar and easy replacement.

> *“I’d replace the like-for-like because the whole system would have been changed otherwise."*
> Workshop participant, off gas grid homeowner, urban, male

A small proportion of workshop and survey respondents said they would consider replacing their current heating system with a more efficient option (6% of survey respondents mentioned one or more of a biomass boiler, GSHP, ASHP or heat network - most commonly a biomass boiler or GSHP (both 3%)).

None of the survey respondents spontaneously mentioned micro-CHP.

A few workshop participants referred to television programmes such as Grand Designs as sources about GSHPs. One workshop participant was actively considering installing a GSHP, while another had investigated it before dismissing it due to high installation cost and the perceived hassle of the installation.

"There are ones where they actually put pipes down into the... not the earth's core, but they take heat from the ground. Things like that do interest me if you think 'well I am going to have really cheap heating'."
Workshop participant, on gas grid, suburban, large property, male

"Another solution I looked at and discarded was a ground source heat pump. It needs acres and acres or to drill deep holes…the initial cost is high, it's not viable."
Workshop participant, on gas grid homeowner, urban, male

Figure 35: Heating systems which would be considered by survey respondents (spontaneous, multiple responses given – all respondents)

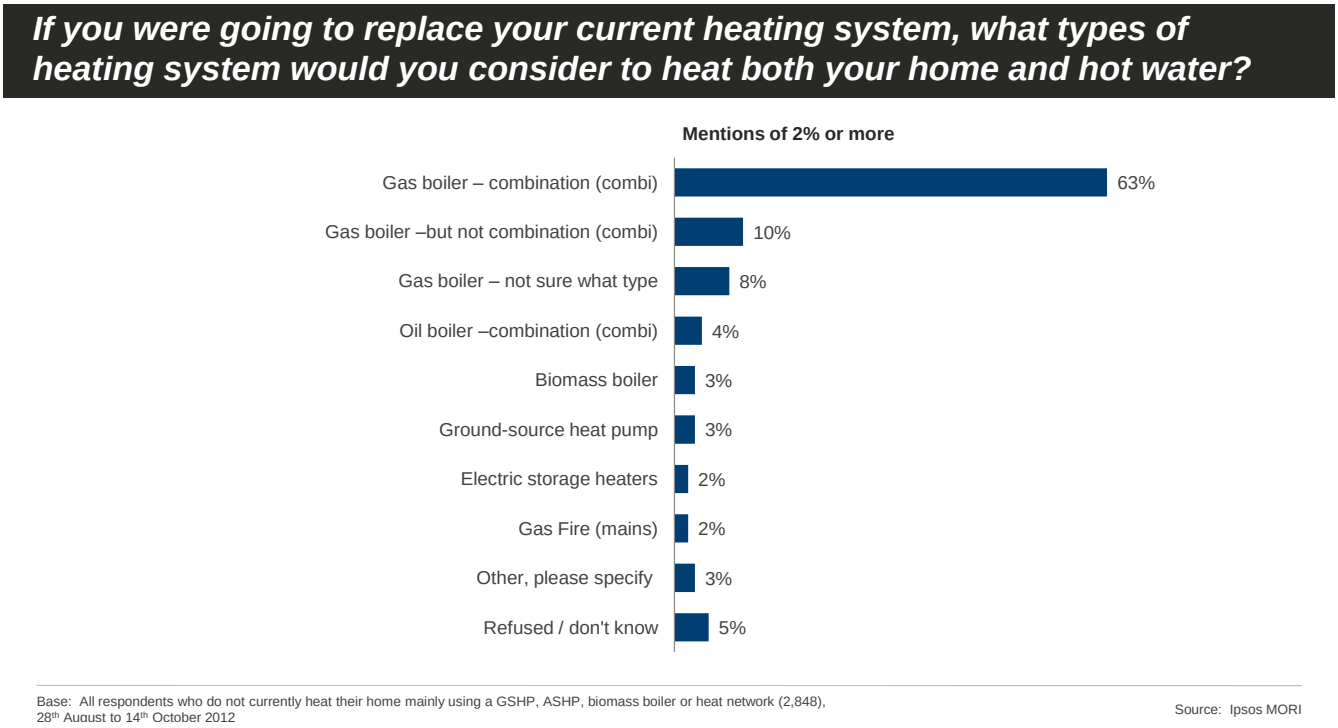


Figure 36: Comparing future heating system considerations for on and off gas grid respondents

	All survey respondents	On gas grid respondents	Off gas grid respondents
Gas boiler (any type)	**80%**	90%	16%
Gas boiler (combination)	**63%**	71%	13%
Oil boiler (any type)	**6%**	*%	40%
Oil boiler (combination)	**4%**	*%	25%

Those **most likely to consider replacing their current heating system with a gas combination boiler** were:

- **Homeowners aged 18-34:** 79%, compared to 63% overall.
- **Homeowners living in Scotland:** 70%, compared 63% in England and 54% in Wales.
- **Homeowners living in semi-detached and terraced properties:** 71% and 70% respectively, compared to 49% of those living in detached properties. Homeowners living in flats were as likely as the average to cite a combination gas boiler (64%).

Solar thermal was frequently mentioned by both on and off gas grid workshop participants as an appealing system[22]. Some cited major projects that used solar technology such as Heathrow's Terminal 5 and the Swiss Re building (the Gherkin).

> *"I've never had problems* [with current gas boiler]*, no intention to change it until I find a new mode of heating like solar or something new."*
> Workshop participant, on gas grid homeowner, urban, male

Some of the workshop participants who mentioned solar thermal spontaneously linked this to a desire to use renewable energy, and for many this was linked to a perception of lower fuel bills.

> *"I really like the idea of solar heating, a carbon neutral house is just wonderful."*
> Workshop participant*,* on gas grid homeowner, urban, male

> *"Would think about solar, simply because of cost-efficiency."*
> Workshop participant, on gas grid homeowner, urban, male – pre-task exercise

However, it is likely that solar thermal was being confused with solar PV by many of these workshop participants. There also seemed little awareness that a solar thermal system would only provide some of the property's hot water and no central heating.

A few workshop participants had given solar thermal serious consideration as a future option. However, they had found the upfront installation costs prohibitive, as well as the need for approval by freeholders, those living in blocks of flats or other owner-occupiers.

> *"I thought of solar heating system and was looking at the cost of getting it installed but as I'm living in a flat I'm afraid getting it approved by the freeholder might prove challenging."*
> Workshop participant, off gas grid homeowner, urban, female

> *"I would consider solar heating if possible to be installed independently from other apartments in the block I live in. Renewable heat."*
> Workshop participant, on gas grid homeowner, urban, female – pre-task exercise

[22] Solar thermal does not appear in Figure 35 above as it was not given as a response during the Phase 2 survey. This question was a spontaneous open-ended question meaning no specific response options were offered to respondents.

4.2.1 How aware are homeowners of more efficient heating systems?

At the start of the survey, prior to being given any information, homeowners were asked their awareness of various home heating systems.

The results are presented in Figure 37. It should be noted that this shows *self-reported* levels of awareness, and homeowners were not asked *what* they knew about each of the technologies if they claimed to do so. 'Awareness' may therefore cover varying knowledge and understanding.

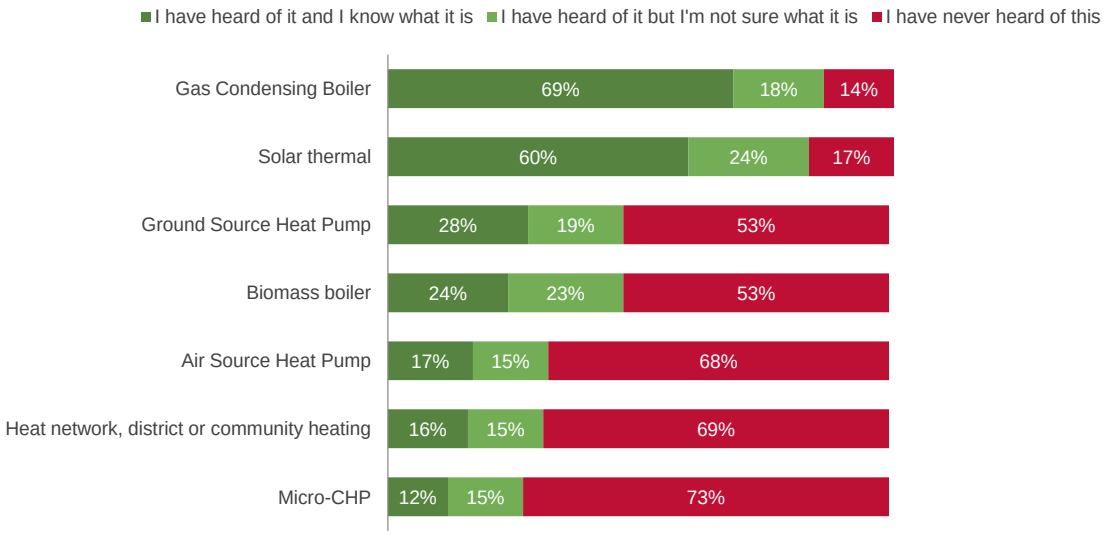
Most claimed to have heard of gas condensing boilers (86%), with 69% saying they knew what this system was. Only one in seven (14%) had never heard of it. Most workshop participants had also heard of gas condensing boilers and understood that these were efficient boilers, even if they did not clearly understand what 'condensing' indicated.

Most in the survey (83%) had also heard of a solar thermal systems and 60% felt they knew what they were. This was also the more efficient technology which workshop participants most often claimed to have heard of and know about.

By contrast, half of survey respondents had never heard of a GSHP or biomass boiler (both 53%). Even more had never heard of an ASHP (68%), a heat network (69%) or micro-CHP (73%). Micro-CHP was a totally unfamiliar term for the workshop participants, with none having heard of it before.

Figure 37: Awareness of more efficient heating systems among survey respondents (single response given)

Which of the following best describes the extent to which you had heard of each of these ways of heating your home and/or hot water before today?



Base: All respondents (2,900), 28th August to 14th October 2012

Source: Ipsos MORI

Even for workshop participants who had not heard these terms before, the names did have some immediate connotations. For instance, a few linked 'biomass' with wood pellets but were unsure how these were used to provide central heating. Some felt 'ground source heat pump' referred to a system using natural thermal springs. Although some homeowners claimed to have seen ASHPs on the side of buildings, it is likely that these were air conditioning units.

The survey showed that homeowners from more affluent social grades[23] (ABs) were the most likely to have heard of each of the more efficient heating systems. For instance, 92% of ABs had heard of solar thermal compared to 82% of C1s, 79% of C2s and 73% of DEs. This trend was mirrored across all seven of the systems.

A few of the systems which could be used in either on or off gas grid areas had a higher profile in the latter. For example, 62% of off gas grid homeowners had heard of GSHPs, compared to 45% of those with mains access.

4.3 How appealing are more efficient heating systems to homeowners?

Key observations 2 – appeal of more efficient heating systems and overall preferences

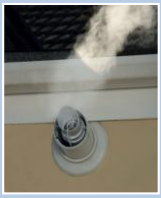
- Initial views of the more efficient heating systems (before seeing cost information) were mixed. The most appealing, by a significant margin, was a gas condensing boiler (80% positive and only 5% negative). Other options were viewed favourably by a significant proportion - 46% positive about micro-CHP, 38% about GSHPs and 34% about heat networks.
- More felt negatively than positively about biomass boilers (44% negative and 26% positive) and ASHPs (39% negative and 29% positive). In the workshops, running a biomass boiler was perceived to involve hassle and the credibility of an ASHP in cold weather was questioned. Both systems were also felt to look unattractive.
- The use of energy from the ground made GSHPs appealing to workshop participants, and they assumed most of the system would be hidden out of sight underground.
- Homeowners were more positive about heat networks in the workshops than the survey. Their appeal in the workshops depended on the assumptions made about how energy bills would be charged and what type of organisation would manage the network. Low levels of responsibility for the homeowner were appealing, as was being connected to a community shared power source.
- The familiarly of how the micro-CHP unit looked appealed, as did the assumed ease of using it. It was not as popular as a gas condensing boiler, however, as the technology was poorly understood and many were uncertain whether it was reliable and proven.

During the workshops and survey homeowners were presented with one page factsheets about each of the more efficient heating technologies (Figure 38). Solar thermal was not discussed at this stage, as it could not be directly compared with other systems providing heating and hot water. The appeal of solar thermal, and the information provided to homeowners, is discussed in section 4.7.

[23] A social grade of A refers a household where the Chief Income Earner is a higher managerial professional, a social grade of B refers to an intermediate managerial professional, a social grade of C1 refers to a supervisory/clerical or junior managerial position, a grade of C2 to skilled manual workers, a social grade of D to semi or unskilled manual labour, and a social grade of E to those not working or retired with a state pension. In households where the Chief Income Earner is retired on a private pension, the social grade is classified according to their previous employment role.

Figure 38: More efficient technology factsheets shown prior to choice experiment[24]

Gas Condensing Boiler



All new boilers since April 2005 are A-rated and condensing. This means they are more energy efficient than older boilers. They can provide all your central heating and hot water. The heat is circulated using radiators or underfloor heating.

Key Facts

- Estimated to last 15 years.
- Typically takes a day to install.
- Uses gas.
- Standard size for a boiler. It can be fixed to your wall.
- Annual service strongly recommended.
- If using a combination (combi) condensing boiler, will not need a hot water tank.

Biomass Boiler

Biomass boilers burn wood logs, pellets or chips to provide your central heating and all or some of your hot water. The heat is circulated using radiators or underfloor heating . You need to have fuel delivered regularly to your home.

Key Facts

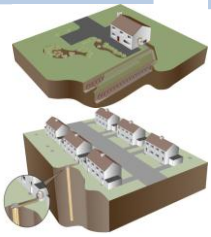
- Estimated to last 20 years.
- Typically take 4 days to install.
- Uses renewable fuel source.
- Storage space is needed for the fuel.
- Some boilers will automatically top-up the fuel but others require the householder to do this.
- Boilers will need to be regularly cleaned.
- Space is needed for a hot water tank

Ground Source Heat Pump

Ground source heat pumps use pipes underground to extract heat. They circulate heat using radiators or underfloor heating. They provide all your heating, and all or some of your hot water.

Key Facts

- Estimated to last 20 years.
- Typically take 2-3 days to install.
- The pipes can be installed horizontally or vertically.
- Needs little maintenance.
- Uses renewable fuel source and electricity.
- Space is needed for a hot water tank

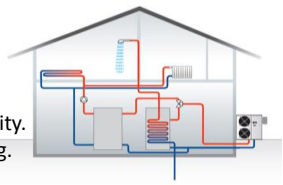


Air Source Heat Pump

Air source heat pumps extract heat from the outside air. The heat is circulated using radiators or underfloor heating. They provide all your heating, and all or some of your hot water.

Key Facts

- Estimated to last 20 years.
- Typically takes 0.5 -1 day to install.
- Space needed on the outside wall.
- Needs little maintenance.
- Uses renewable fuel source and electricity.
- Emits some noise outside of the building.
- Space is needed for a hot water tank



Micro Combined Heat and Power (CHP)

When generating heat for your central heating and hot water, a micro CHP boiler also provides all or some of the electricity you use. The heat is circulated using radiators or underfloor heating.

Key Facts

- Estimated to last 15 years.
- Typically takes 1 to 2 days to install.
- Uses gas.
- Same size or slightly larger than a standard boiler. May stand on the floor or be fixed to a wall.
- Annual service strongly recommended.
- Users are paid for electricity that they generate.
- Space is needed for a hot water tank

Heat Network

A heat network provides heat generated from a local source to more than one building or home via a network of pipes. The heat can be used to provide central heating and hot water. It is circulated using radiators or underfloor heating. The amount you pay depends on the amount of heat you use.

Key Facts

- Estimated to last 20 years.
- Typically takes 2 days to connect a home to the network.
- Uses gas and/or renewable fuel sources.
- Householders can control when the heating comes on and the temperature. The control unit would take up less space than a standard boiler.
- Annual maintenance provided by heat network operator.
- In some cases may need a hot water tank if used for heating water

[24] The Energy Saving Trust and DECC provided information for these factsheets.

The survey asked homeowners to rate the appeal of each technology on the basis of the information they had seen (at this stage *without* any additional information on installation or running costs beyond the factsheet).

Each homeowner was only shown the factsheets for the heating systems which were likely to be appropriate in their current property. So, only those living in properties connected to the gas grid were shown the gas condensing boiler and micro-CHP factsheet, and only those living in a property with private outside space adjacent to the main inhabited building were shown the GSHP. Although heat networks are currently only likely to be installed in high density urban areas, during this choice experiment they were shown to all homeowners regardless of circumstance – so as to 'future proof' the findings.

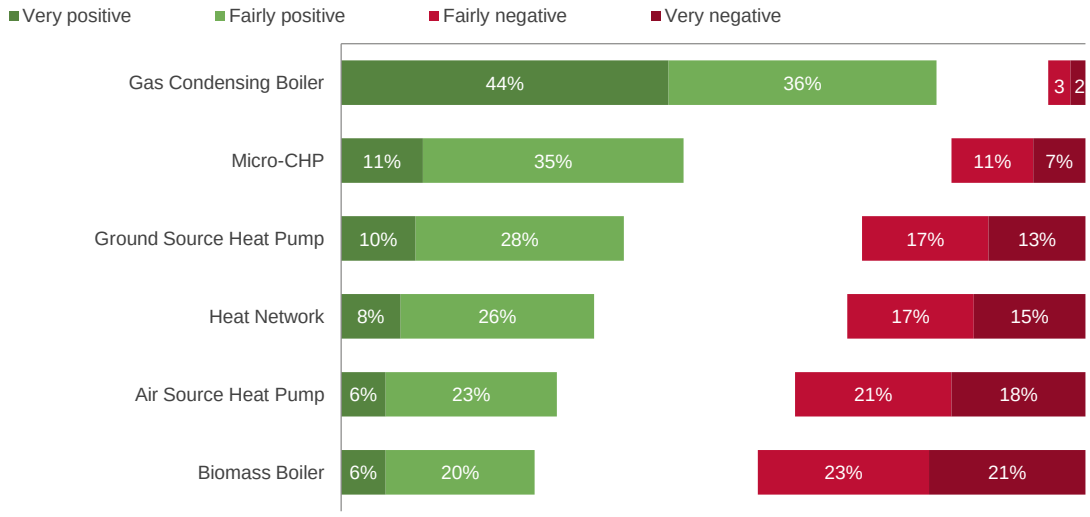
On the basis of the factsheets, the best-regarded system was clearly the gas condensing boiler. Four in five (80%) felt positively about it compared to only 5% being negative.

Far fewer felt positively about the other systems – but relatively best-rated was micro-CHP (46% positive, 18% negative). People were on balance also favourable towards both the GSHP (38% positive, 30% negative) and the heat network (34% positive, 32% negative). However, the reverse was true for AHSPs (28% positive, 39% negative) and biomass boilers (26% positive, 44% negative). Around one in five said they felt *very* negatively about these last two heating systems.

Many were not able to give an opinion on the technologies – reflecting their lack of previous knowledge (section 4.2). Around a third did not give an opinion on each of the less familiar systems – but this fell to just 15% neutral / unsure about gas condensing boilers.

Figure 39: Appeal of more efficient heating systems among survey respondents on basis of factsheets (single response given)

Having seen this information, how would you say you feel about a...



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

The following section sets out the positives and negatives of each technology according to the workshops and follow-up interviews. It also records the queries raised which would need to be resolved before people seriously considered installing specific systems.

Phase 2 survey:
26% positive
44% negative

Biomass[25]

- Use of renewable fuel source was appealing, and linked by many workshop participants to recycling which made them feel positively toward the technology. Follow-up interview participants who liked biomass felt it was a natural approach to producing energy.
- Conjured positive connotations for many of creating a warm cosy home as it was associated with Agas and wood stoves.
- A few follow-up participants viewed biomass as a proven technology, so were reassured on its reliability and effectiveness.

- While modern gas boilers were felt compact and unobtrusive, biomass boilers were seen by most workshop and interview participants as a retrograde step; the images suggested they were bulky and unattractive.
- The work and responsibility involved for the homeowner was seen as onerous: taking fuel deliveries, feeding the boiler, cleaning waste products.

"Do you have to clean it? I mean is it like cleaning out your log fire or do you have to pay someone to come and do it? It's still a hassle to some extent."
Workshop participant, on-grid homeowner, suburban, large property, female

"Think about the winter we had last year…you would never get deliveries to the house. I mean how could you sustain some distant place?"
Workshop participant, on-grid homeowner, suburban, large property, male

"The fact that something requires a regular fuel delivery is a really annoying nuisance"
Workshop participant, off gas grid homeowner, urban, male

"Electricity you don't see. You just flick on a switch and it's there. You don't see anything. You don't have to consider deliveries or anything like that..."
Workshop participant, off gas grid homeowner, rural, small property, female

- The space required to store the fuel and boiler was seen as a negative by many workshop and interview participants.
- Some workshop participants had concerns about the sustainability of the fuel source and questioned whether it was really renewable.

"But if it is burning wood I mean how sustainable is that?"
Workshop participant, on-grid homeowner, suburban, large property, female

"Biomass and biofuels and all the rest of it are renewable... but it's the land use. If we all have these... we need to hand over land that could be used for... something else."
Workshop participant, off gas grid homeowner, rural, small property, male

- There was some confusion among a few workshop and interview participants about the fuel used in a biomass boiler and how the system worked. Some workshop participants assumed it could be fed with MDF or with organic waste (e.g. vegetable peelings).
- A few workshop participants were concerned about whether there would be a smell of smoke and whether modern flats have sufficient ventilation.

[25] The one page summary of attitudes to each more efficient heating technology is taken from the qualitative workshops and in-depth interviews (except where percentages are given which are taken from the Phase 2 survey).

Air Source Heat Pump[26]

Phase 2 survey:
28% positive
39% negative

- Use of renewable fuel source was appealing, and homeowners liked there not being a tie to a fuel provider or need to refuel.
- The installation of an ASHP was perceived by workshop and interview participants as less disruptive than some of the other technologies e.g. GSHPs.
- Among the follow-up participants, a few believed the ASHP unit could be located entirely outdoors which was appealing as it would not take up space inside.

- Unit felt to be ugly and bulky by many workshop and interview participants.
- Some workshop and interview participants were concerned about noise from the unit, either in the effect on neighbours or on themselves.
- A few workshop participants had concerns about safety. They queried whether it is a fire risk and whether it could be tampered with.

"It's pretty vulnerable isn't it…somebody could tamper with it."
Workshop participant, off gas grid homeowner, urban, male

- Many workshop and interview participants queried its effectiveness in cold temperatures and struggled to understand the process by which heat was extracted

"How much heat could you get from the air in Scotland in winter?"
Workshop participant, on-grid homeowner, suburban, large property, female

"What happens when it's cold outside?"
Workshop participant, off gas grid homeowner, rural, small property, female

"We found out that you'd have to keep your boiler because if the temperature drops to below a certain level it doesn't work - so you have to have a back up."
Workshop participant, off gas grid homeowner, rural, large property, female

- A few workshop participants queried whether the system could be used in areas of poor air quality and whether the air would be filtered. This reflected the ongoing confusion for some in understanding the technology, and the associations made with air conditioning units.
- A few workshop and interview participants had queries about the longevity of the systems and whether they rust.

[26] A few participants assumed that no unit would be required indoors when using an ASHP. In reality, there are two types of ASHP - mono-block models with unit just outside, and a split system with unit inside and out.

Ground Source Heat Pump

Phase 2 survey:
38% positive
30% negative

- The principle of using heat from the ground was appealing to many workshop and interview participants. It was felt to be a good source of constant, natural and renewable heat.
- Most workshop participants liked the lack of maintenance.
- The lack of fuel deliveries was another positive facet for most workshop participants.
- A few workshop participants assumed the pipes and pump of the GSHP would be subterranean and so invisible. This was considered more visually appealing than biomass boilers or ASHPs - although people did not appear to consider the other units which would be needed above ground and within the home to run a GSHP when considering overall aesthetics.
- A few follow-up participants were attracted by the GSHP's long life expectancy.

- Some workshop and interview participants found the technology difficult to understand which reduced trust in it. They also questioned whether it was sufficiently tried and tested.

  "I know so little about it… fear of the unknown I suppose."
  Workshop participant, off gas grid homeowner, rural, small property, male

- There were concerns among some workshop and interview participants about disruptive maintenance work (digging up ground to access pipes), and system replacement was also considered far more of a 'hassle' than for alternative technologies.
- Some workshop participants felt the technology was better-suited to new properties where it could be installed prior to occupation and so reduce disruption. It was viewed as a major engineering project by these homeowners.

- A few workshop participants questioned whether installation would affect a property's foundations, and in turn building insurance premiums.

  "The thing I would worry about is the foundations. Would it affect insurance or anything like that?"
  Workshop participant, on-grid homeowner, suburban, large property, male

- A few workshop participants questioned how much control they would have to change the temperature. They were uncertain how this would work given the fairly constant ground temperature - leading to concerns about reaching the desired temperature inside.

Gas Condensing Boiler

Phase 2 survey:
80% positive
5% negative

- This technology was familiar to and trusted by most on-grid workshop and interview participants. They often drew either on their own experiences or those of friends and family – being reassured that it would be reliable and effective.

  "It's like what we have got now."
  Workshop participant, on-grid homeowner, suburban, large property, female

- A few follow-up interviews made the point that because it was such a common technology it would be easy to find someone to maintain it.
- A couple of follow-up interview participants noted it was a relatively small unit that did not require a hot water tank, making it more convenient and less obtrusive than some of the other systems, if using a 'combi' boiler.

- Many workshop participants mentioned that the high (and probably still-rising) price of gas means this is an expensive option.
- A few workshop participants also disliked this option as it did not represent a step forward; they expected new systems to be fuelled from renewable sources.

- Many workshop participants were unsure whether a gas condensing boiler could be a combination boiler - so questioned whether it would provide instant hot water. Nearly all felt the system would be most appealing as a combination boiler – so not requiring a cumbersome and inflexible water tank.

Micro CHP

Phase 2 survey:
46% positive
18% negative

- Some workshop participants considered the feed-in tariff (which was stated as a feature of this technology on the information provided) a strong incentive to adopt this system, although it was not fully understood by some and many were entirely unaware of it.
- The unit looked familiar to most workshop and interview participants as they felt it was similar to a standard boiler. Thus, it looked unobtrusive and fitted in with the style of most properties.

- Many of the workshop and interview participants were unsure about how the technology worked and questioned its reliability. It was unfamiliar to nearly all, and so not considered fully tried and tested.
- The need for a hot water tank was seen as a step backward for some workshop and interview participants.

- Most of the workshop and interview participants had such a poor understanding of how a micro-CHP system worked that they had no queries about it.

Heat Network

Phase 2 survey:
34% positive
32% negative

- The concept of a communal heat supply was appealing to many workshop and interview participants. It was perceived as being more cost and energy-efficient – and many liked to think about a community being linked together.

"I like the sort of thought of being part of a network of consumers who are all likeminded."
Follow-up interview participant, on-grid homeowner, urban, small property, female, resp. 17

- The lack of responsibility on the homeowner for maintenance was also a plus for many of the workshop and interview participants. This was particularly true for off gas grid households who were very keen to be linked into a system with a readily available supply of energy.
- This was viewed as a very reliable and constant source of heat by many workshop participants, and they presumed it would be well maintained and run by professionals.
- A few of the workshop participants had positive previous experiences of living in properties connected to district heating – prompting favourable views here.

"If I could go back to the place with a heat network I'd do it tomorrow; no maintenance, the service charge, constant hot water, regardless of how much hot water I use – just peace of mind, know boiler's not going to blow up in winter."
Workshop participant, on-grid homeowner, urban, male

- Views were tempered by fears that the building and installation of a heat network would be too disruptive and difficult to install into an existing property and community.

"Could it be installed in an existing build? I can see disruptions for properties that already exist."
Workshop participants, on-grid homeowner, urban, male

- Some workshop participants were less attracted to heat networks as it conjured images of a large power station being built in their neighbourhood. These homeowners disliked both the aesthetic and safety implications of such a system.

"These big stations…how many of them do you need and who wants to live next to these big buildings? How close would they be to neighbourhoods."
Workshop participant, on-grid homeowner, suburban, large property, male

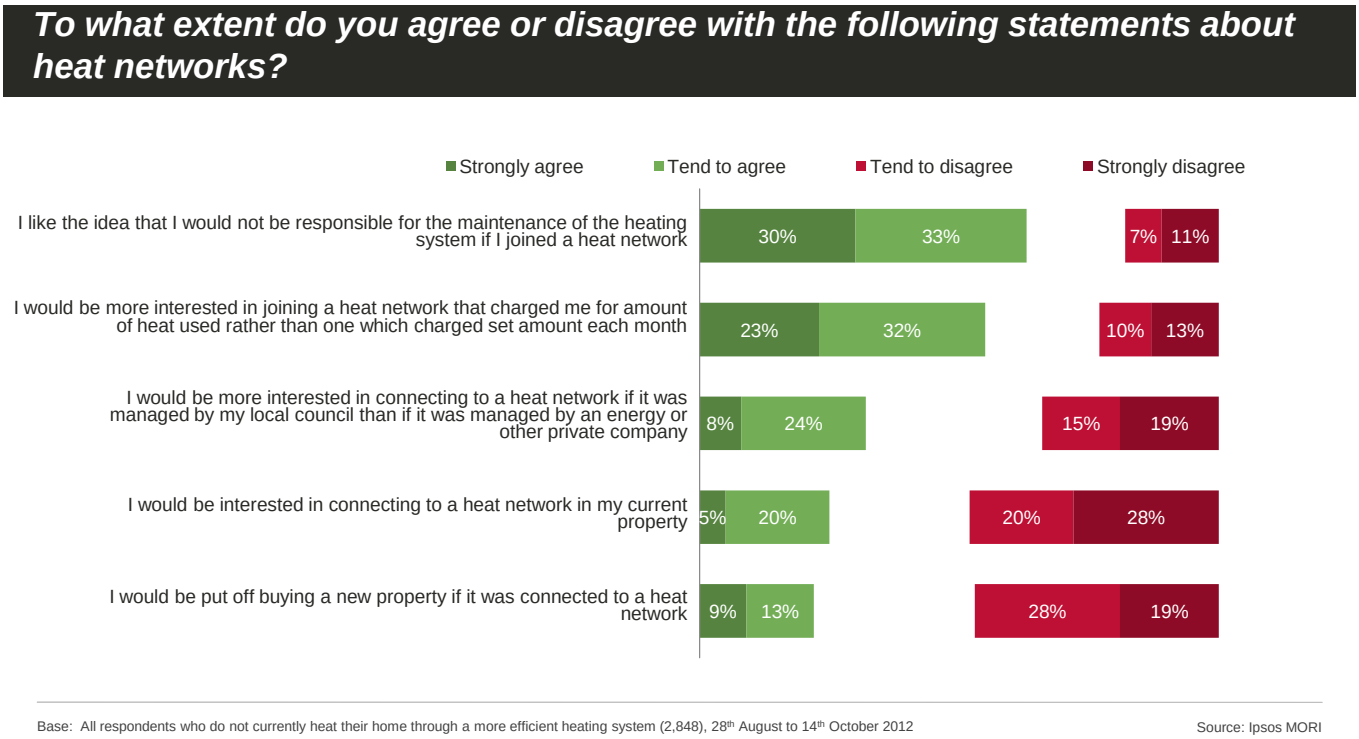
- Although the lack of maintenance responsibility was generally a plus point, it raised concerns for a few who foresaw a loss of control. They worried that this might mean problems were not promptly fixed, for instance.

- Most homeowners asked about the basis for billing a property on a heat network.
- A second key concern was whether a network would be run by a private company or local authority.
- In the survey, questions were specifically included about these issues (see Figure 35). On balance, the preference (55%) was to be charged for the amount used rather than a set amount – but 23% expressly disagreed, and a further 16% were neutral / undecided. Views were mixed on who should best run a network. Around a third each agreed and disagreed that a local authority-run network would hold more appeal than one managed by an energy or other private company. Another third said they were neutral or did not know.
- A few workshop participants queried whether they would have control of the timing and temperature of the heating. When communicating heat networks it will be essential to reinforce this fact as it is a critical factor for any heating system according to the workshop participants.

"I don't think you would accept any heating system that you couldn't control your heating."
Workshop participant, on-grid homeowner, suburban, large property, male

- Some workshop and interview participants queried how realistic a heat network system was for their own area - either because other households would not adopt it, or because their (rural) area had insufficient homes to make it viable. The survey detected different levels of appeal of a heat network in different areas - as discussed below.

Figure 40: Attitudes to heat networks among survey respondents (single response given)



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

4.4 Which more efficient heating systems do specific groups of homeowners prefer?

Overall, preferences were linked to the population density of the area, the size of (and available space in and around) the property, and the amount of time the homeowners had to maintain a heating system.

The survey showed that those in very high density areas were the most likely to be positive about **heat networks** (43% compared to 34% overall), mirroring the workshop discussions. This was also the preferred system among a few workshop participants in suburban areas.

In the survey, those living in off gas grid areas were the most likely to be positive about **GSHP**s (53% compared to 38% overall). The workshops identified homeowners living in *rural* off gas grid areas (who also tended to be those with the most outside space) as particularly attracted to GSHPs.

GSHP was also the most popular technology among AB survey respondents in suburban areas. Overall, the GSHP was more popular with homeowners than the **ASHP**, due to scepticism about how heat would be extracted from the air. However, off gas grid survey respondents were far more positive about ASHPs than those on the gas grid (41% against 26%).

The workshops and follow-up interviews found **biomass boilers** to be most appealing to those in rural areas who had larger properties. This was reflected in the survey where 30% of those in rural areas felt positively about a biomass boiler compared to a quarter of those in urban or suburban areas (24% or 25% respectively).

> *"That's* [the biomass boiler is] *old fashioned that isn't it, we've passed that nowadays. Having to have fuel delivered - where gas is just there isn't it. I know it sounds silly because we know we're using all this energy up but it's there, it's easy. I read it all and I thought no, no space and it's too messy."*
> Follow-up interview participant, on gas grid homeowner, suburban, small property, male, resp. 7

> *"I quite like biomass, because it burns things like logs and our house is built at the edge of a wood and we own some of it and we have quite a lot of wood. I do like the idea of sort of it burning wood because somehow wood and coal seem more natural materials for burning to me"*
> Follow-up interview participant, on gas grid homeowner, urban, large property, female, resp. 9

Gas condensing boilers were popular with nearly all homeowners living in on gas grid areas. This was especially the case among terraced property owners (85% positive compared to 78% of detached and semi-detached owners).

The same trend was true of **micro-CHP,** with 51% of terraced property owners positive (for whom space is at a premium) compared to 46% overall. Micro-CHP was fairly popular with many homeowners – but relatively *least* positive were those aged 55+ (who had reservations about the technology) and C2DEs.

The Green Deal '**Convertibles'** tended to be more positive than others about many of the systems: micro-CHP (60% to 46% overall); heat networks (47% to 34%); GSHPs (48% to 38%); ASHP (36% to 28%); and biomass boilers (37% to 26%). The DECC study[27] identified this group as higher income working families who were already considering making energy efficiency improvements.

By contrast, '**Disengaged rejecters'** were the most likely to be negative about most of the technologies. These were older homeowners who were not planning to make their homes more energy efficient and not considering the Green Deal at all according to the DECC study.

[27] GfK NOP and Kantar Research, 2012, *Green Deal Segmentation,* DECC. Available at http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/green-deal/7057-research-report-green-deal-segmentation.pdf

4.5 What trade-offs do homeowners make between different more efficient heating systems and what encourages uptake of one over another?

4.5.1 Key factors used by homeowners to trade-off technologies

Key observations 3 – Factors determining preferences between more efficient heating systems (non-emergency situations)

This section discusses the results of the Phase 2 choice experiment which formed part of the Phase 2 survey. Respondents were presented with a series of choices between more efficient heating systems and asked which they would be most likely to install in a non-emergency scenario (when their current heating system was still working but was perhaps coming towards the end of its life or they were considering replacing it for another reason). Key information was presented next to each heating system option to help inform their decision making (e.g. installation cost, likely fuel bill, financial help available).

- The key driver of choice was the technology itself, rather than installation cost or financial incentives available. The nature of the technology drove 54% of the decisions in the choice experiment. Two key ways in which the technology itself was assessed was how appropriately sized it was for a particular property, and, at an intuitive level, how credible it sounded for a colder climate such as Great Britain.
- The upfront grant was the next most influential factor - explaining 13% of choices made - while the tariff amount and length each explained 9%, and the installation cost 8%. Finally, the estimated annual fuel bill recorded 7%.
- The choice experiment found considerable barrier costs[28] to homeowners replacing their current system for a more efficient option (in non-emergency situations). 'Barrier costs' are the economic value homeowners would need to be compensated by to address their concerns about the new technology (e.g. being disruptive to install, inconvenient to maintain etc).

This section considers the key factors which determined homeowners' choices of heating systems. The full results are shown in Figure 41.

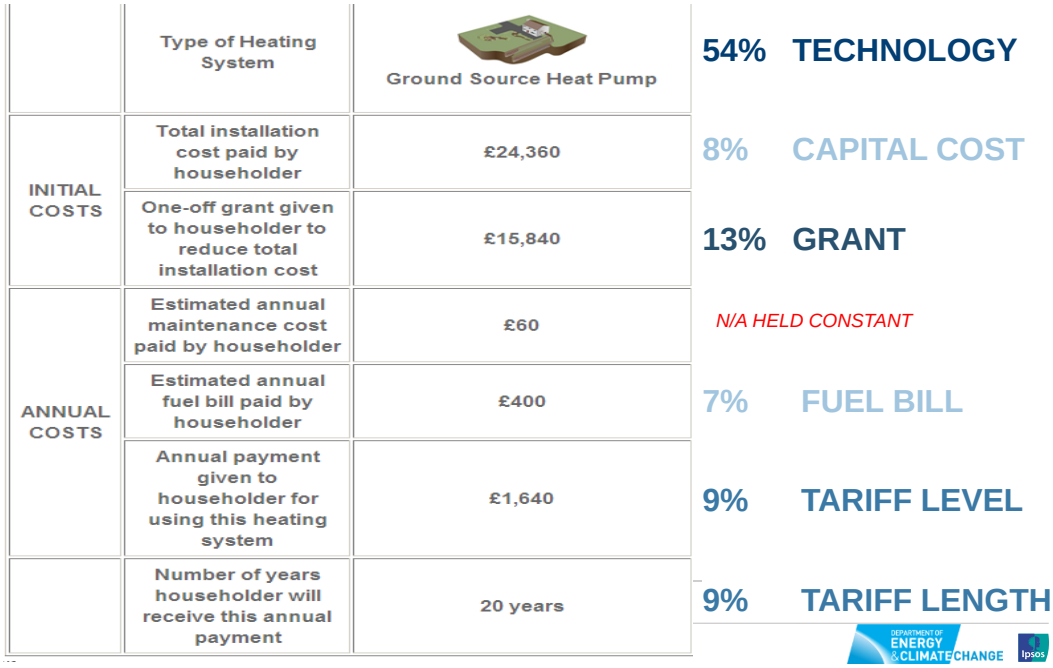
Overall, the type of heating system being presented was the most influential driver, explaining 54% of the choices made overall. The most influential *cost* information was the upfront grant - dictating 13% of choices - with capital cost, tariff level and the tariff amount having a similar influence (8% and 9% of choices. Fuel bills were the least important cost factor (7%).

During the workshops and follow-up interviews participants were asked directly which of the pieces of information they felt were most influential in determining their choices between the technologies. Most participants felt it was the upfront cost, rather than grant, that influenced them the most. Analysis of the choice experiment shows, however, that ultimately greater weight was placed on the grant.

The estimated annual maintenance cost was not included in this ranking exercise – assumed to be a constant value for each technology – and the workshops and follow-up interviews found that this was in any case largely overlooked in the decision-making; it was relatively low amount (between £0 - £230 per year) compared to other costs, and did not vary across the options.

[28] Further information on the barrier costs calculated using the choice experiment results will be published separately.

Figure 41: Relative importance of attributes in trade-offs made during choice experiment



The attributes driving the trade-off decisions made by different groups of survey respondents has also been examined. Figure 42 shows this analysis for on and off gas grid survey respondents compared with survey respondents overall. The type of heating system was the main driver for both these groups of homeowners, however Figure 42 shows that those living off the gas grid were more influenced by the one-off grant than those connected to the grid. While on gas grid respondents were no more likely to be influenced by the tariff amount, they were more likely to make choices on the basis of the tariff length and the total installation cost than off gas grid homeowners.

Figure 42: Drivers of preferences between more efficient heating systems for on and off gas grid survey respondents

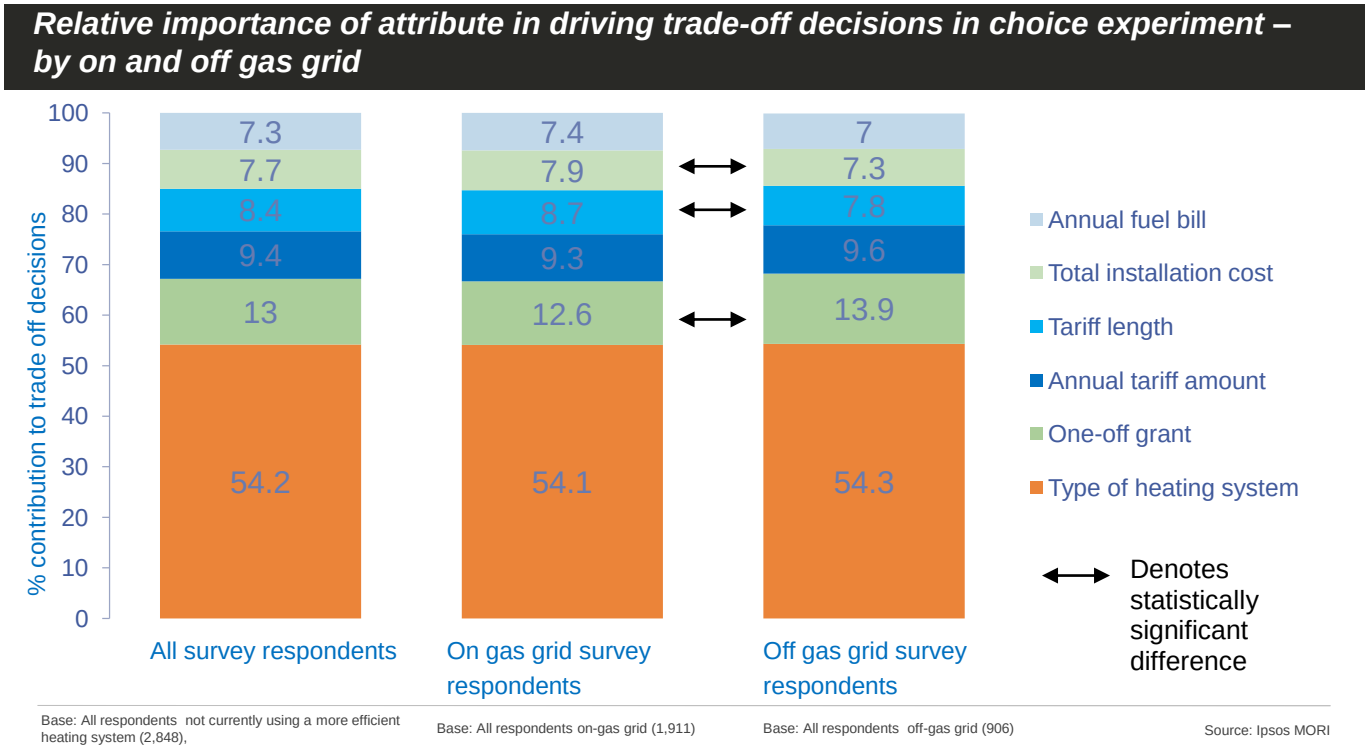


Figure 43 shows the relative importance of the attributes in driving the trade-offs made by homeowners of different incomes. Again the type of heating system was the most influential factor for all these survey respondents, but they were affected to different extents by the financial incentive information. The lowest income survey respondents (those with a total annual household income of less than £10,000) were more likely to have been influenced by the one-off grant than those on the highest incomes (those with a total annual household income of over £50,000). Those on the highest incomes were however, more likely to have been influenced by the annual tariff length than those on lower incomes.

Figure 43: Drivers of preferences between more efficient heating systems for survey respondents with different incomes

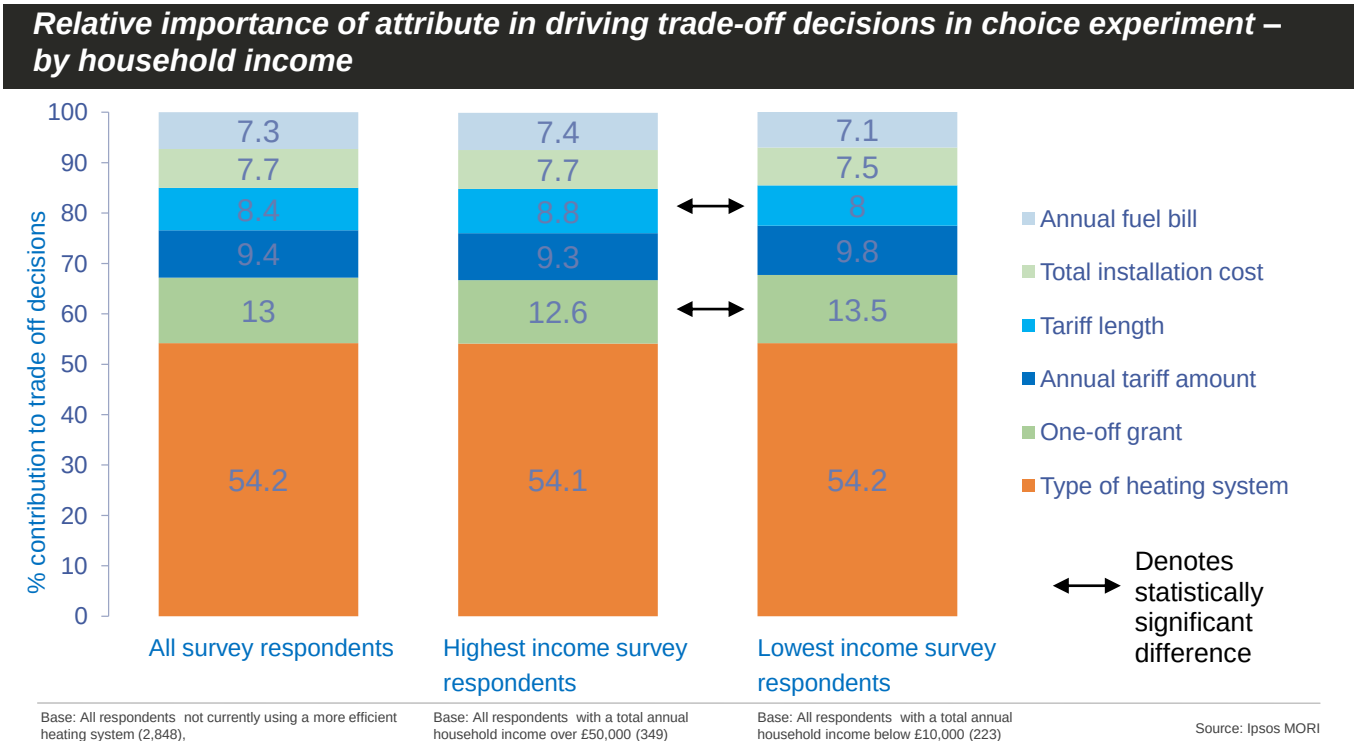
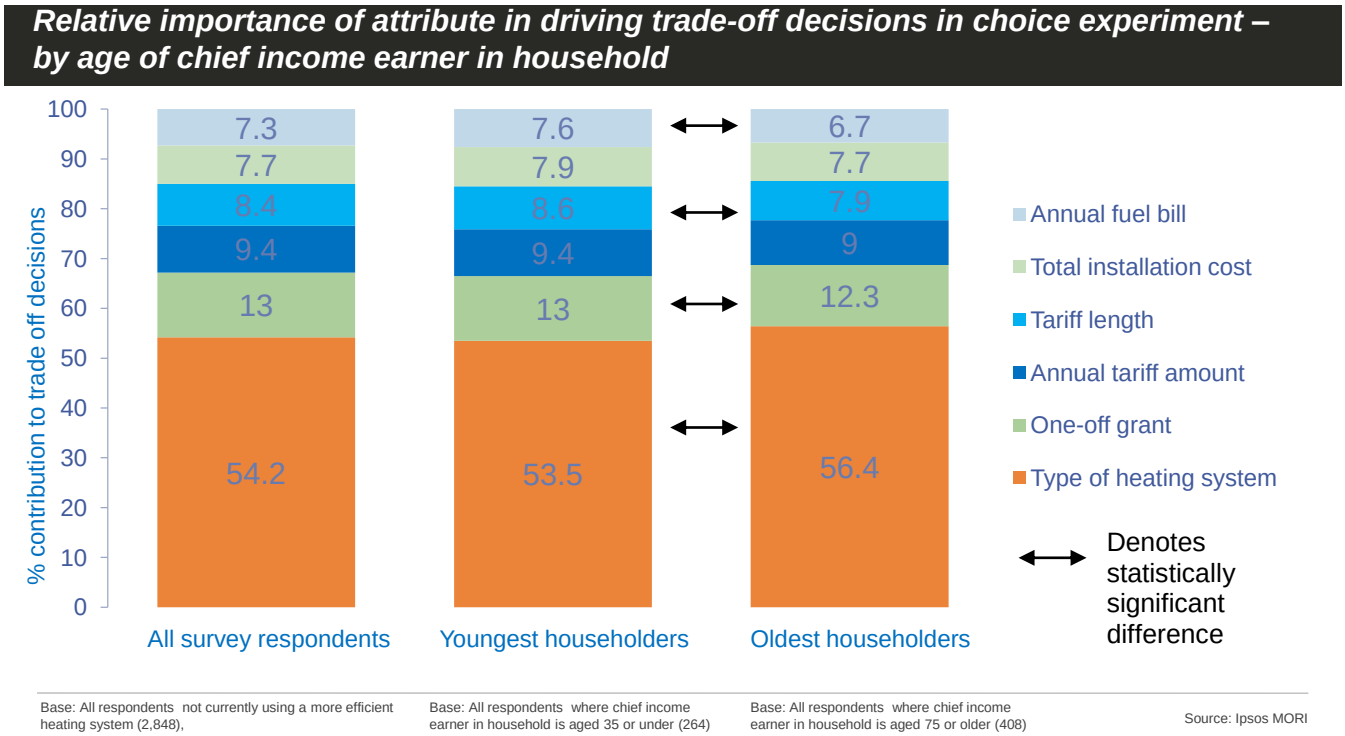


Figure 44 shows the relative importance of the attributes for survey respondents of different ages. The type of heating system is shown to be particularly important for survey respondents living in households with a chief income earner over the age of 75. The one-off grant, tariff length and fuel bill were less influential for this group than for survey respondents living in a household with a chief income earner under the age of 35 however.

Figure 44: Drivers of preferences between more efficient heating systems for survey respondents of different ages



The same analysis conducted on other groups of survey respondents has revealed the following patterns:

- those currently heating their home with an oil or electric system were more likely to be influenced by the grant value than respondents overall, and those currently using a gas boiler;
- those living in flats were more likely to be influenced by the installation cost than those living in detached properties, while they were less likely to be influenced by the tariff amount.

The fact that the technology itself was the strongest driver of choices for all survey respondents suggests that the information included on the factsheets about each heating system (which did not include any cost information) may have been very influential in determining homeowners' preferences.

The ways in which homeowners digested the factsheet information was explored during workshops and follow-up interviews. During the workshops the homeowners were presented with choices between more efficient heating systems in the same way as the survey and asked to explain the trade-off they would make. A key part of the follow-up interviews was also asking homeowners to explain the trade-offs they had made in the survey and what pieces of information in particular they had used to help them make a decision between the two technologies presented to them. These qualitative discussions uncovered the following ways in which homeowners, and in some cases, particular groups of homeowners, were selecting one technology over another.

Most important information on technology factsheets

The workshops and follow-up interviews explored how homeowners assessed the appeal of each technology and which pieces of information on the factsheets were most critical to informing their impressions. These qualitative phases revealed that homeowners tended to determine the level of appeal of each technology (prior to seeing any cost information) based on the following criteria. These are ordered broadly in terms of how important they appeared to be to homeowners.

- Many instantly assessed the technology on the basis of its appropriateness for their property in terms of the space it required inside and outside (including whether it required a hot water tank);

- Some considered the credibility of the technology, and whether it intuitively felt trustworthy and reliable as a source of heat was also considered by most homeowners;
- Some thought about the level of responsibility placed on the individual householder to manage the system – in particular the level of maintenance required was a key criteria for some homeowners;
- A few placed importance on the image of the technology included on the factsheet, as this informed some homeowners' impressions of how much space the system required and whether it would fit with the style of the home;
- A few considered the expected lifetime of the system as a few homeowners wanted to know that it would not need to be replaced frequently; and
- only a very few considered the installation time of the system and for most homeowners this was of little importance in their consideration of the appeal of the technology.

Despite some homeowners expressing a strong interest in installing a renewable technology, many of the homeowners did not consider the environmental credentials of these technology choices at all. Most were focussed on practicality and their own circumstances and the level of hassle they would tolerate in terms of having to clean and maintain the system and have fuel delivered.

Overall most important information used by homeowners to make trade-offs between more efficient heating systems

This section considers overall which pieces of information on each more efficient heating technology were most important in informing homeowners' choices. Ultimately, the technology itself was a key driver for many, with the cost information only becoming influential in the choice when it dramatically differed between the two options. The workshops and follow-up interviews revealed three groups of homeowners who made their choices in different ways. It should be noted that these groups have been defined on the basis of a small number of qualitative interviews and workshops and so are indicative of some of the ways in which homeowners are likely to approach a trade-off decision. They do not attempt to cover the full range of nuanced decision-making processes that might exist.

- The most common approach was to base the decision primarily on the impression formed about each technology on the basis of the factsheet information, with the cost information used as a final sense-check that this was the right decision. This approach was confirmed by the survey analysis which revealed the strongest driver to be the type of heating system, rather than any of the cost information. Many of the follow-up interview participants explained that they had already decided which of the technologies to dismiss as options for their home based on the assessments they made when reading the factsheets. Only if the costs of the two technologies differed substantially from one another, or between the chosen technology and the current running costs of their existing system, would the homeowner choose the alternative option. If this was the case they would generally go on to say they would be highly unlikely to actually install this technology in place of the system currently installed in their home. In only a few cases did the sense check of costs lead the homeowner to change their preference due to a very high installation cost or high fuel bill.
- A small group of workshop and interview participants' choices were driven entirely by the way the technology was described on the factsheet. When asked explicitly to look at the costs, these homeowners tended to say that these were a bonus (if favourable) or a minor factor (if more expensive).
- Another small group of workshop and interview participants were not strongly in favour of any of the more efficient heating systems based on the factsheet information. These homeowners made their choices based almost entirely on the costs, and in particular the upfront cost, rather than the technology.

4.5.2 How much would homeowners be willing to pay (or need to be subsidised by) to take up each alternative technology?

The choice experiment found that homeowners would often require a subsidy to replace their current heating system with one of the technologies studied. This subsidy is referred to as a 'barrier cost' - representing the financial cost that a householder puts on the additional perceived disturbance or risk from that technology relative to a default technology. The default was taken as a gas condensing boiler for on gas grid homeowners, and was set as a 'do nothing scenario' for off gas grid homeowners (while the definition of the default differed for on and off gas grid homeowners, the barrier costs for these two groups can be compared). In both cases, the barrier cost is that critical price or discount (the 'tipping point') at which homeowners would be persuaded to switch from their current heating system to a more efficient option, excluding installation costs.

A barrier cost was estimated for every survey respondent by calculating what reduction in installation cost would be required to equalise the appeal of one of the more efficient heating systems with the default technology - all other aspects being equal.

Further information on the barrier costs calculated using the choice experiment results will be published separately.

4.6 Likely take-up of more efficient heating systems

This section considers the likelihood of homeowners replacing their current heating system with a more efficient option in two different scenarios: firstly a non-emergency situation when their current system is still working but is perhaps coming towards the end of its life or they are considering replacing it for another reason; and secondly an emergency situation when their current system has broken down and they are unable to get any heating or hot water.

The selections that survey respondents made in the choice experiment were based on a non-emergency scenario. During the choice experiment, homeowners were not able to give a neutral or 'don't know' response, however, there was a follow-up question after each choice screen which asked homeowners *how likely* they would be to actually install their selected technology in a non-emergency scenario.

Key observations 4 – Likelihood of homeowners taking up more efficient heating systems

- In a non-emergency scenario (where homeowners' heating is still working, but they are considering replacing it perhaps because it's coming towards the end of its life, or for another reason), the vast majority of homeowners would not make a replacement.
- Among the on gas grid homeowners who *would* make a non-emergency replacement, the most popular option would be a gas condensing boiler, with 15% installing this in a 'base scenario', compared to 1% for GSHP and less for the other renewable options. This compares with 80% who would not make a replacement.
- Even in a scenario where gas prices increase by 40% (and all other fuel prices remain at 2012 levels) the gas condensing boiler is still the most popular choice amongst those making a replacement.
- Among off gas grid homeowners who would make a non-emergency replacement, the most popular option was a heat network, with 5% choosing this in a 'base scenario', compared to between 1% and 2% for each renewable technology (biomass boiler, GSHP, ASHP), and 91% who would not make a replacement.
- The provision of an upfront grant for renewable options would encourage uptake in a non-emergency situation. This would increase as the value of the grant increased (although the experiment results showed no additional uptake with a grant set to 130% of the installation cost compared to a 100% grant. A 100% grant would encourage +2.4% shift to any renewable heat option (GSHP, ASHP or biomass boiler) compared to a base scenario with no financial incentives (from 1.5% to 3.9%).
- The provision of an annual tariff - but no upfront grant - for renewable options would prompt a shift in (non-emergency) uptake. A seven year tariff (set to 'RHI 2012 consultation' tariff level) would encourage +1.9% shift to any renewable heat option (GSHP, ASHP or biomass boiler) compared to a base scenario with no financial incentives (from 1.5% to 3.4%).
- It can be concluded that any form of financial assistance statistically significantly increases the proportion of homeowners opting for renewable heat. However, the relative effectiveness of a tariff or a grant encouraging uptake cannot be determined as the results are too similar.
- In emergency situations, willingness to replace a system is considerably higher – but predominantly with a gas condensing boiler among on gas grid homeowners. Off gas grid homeowners were equally likely to be willing to connect to a heat network or install a GSHP with slightly fewer likely to install an ASHP or biomass boiler.

4.6.1 Preferences between heating technologies in a non-emergency situation

The outputs from the choice experiment can be used to explore which more efficient heating systems homeowners would be most likely to install in a non-emergency scenario. They show the share of the population likely to take up a more efficient heating system over another in a range of cost, grant and tariff scenarios. The analysis provides an order of preference between the more efficient heating systems when homeowners were in a non-emergency scenario. However, it should be remembered that, overall, most homeowners would be unlikely to replace their heating system in a non-emergency situation. The range of reasons for this was discussed in section 3.1.4.

The preference shares discussed in this section are based on the choices survey respondents made in the trade-off exercise but also their stated likelihood of actually installing the technology in their current

home in a non-emergency situation. Homeowners' stated likelihood was converted into a probability of uptake by down weighting it for likely over claim. The down weighting was based on an average value frequently used by Ipsos MORI to adjust consumer claims about purchasing new high price ticket products or switching services.

It is important to note that the choice experiment does not offer a market forecast. The method was chosen to measure the attractiveness of more efficient heating systems relative to each other, and whilst uptake figures are generated by this method and shown for illustrative purposes, there are a number of caveats which mean these figures should not be considered to be a market forecast for demand for these heating systems (these will be devised through further modelling by DECC). The choice experiment was based on homeowners receiving basic and unbiased information about each of the more efficient heating systems. There are therefore a variety of factors not included in the research that are expected to influence uptake. These include, marketing activity by providers, reputation, word of mouth, whether the homeowner is at a key trigger point such as their existing system breaking down or refurbishing their property, tailored advice, competitive activity and government awareness raising activities. Estimates are a short term measure of current appeal, based on the offer being available to everyone at one point in time. They results offer a snapshot based on homeowners current financial, economic and household situation.

Preferences between more efficient heating technologies given current installation and fuel costs and no financial incentives

Figure 45 shows the relative preferences of survey respondents in what is described as the 'base scenario'. This has been set up to match current market conditions as closely as possible. It has been defined as follows:

- **Upfront installation cost:** current market price for all technologies;
- **Upfront grant:** not available for any technology;
- **Annual fuel cost:** current price for gas, electricity and biomass pellets; and
- **Annual tariff payment**: not available for any technology[29].

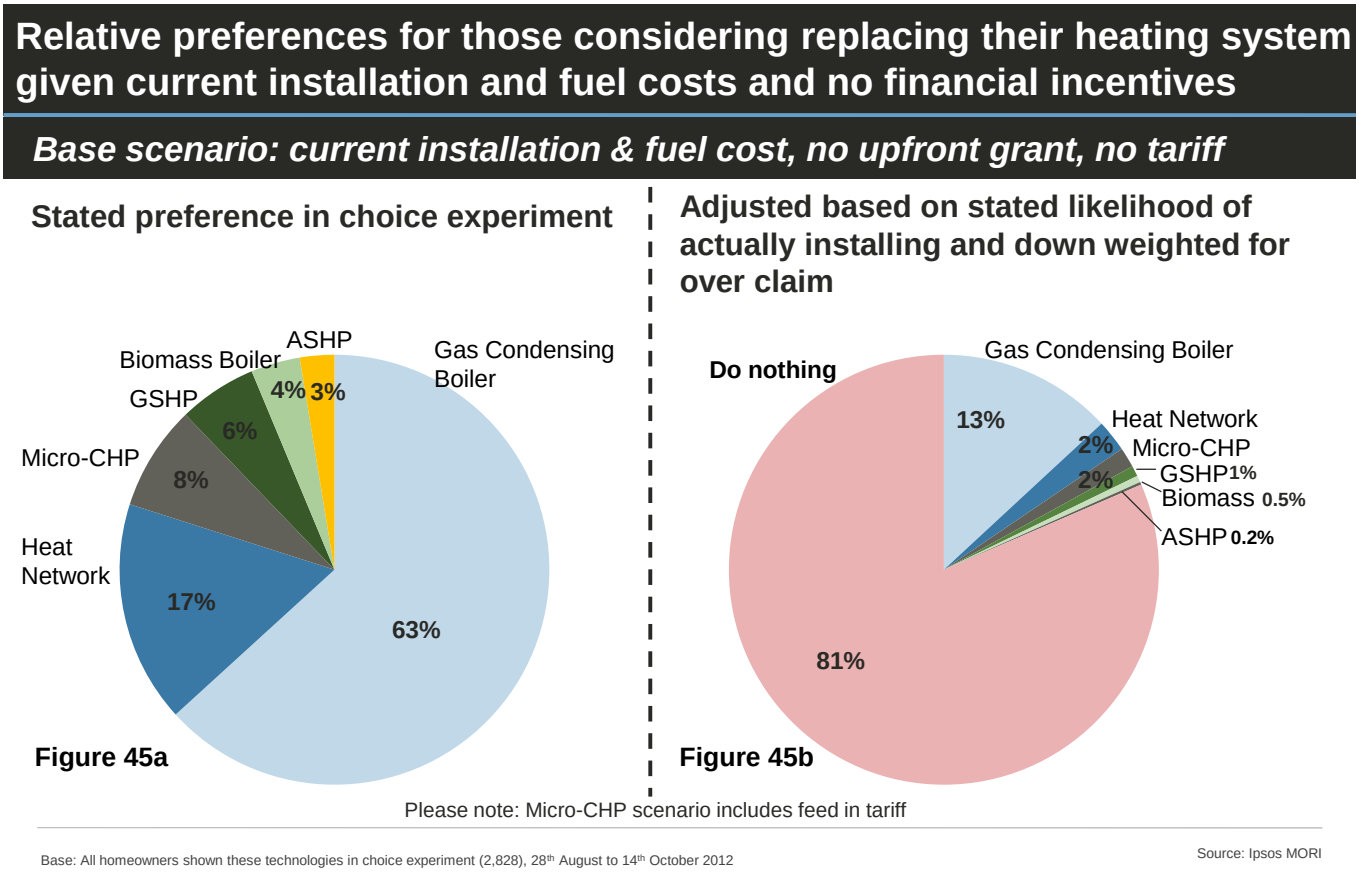
Figure 45a shows the **raw share of preferences** between the technologies. Figure 45b shows **adjusted preferences** which take into account homeowners' own stated likelihood of installing their selected technology, and the down weight to adjust for likely over claim on this. This shows that, across all the survey respondents, a gas condensing boiler is the most popular technology to install in a non-emergency situation. Although 63% of homeowners selected this option during the choice experiment, the proportion likely to actually change their current technology and install this new technology in a non-emergency is 13%.

Figure 45b shows that four in five (81%) homeowners would choose to 'do nothing' in a non-emergency situation given current installation and fuel costs and given no financial incentive to install any of the more efficient heating systems.

The order of preference between the technologies remains the same between the raw (left hand side) and adjusted (right hand side) figures. A heat network was the second most frequently selected option, followed by mirco-CHP. The GSHP was the most popular renewable heating option in this non-emergency scenario.

[29] However, please note that the base scenario tariff payment attribute does include a feed-in-tariff for micro-CHP.

Figure 45: Non-emergency scenario preferences for all survey respondents



The rest of the results discussed in this section are all based on the adjusted preference figures. The relative share of preference in the base scenario can also be considered for specific groups of homeowners. Figure 46 shows the results for those connected to the gas grid and those who are off gas grid. This is an important distinction as off gas grid homeowners were not offered the gas condensing boiler or micro-CHP systems in their choice experiment.

Figure 46a shows that the order of preference between the technologies in a non-emergency scenario was the same for on gas grid homeowners as for homeowners overall. They were also most likely to select, and say they would install, a gas condensing boiler in a non-emergency scenario (15%).

The heat network was the most popular option among off gas grid homeowners: 5% would choose this option in a non-emergency situation (shown in Figure 46b), with very similar proportions selecting, and saying they would install, a GSHP (2%), biomass boiler (2%) or ASHP (1%). It is important to note however, that it is unlikely that many off gas grid homeowners, particularly those in rural areas, would have the opportunity to connect to a heat network at the present time. This option was shown to these homeowners to future proof the research and provide an indication of whether this would be a popular option should it become available. The model allows one or more of the more efficient heating systems to be removed as possible future options. If the heat network is removed the 5% of off gas grid homeowners who would have chosen this system are split across the 'do nothing' percentage (which increases from 91% to 92%) and the three renewable heating systems. The share opting for the GSHP in this non-emergency situation increases from 2% to 3%, the share opting for ASHP increases from 1% to 3% while the share opting for the biomass boiler remains the same (2%).

Figure 46b also shows that off gas grid homeowners would be more likely than on gas grid homeowners to not replace their heating system at all in a non-emergency given the costed options presented to them. Nine in ten (91%) off gas grid homeowners would be likely to do nothing compared to four in five (80%) on the gas grid. This contrasts with the qualitative discussions which found off gas grid homeowners to

be the most interested in replacing their heating systems. The proportion of on gas grid homeowners who would 'do nothing' does increase if the gas condensing boiler and micro-CHP are taken away as potential future options (do nothing becomes 86%) however it is still lower than among the off gas grid group.

Figure 46: Non-emergency scenario preferences for on and off gas grid survey respondents

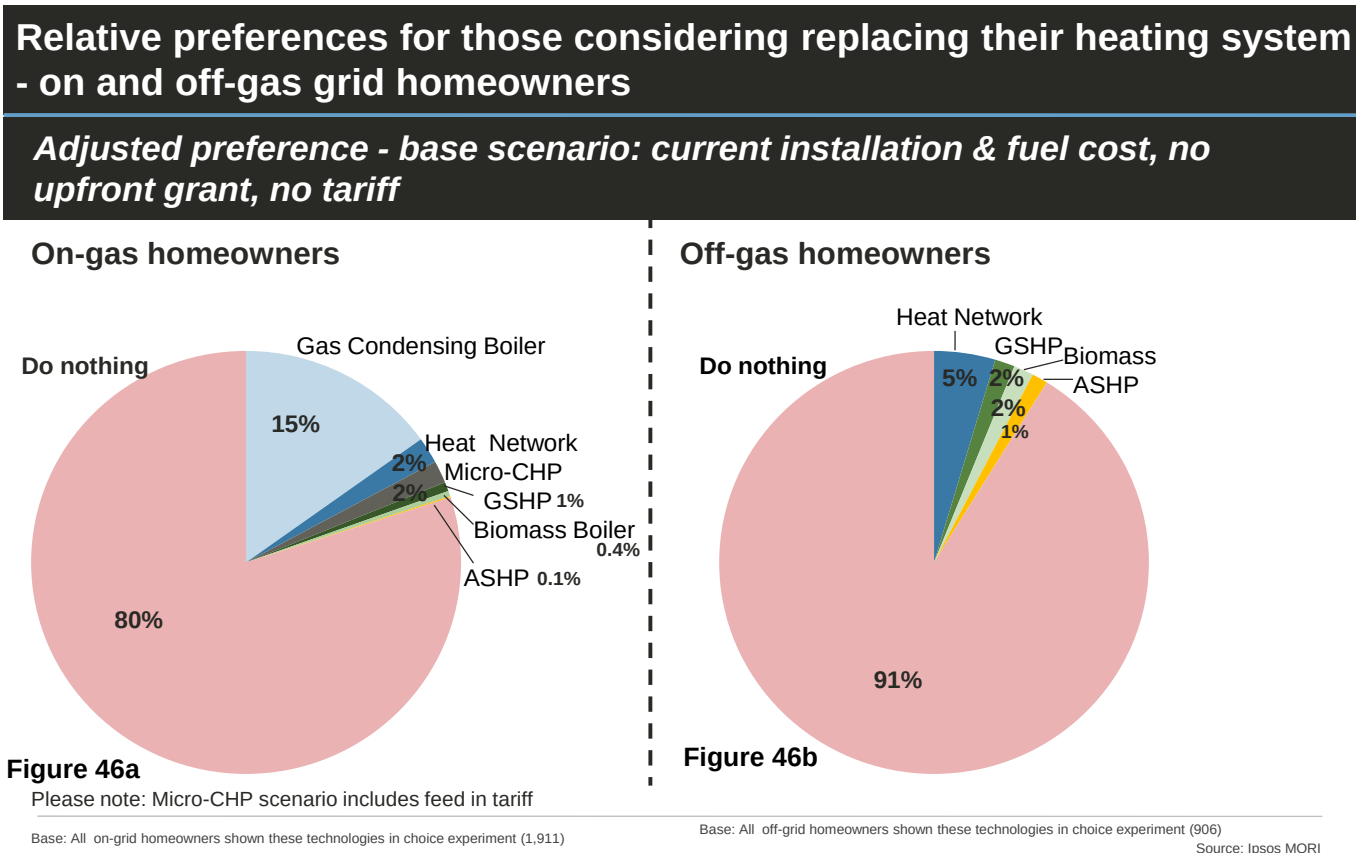


Figure 47 and Figure 48 show the adjusted relative preferences for homeowners living in different property types, and who are either on or off the gas grid. The order of preference between the technologies is the same for both on and off gas grid groups regardless of property type.

However, there are some interesting differences in the share of homeowners selecting each technology, particularly among the off gas grid group. Off gas grid homeowners living in flats were the most likely to select a heat network and say they would be likely to connect to one in their current property in a non-emergency scenario. The workshops and follow-up interviews suggested that this is likely to be because these homeowners believed a heat network was a viable option for them compared with those living in large detached properties in rural areas who tended to assume it was not a realistic option for them.

Off gas grid homeowners living in detached properties were more likely to select, and be likely to install, a GSHP or biomass boiler than those living in smaller properties, particularly flats. This again matches the discussions at the workshops and follow-up interviews which found these homeowners more likely to feel they had the space needed, either inside or outside the property, for these technologies.

Figure 47: Adjusted relative preferences in base scenario in non-emergency for on gas grid homeowners living in different property types

Base scenario: *Current upfront costs and fuel bill* *No financial incentives*	**On gas grid homeowners** **Adjusted preferences**			
	Detached	Semi	Terrace	Flat
Base:	*(372)*	*(895)*	*(523)*	*(201)*
Gas Condensing Boiler	13%	16%	17%	13%
Heat Network	2%	2%	2%	1%
Micro-CHP Boiler (includes FIT)	2%	2%	2%	1%
Ground Source Heat Pump	1%	1%	0%	0%
Biomass Boiler	1%	0%	0%	1%
Air Source Heat Pump	0%	0%	0%	0%
Do nothing	82%	79%	79%	84%

Figure 48: Adjusted relative preferences in base scenario in non-emergency for off gas grid homeowners living in different property types

Base scenario: *Current upfront costs and fuel bill* *No financial incentives*	**Off gas grid homeowners** **Adjusted preferences**			
	Detached	Semi	Terrace	Flat
Base:	*(296)*	*(381)*	*(106)*	*(123)*
Heat Network	4%	5%	4%	6%
Ground Source Heat Pump	2%	1%	1%	0%
Biomass Boiler	2%	1%	1%	1%
Air Source Heat Pump	1%	1%	2%	1%
Do nothing	91%	91%	91%	91%

Figure 49 shows the adjusted relative preferences for on gas grid homeowners with different total household incomes (before tax). Those with higher incomes would be more likely to make a replacement. These preferences are based on a scenario where no financial incentives are available to install these systems. The workshops and follow-up interviews found that in this situation, many lower income homeowners felt they could not afford, or did not want to prioritise capital, to replace their current system in a non-emergency situation.

Figure 49: Adjusted relative preferences in base scenario in non-emergency for on gas grid homeowners with different total household incomes

Total annual household income before tax	On gas grid homeowners					
	Adjusted preferences					
	<£10k	£10k-£19k	£20k-£29k	£30k-£39k	£40k-£49k	>£50k
Base:	*(121)*	*(281)*	*(283)*	*(240)*	*(166)*	*(263)*
Gas Condensing Boiler	15%	14%	15%	15%	17%	16%
Heat Network	1%	1%	2%	2%	2%	3%
Micro-CHP Boiler	1%	1%	2%	2%	3%	2%
Ground Source Heat Pump	1%	0%	0%	1%	1%	2%
Biomass Boiler	1%	0%	0%	0%	1%	0%
Air Source Heat Pump	0%	0%	0%	0%	0%	0%
Do nothing	81%	83%	79%	80%	75%	76%

The same analysis has been conducted on the relative preferences of off gas grid survey respondents with different household incomes. However, there was no significant variation among these homeowners based on their income.

The order of preference between the more efficient heating systems has remained consistent across all groups of homeowners, when considering the base scenario. This order also follows fairly closely with the level of appeal each technology was considered to have during workshops. This provides further evidence to suggest that the technology itself, rather than the costs associated with it, is the key driver of choices between these heating systems.

Preferences between more efficient heating technologies in a non-emergency under Renewable Heat Incentive scenario

The rest of this section goes on to test whether the likely uptake of more efficient heating systems in a non-emergency situation, and the order of preference between them, can be changed through financial levers. It explores whether the availability of an upfront grant is more or less effective at increasing likely uptake than an annual tariff payment. It also considers how preferences change if a tariff or grant is offered for one of the technologies but not the others, and the impact of a high rise in the price of gas.

Figure 50 compares the **adjusted relative preferences** in the base scenario which have just been discussed, with indicative tariff levels set out in the domestic RHI consultation (September 2012)[30]. This has been defined as follows:

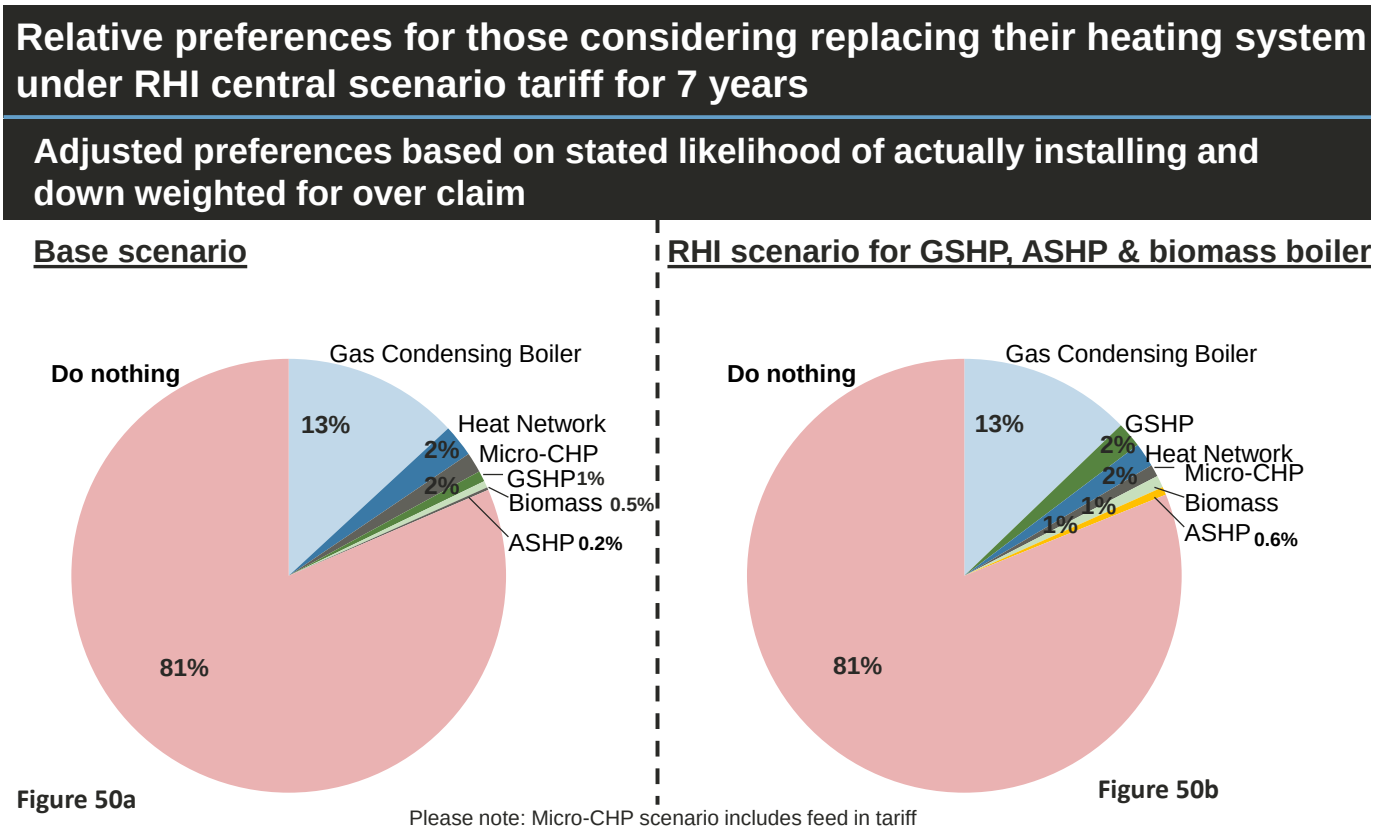
- **Upfront installation cost:** current market price for all technologies;
- **Upfront grant:** not available for any technology;
- **Annual fuel cost:** current price for gas, electricity and biomass pellets;

[30] The domestic RHI consultation document launched in September 2012 set our ranges of tariffs. The midpoint was used in the Phase 2 survey of this research study. It is referred to as the RHI central scenario tariff throughout this report. More information about the consultation and the consultation document is available here: http://www.decc.gov.uk/en/content/cms/consultations/rhi_domestic/rhi_domestic.aspx#

- **Annual tariff payment**: RHI 'central scenarios' tariff level available for GSHP, ASHP and biomass boiler only[31] (set at central tariff scenario level); and
- **Length of tariff payment**: seven years for GSHP, ASHP and biomass boiler.

The comparison shows that the availability of a seven year RHI central tariff for the renewable heating technologies had an impact on the likelihood of homeowners installing these systems in a non-emergency scenario. The share selecting, and likely to install, a GSHP increased from 1% under the base scenario to 2% under the 7 year RHI central tariff also led to an increase of 0.4% selecting either an ASHP or a biomass boiler. The overall change in the percentage share likely to take up any renewable heat option (GSHP, ASHP or biomass boiler) was +1.9% from the base scenario when no financial incentive was offered for these technologies. These are statistically significant changes.

Figure 50: Non-emergency scenario preferences among all survey respondents with RHI tariff available for renewable technologies



[31] Micro-CHP tariff level included feed in tariff payment.

Figure 51: Impact of seven year tariff on appeal of renewable heating systems in non-emergency scenario

SUMMARY OF SIGNFICANT CHANGES UNDER 'RHI 2012 CONSULTATION' TARIFF LEVEL *(available for GSHP, ASHP or biomass boiler for 7 years)* *Figures based on all respondents*			
	% opting for technology under base scenario (no financial incentive for any heating system)	% opting for technology under 'RHI 2012 consultation' tariff level	**Relative change in % share opting for technology under 'RHI 2012 consultation' tariff level**
GSHP	0.8%	1.9%	**+ 1.1%**
Biomass	0.5%	0.9%	**+ 0.4%**
ASHP	0.2%	0.6%	**+ 0.4%**
Any renewable heating system	**1.5%**	**3.4%**	**+ 1.9%**

Figure 52 presents the results under the seven year RHI central tariff scenario for off gas grid homeowners compared with the preferences for this group discussed above under the 'base scenario' (i.e. no incentives). This shows that the RHI creates shifts in the share of off gas grid homeowners likely to install a renewable heating system in non-emergency. Specifically, it encourages a shift in the appeal of the GSHP (+0.7%) and ASHP (0.4%). However, it does not have a significant impact on the proportion opting for a biomass boiler. The overall change in the percentage share likely to take up any renewable heat option is significant at 1.4%.

Figure 52: Comparison of non-emergency scenario preferences between base scenario and 'RHI 2012 consultation' tariff level among off gas grid survey respondents

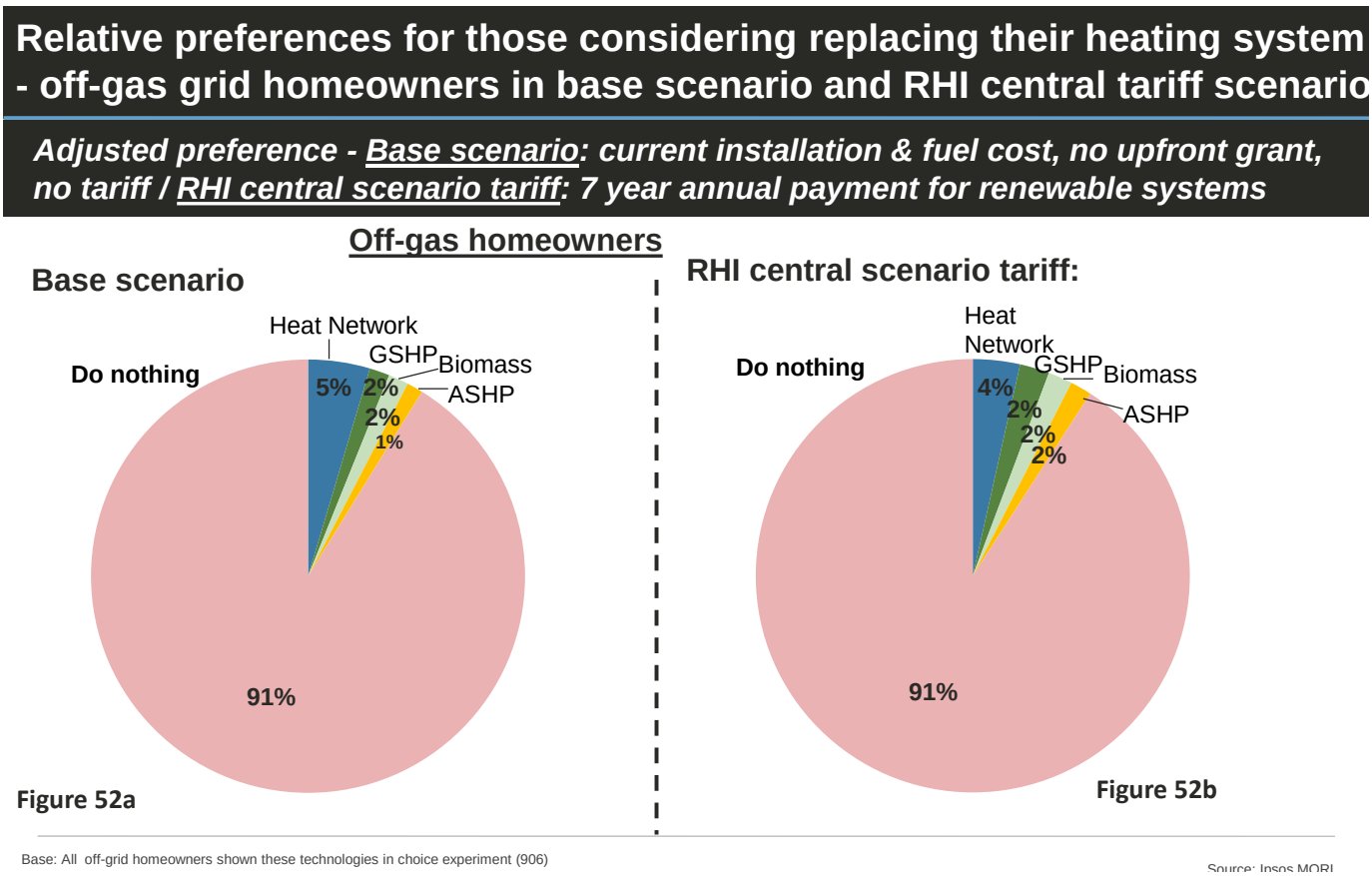


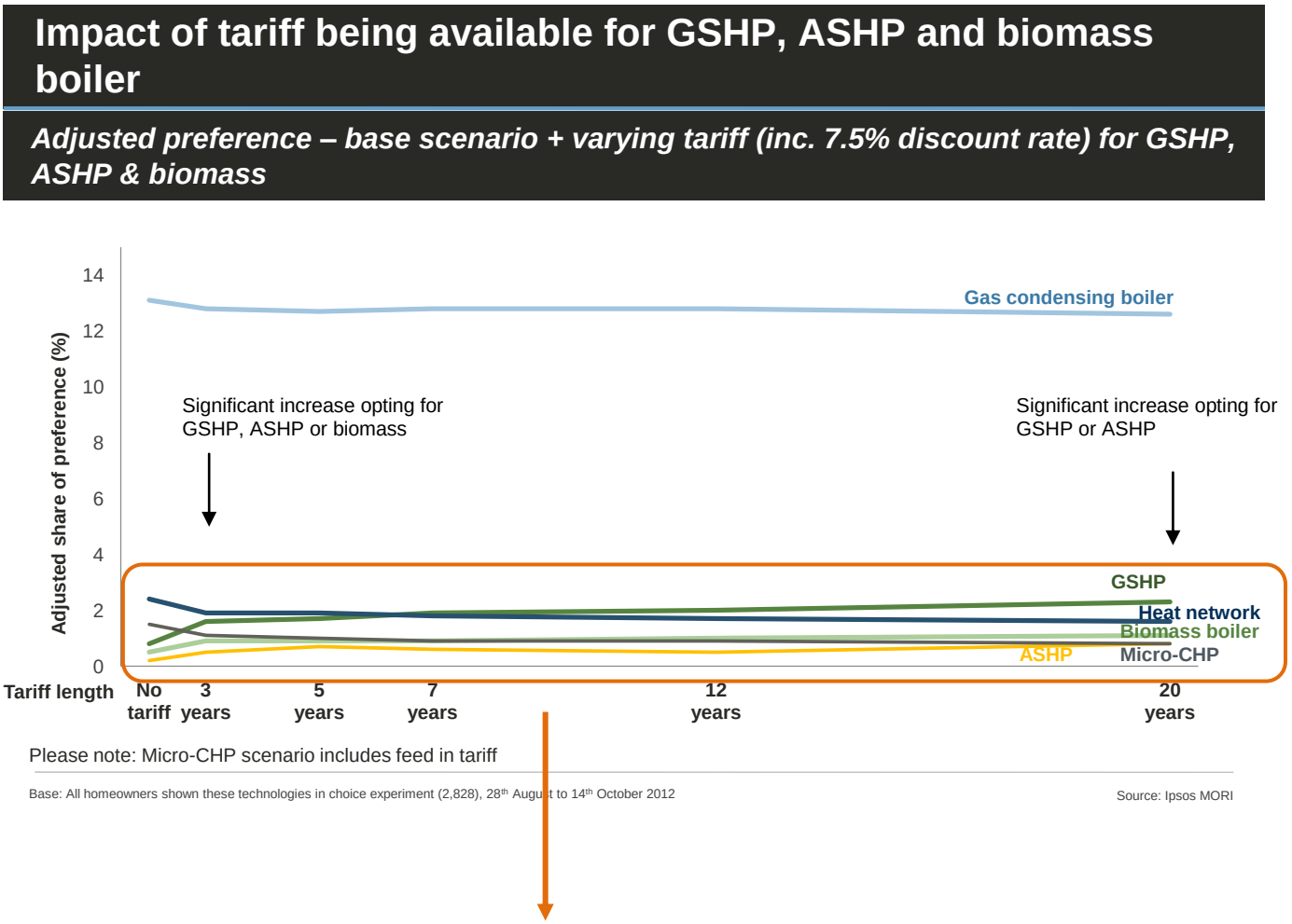
Figure 53: Impact of seven year tariff on appeal of renewable heating systems for off gas grid homeowners in non-emergency scenario

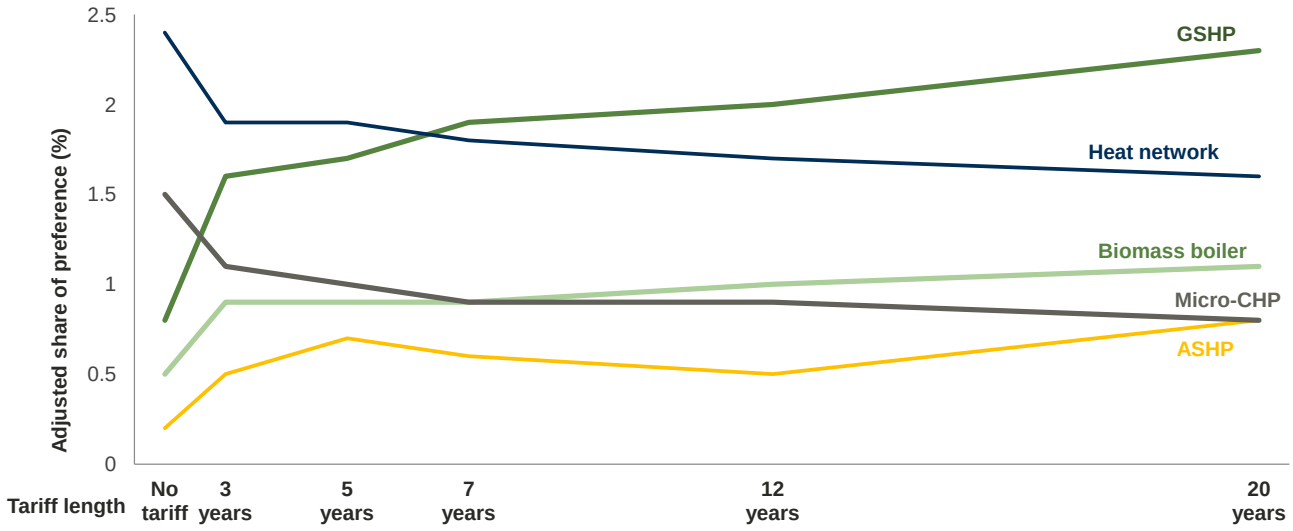
SUMMARY OF SIGNFICANT CHANGES UNDER 'RHI 2012 CONSULTATION' TARIFF LEVEL *(available for GSHP, ASHP or biomass boiler for 7 years)* *Figures based on off gas grid respondents only*			
	% opting for technology under base scenario (no financial incentive for any heating system)	% opting for technology under 'RHI 2012 consultation' tariff level	**Relative change in % share opting for technology under 'RHI 2012 consultation' tariff level**
GSHP	1.5%	2.2%	**+ 0.7%**
ASHP	1.2%	1.6%	**+ 0.4%**
Any renewable heating system	**4.2%**	**5.6%**	**+ 1.4%**

During the choice experiment the annual tariff amount varied between 0% and 135% of the RHI central tariff amount. Where an annual tariff was offered, the tariff length was varied between 3, 5, 7, 12 and 20 years, with yearly payment amounts discounted, so that while the overall subsidy offered increased with tariff length, this was equivalent in terms of present value (using the RHI discount rate of 7.5%). The model can, therefore, be used to analyse the impact on technology choices in a non-emergency of offering an equivalent RHI central tariff amount spread over any of these time periods.

Figure 54 confirms that an RHI central tariff, given over any time period, increased the appeal of all three renewable technologies compared to no tariff being available. It also reduced the proportion opting for the non-renewable technologies (gas condensing boiler, micro-CHP or heat network). This analysis also revealed that the period of time over which the tariff was paid did not substantially increase the level of interest in renewable systems. That said, an increased share opted for the GSHP and ASHP when the tariff length reached 20 years (this was not significant in case of biomass). Given the yearly payment amounts were discounted to be equivalent in terms of present value, this suggests that respondents were not making discounted cash flow calculations themselves. The positive reaction to the 20 year tariff suggests a psychological rather than economic trigger.

Figure 54: Non-emergency scenario preferences among all survey respondents when 'RHI 2012 consultation' tariff level available for renewable technologies

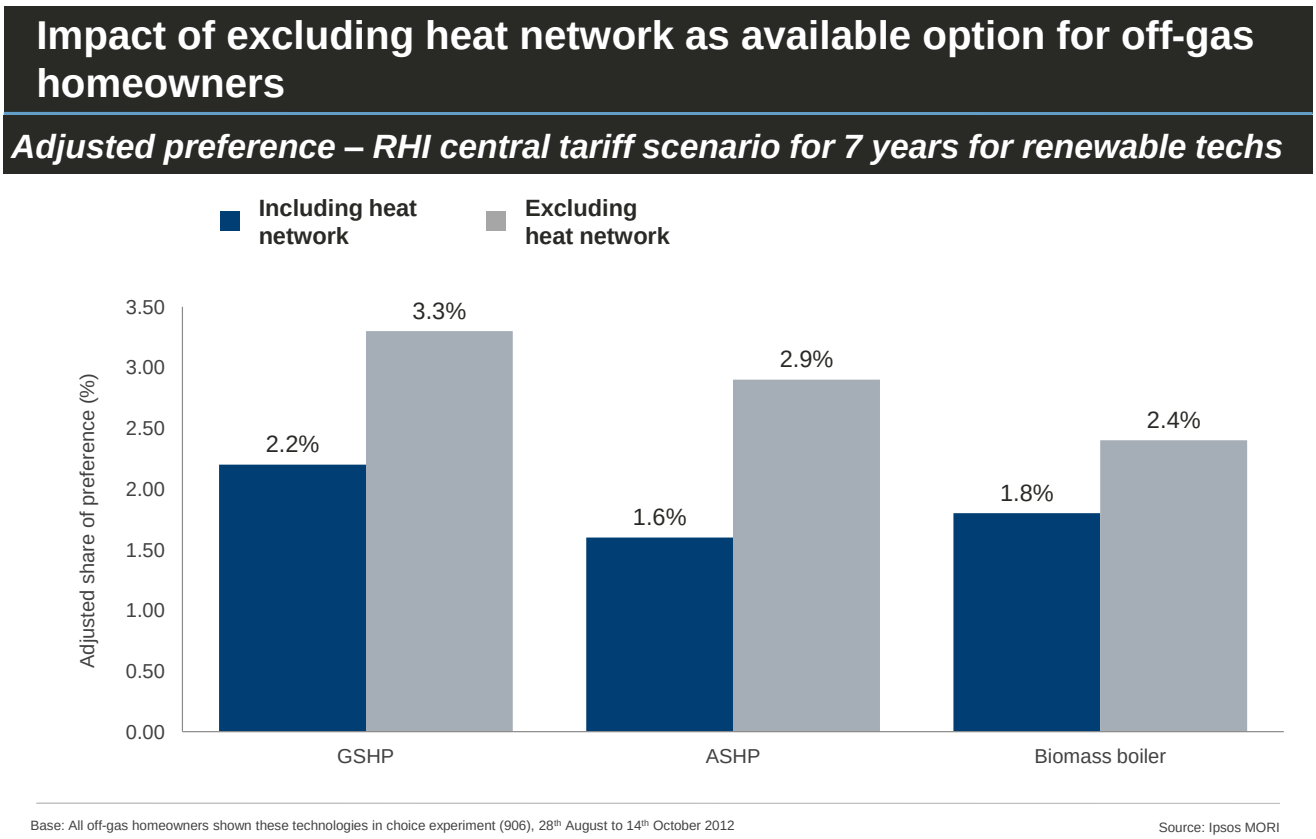




A major focus of the Renewable Heat Incentive is the off gas grid population. Figure 51 therefore presents the model results for an RHI central tariff amount spread over a varying number of years based on the trade-offs made by off gas grid respondents only. The results are shown for a non-emergency scenario where a heat network is offered as an option to these respondents and also a scenario where it is not. In reality it is unlikely that a heat network will be a viable option for many off gas grid communities.

It is evident that interest in the renewable options was significantly higher in the absence of a heat network. It is of particular interest to note that the share of off gas grid respondents opting for an ASHP increased significantly more when a heat network was not available than respondents opting for a biomass boiler or GSHP. Indeed, the proportion of off gas grid respondents opting for an ASHP was greater than those opting for a biomass boiler. This indicates that off gas grid homeowners who had selected the heat network were most likely to select the ASHP if their first choice was not available. It is likely that these homeowners were those living in smaller properties, and probably with limited private outside space, who had made a decision prior to the choice experiment that a GSHP or a biomass boiler would not be suitable for them. This assumption can be made on the basis of knowing that the technology type was the strongest factor driving choices between technologies, and much more so than the tariff amount or length.

Figure 55: Non-emergency scenario preferences among off gas grid survey respondents when grant available for renewable technologies



Preferences between more efficient heating technologies in a non-emergency if upfront grants were available for renewable options

The following discussion considers the impact of an upfront grant on the relative preferences between more efficient heating systems in a non-emergency. Five different levels of grant have been tested: zero grant, 10% of the installation cost, 65% of the installation cost, 100% of the installation cost and 130% of the installation cost. The installation costs and fuel bills are set at the current level for all the technologies and no annual tariff payment is available. The results are based on the adjusted preferences which take account of how likely homeowners are to actually install their selected technology, and which are down weighted to adjust for over claim.

In summary, the model shows that as the grant offered for renewable systems (GSHP, ASHP or biomass) increased the proportion of respondents opting for one of these also increased (although there was no additional uptake with a grant set to 130% of the installation cost compared to a 100% grant). An upfront grant had the largest impact on increasing the share of respondents opting for a GSHP (see Figure 56). For all grant levels, the order of preference was firstly the GSHP, then the biomass boiler and thirdly the ASHP. The workshops and follow-up interviews confirmed that the GSHP was the most popular of the three renewable technologies, however, its high installation cost was often raised as a major barrier. The choice experiment shows the availability of a grant can help overcome this barrier.

Figure 56: Non-emergency scenario preferences among all survey respondents when grant available for renewable technologies

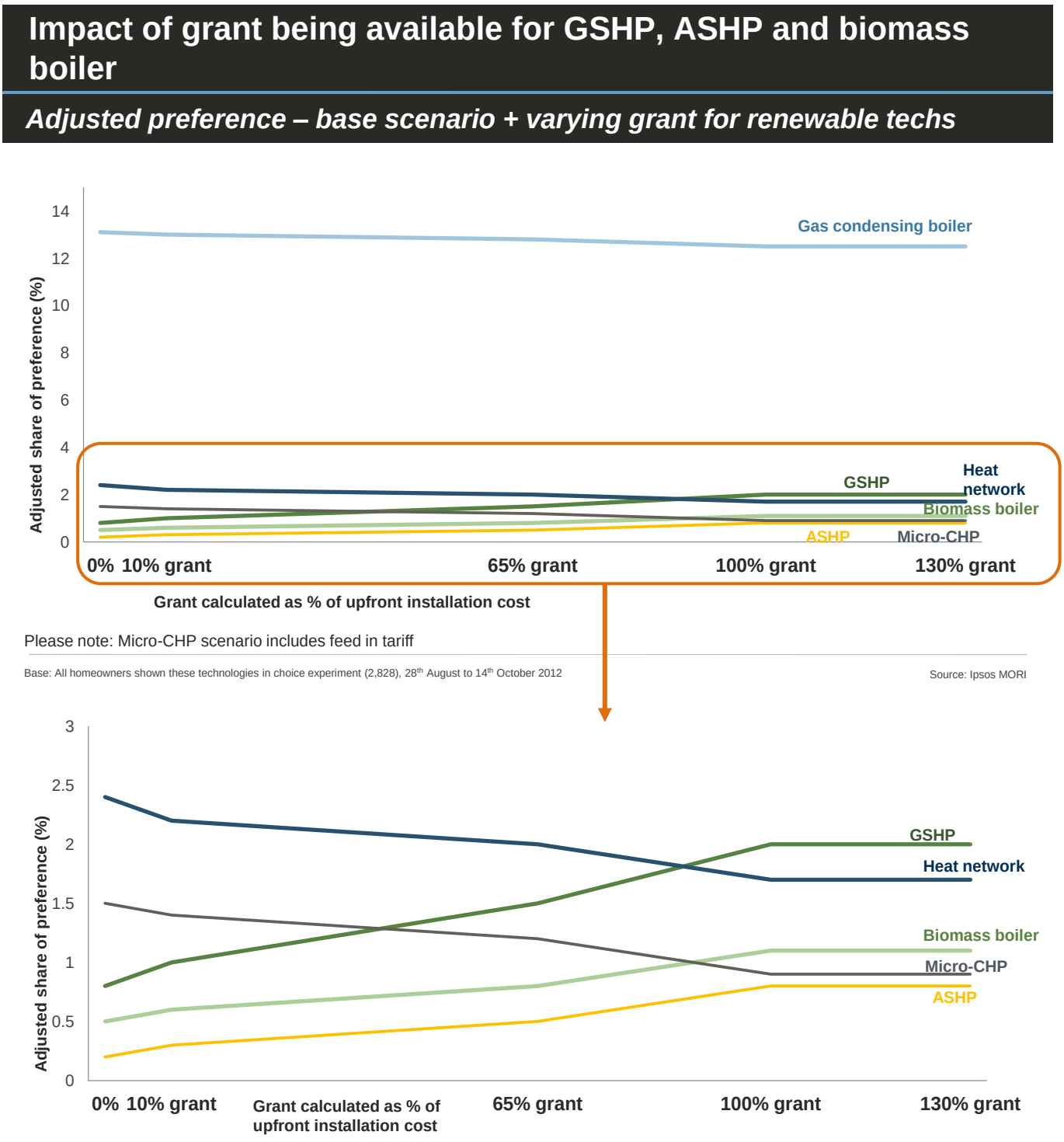
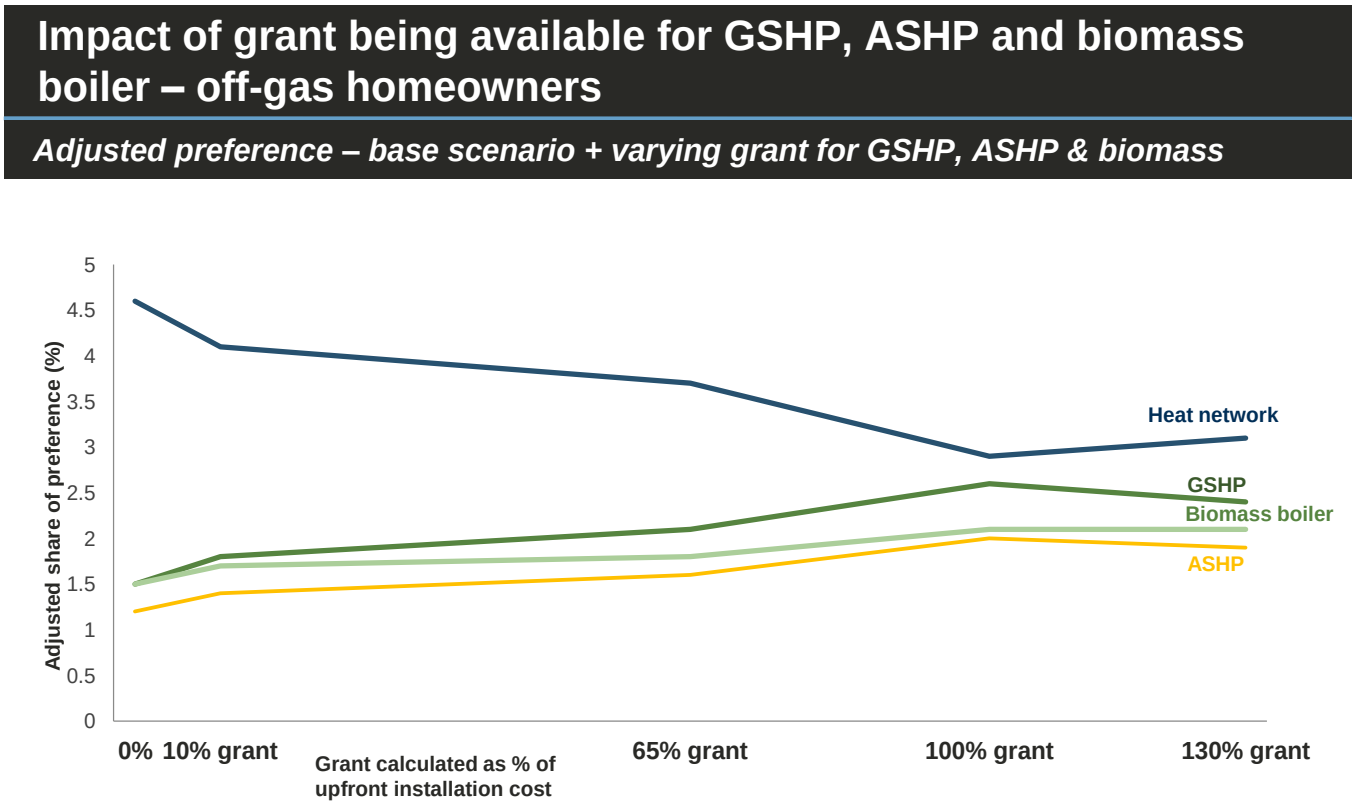


Figure 57: Impact of 100% upfront grant on appeal of renewable heating systems in non-emergency scenario

SUMMARY OF SIGNFICANT CHANGES UNDER 100% UPFRONT GRANT *(available for GSHP, ASHP or biomass boiler)* *Figures based on all respondents*			
	% opting for technology under base scenario (no financial incentive for any heating system)	% opting for technology with 100% upfront grant	**Relative change in % share opting for technology under 100% upfront grant**
GSHP	0.8%	2.0%	**+ 1.2%**
Biomass	0.5%	1.1%	**+ 0.6%**
ASHP	0.2%	0.8%	**+ 0.6%**
Any renewable heating system	**1.5%**	**3.9%**	**+ 2.4%**

Figure 58 shows the results among just off gas grid respondents. This shows the same order of preference between the technologies, and again the proportion opting for a renewable system increases as the grant increases (although no additional increase for a 130% grant compared to 100% grant).

Figure 58: Non-emergency scenario preferences among off gas grid survey respondents when grant available for renewable technologies



Please note: Micro-CHP scenario includes feed in tariff

Base: All homeowners shown these technologies in choice experiment (2,828), 28th August to 14th October 2012

Source: Ipsos MORI

Figure 59: Impact of 100% upfront grant on appeal of renewable heating systems for off gas grid homeowners in non-emergency scenario

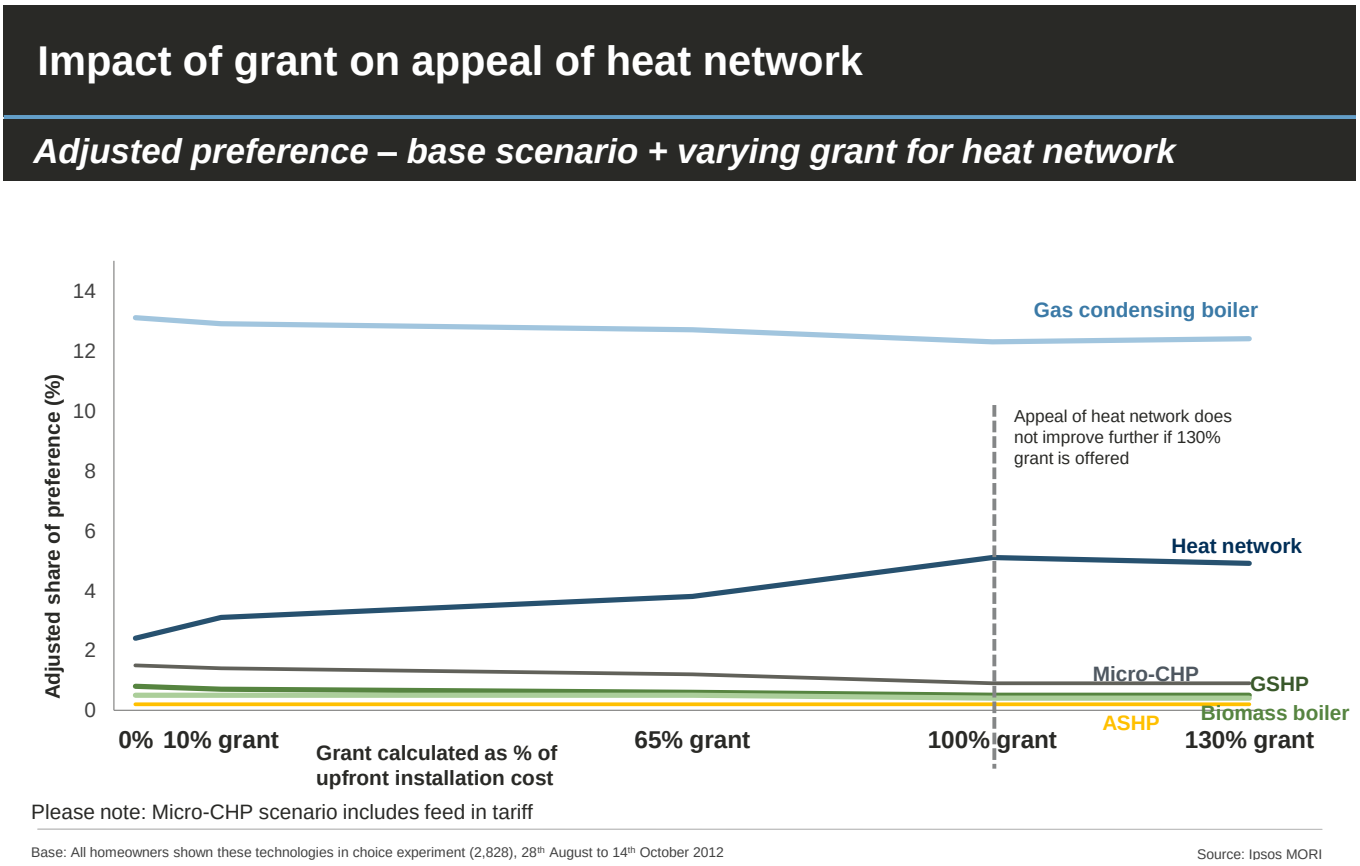
SUMMARY OF SIGNFICANT CHANGES UNDER 100% UPFRONT GRANT *(available for GSHP, ASHP or biomass boiler)* *Figures based on off gas grid respondents*			
	% opting for technology under base scenario (no financial incentive for any heating system)	% opting for technology with 100% upfront grant	**Relative change in % share opting for technology under 100% upfront grant**
GSHP	1.5%	2.6%	**+1.1%**
Biomass	1.5%	2.1%	**+0.6%**
ASHP	1.2%	2.0%	**+0.8%**
Any renewable heating system	**4.2%**	**6.7%**	**+2.5%**

The model also tested a scenario where a heat network was not an available option for off gas grid respondents. Similarly to the tariff analysis presented above (see Figure 55), this created a shift towards the ASHP which overtakes the biomass boiler in terms of share of preference.

The model has also been analysed to assess the impact of offering a financial grant for one of the more efficient heating systems but not all. Figure 60 shows that if an upfront grant is available for the heat network only, the proportion of homeowners opting for this technology increases as the grant increase. However, there is again no further increase between a 100% and 130% grant.

Figure 60 also shows that even a very high upfront grant which leaves the homeowner in credit following the installation, is unlikely to lead more homeowners to connect to a heat network than to install a gas condensing boiler in a non-emergency situation.

Figure 60: Non-emergency scenario preferences among all survey respondents when grant available for heat network



The same analysis has been done for an incentivised GSHP. This also clearly shows that the gas condensing boiler is by far the most popular option for homeowners in a non-emergency scenario and no level of grant is likely to encourage homeowners who prefer this technology to install a GSHP instead. However, an upfront grant which covers some of the installation cost of a GSHP can lead it to be a more popular choice than micro-CHP or a heat network.

Looking at these results among just off gas grid homeowners, the model results show that the GSHP equals the appeal of a heat network but does not fully overtake it. It also shows that off gas grid homeowners too do not become more likely to opt for this technology if the grant is set to 130% compared to 100%. These patterns are the same if the heat network is taken away as an option for the off gas grid respondents.

The appeal of a biomass boiler or an ASHP in a non-emergency can also be increased above that of other more efficient heating systems if an upfront grant was available for this system and not for any of the other technologies. Unlike the GSHP scenario shown above however, the share of homeowners likely to take up either of these technologies cannot overtake the likely uptake of a heat network.

Similarly to the GSHP scenarios, the level of uptake does not increase from a 100% to 130% upfront grant for both a biomass boiler and ASHP.

Overall comparison of effectiveness of a grant or tariff in encouraging uptake of more efficient heating systems

The table below summarises the proportion of survey respondents opting for any one of the three renewable technologies (GSHP, ASHP or biomass) during the choice experiment under three different scenarios[32]:

1) **Base scenario**: no financial incentives available for renewable heating systems;

2) **20 year RHI central tariff**: annual tariff payment made on GSHP, ASHP and biomass boiler for 20 years (set to 'RHI 2012 consultation' tariff level); and

3) **100% upfront grant**: one-off payment equivalent to installation cost made on GSHP, ASHP and biomass boiler. No tariff payment offered.

This shows that the provision of financial assistance, whether in the form of a tariff or a grant, led to a significant increase in the proportion of respondents opting for a renewable heating system compared to the base scenario. The difference between the figures for the tariff and the grant are not significant however and so it cannot be concluded that one form of finance is more or less effective than the other.

Figure 61: Summary of impact of financial assistance on appeal of renewable heating systems in non-emergency scenario

Scenario	**All survey respondents**	**Off gas grid survey respondents**	**Off gas grid survey respondents with heat network removed as option**	**Significance testing**	
	Proportion opting for one of renewable heating systems (adjusted shares)			*Significant*	*Not significant*
1) Base scenario (no financial incentives)	1.5%	4.2%	7.9%	↕ ↕	
2) 20 year RHI central tariff	4.2%	6.5%	9.1%	↕ ↕	↕
3) 100% upfront grant	3.9%	6.7%	9.2%	↕	↕

Looking at the results of the survey and choice experiment in the round, it is likely that one form of financial assistance is more suited to some homeowners than others. Analysis of the drivers of the trade-offs made in the choice experiment showed, for instance, that older respondents and those on lower household incomes were more influenced by the grant than younger, and more affluent respondents. Follow-up interview participants who had no, or limited, savings felt they placed greatest importance on

[32] In all three scenarios the micro-CHP costs included a feed-in-tariff payment.

the upfront grant as without this they would not be able to pay for the installation. In nearly all cases, these homeowners would prefer to receive the grant than take out a loan or mortgage to cover the upfront cost and then claim an annual tariff. In part, this may have reflected the lower level of familiarity with the tariff and as this becomes more well-known it is possible that these views could change.

Most follow-up interview participants would be happy to claim the one-off grant after the installation was complete and already paid for. Most said they would use savings to pay the upfront cost, and even those who were reluctant to use their savings for household improvement would do so in this situation as they knew they would be reclaiming the money. Some follow-up interview participants did stipulate that they would expect the repayment to be made within about three months of the installation.

> *"Yes I would [take the grant if paid in arrears], because if could claim the money back I would just pay the loan off straightaway"*
> Follow-up interview participant, on gas grid homeowner, rural, large property, female, resp. 12

Only a few follow-up interview participants would not be willing to accept a grant which was paid in arrears. Their reasons were either that they would not be able to afford the installation at all without this financial assistance, or because they were suspicious about whether the grant would be awarded. These suspicions were lessened if the grant was government-provided rather than through a commercial enterprise.

The annual tariff payment was the preferred form of financial incentive for follow-up interview participants with higher incomes and greater savings and who were willing to use this capital to pay the upfront cost. These homeowners placed greater priority on lowering their annual fuel and maintenance costs as the upfront outlay was not a problem for them.

> *"It doesn't matter so much about the installation cost because it's not that expensive really. The annual payment to the house really makes this free really doesn't it over the five years or so and they actually pay for the total installation costs over the five years anyway."*
> Follow-up interview participant, off gas grid homeowner, urban, small property, female, resp. 4

Although the annual payment was generally not well-understood by follow-up interview participants, either in terms of how it would work or who would pay it, most felt that potential processes which were described to them (e.g. through a half day energy assessor visit, a completed application form with proof of ID, residence and installation, and annual proof of usage) seemed fair and logical. Only one of the 18 follow-up interview participants objected to this on the grounds of it being too much hassle, but that was very much the exception to the general rule.

The workshops suggested there could be a communication challenge around policies to offer financial assistance to encourage the installation of renewable heat technologies. In many cases, workshop participants were sceptical that they would be eligible to receive the financial assistance as they assumed it would be means tested. This attitude persisted among some workshop participants even when they were told that the one-off grant, or tariff, would be available to everyone.

Preferences between more efficient heating options in a non-emergency if high gas price rise scenario

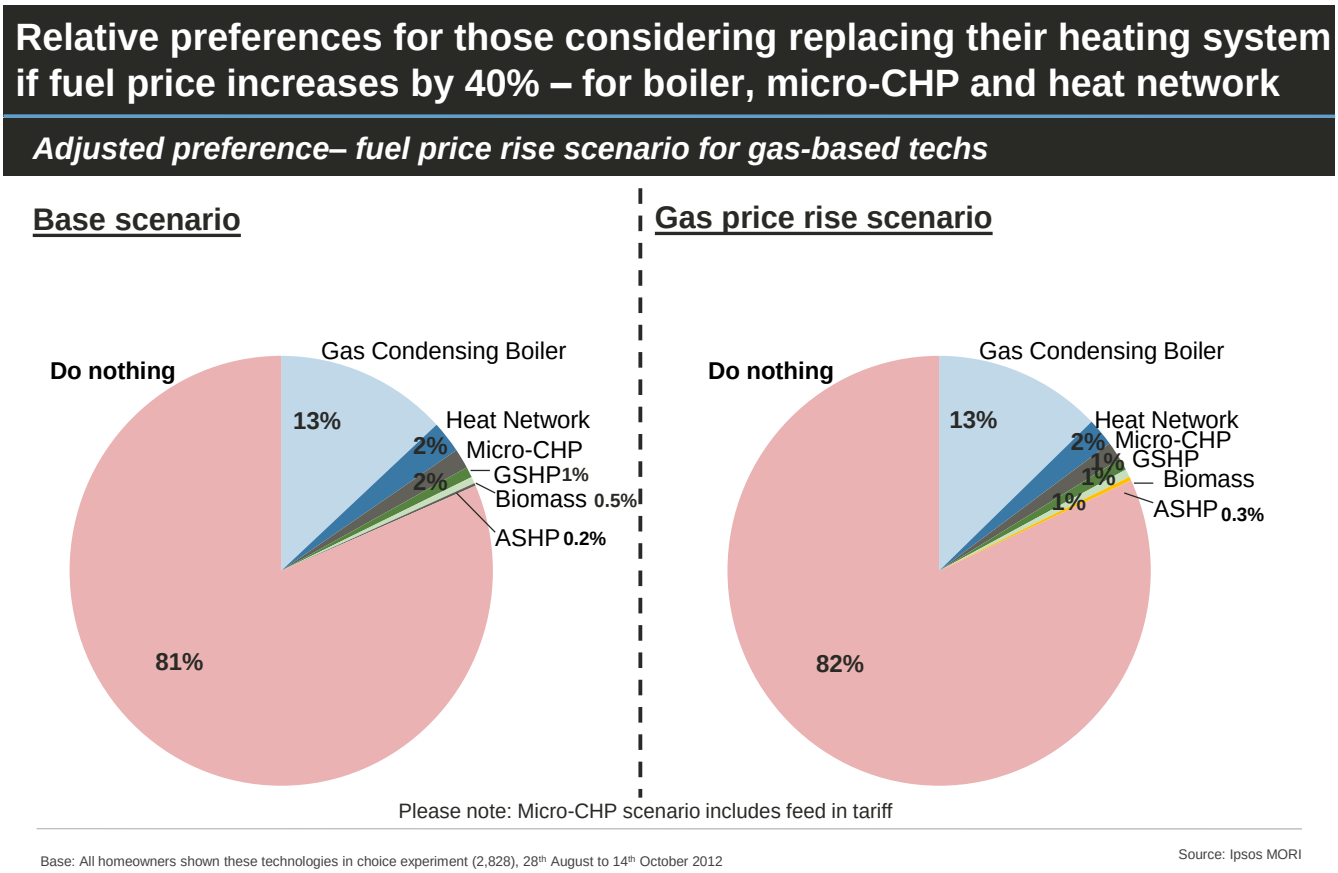
In all of the cost scenarios presented above, the gas condensing boiler was the most favoured heating system among on gas grid homeowners for a non-emergency replacement situation. Figure 62 shows that this is the case even in a scenario where the price of gas is far higher than 2012 rates and electricity

prices remain at current levels[33]. In this scenario the share of on gas grid homeowners opting for the gas condensing boiler stays the same as in the base scenario. This scenario was defined as follows:

- **Upfront installation cost:** current market price for all technologies;
- **Upfront grant:** not available for any technology;
- **Annual fuel cost:** price for gas set at 40% higher than 2012 rates – this affects annual fuel costs for gas condensing boiler, micro-CHP and heat network. All other fuels at current price; and
- **Annual tariff payment**: not available for any technology.

During the survey respondents stated the factors they felt were most important for a heating system. The most frequently selected factors were the system having low energy bills and being cheap to run. However, the results of the choice experiment, and the analysis on the key drivers of choice, suggests that fuel bills were not a key concern compared with homeowners' over-riding preference for the more familiar and trusted gas-based technology.

Figure 62: Non-emergency scenario preferences among all survey respondents in high gas price rise scenario

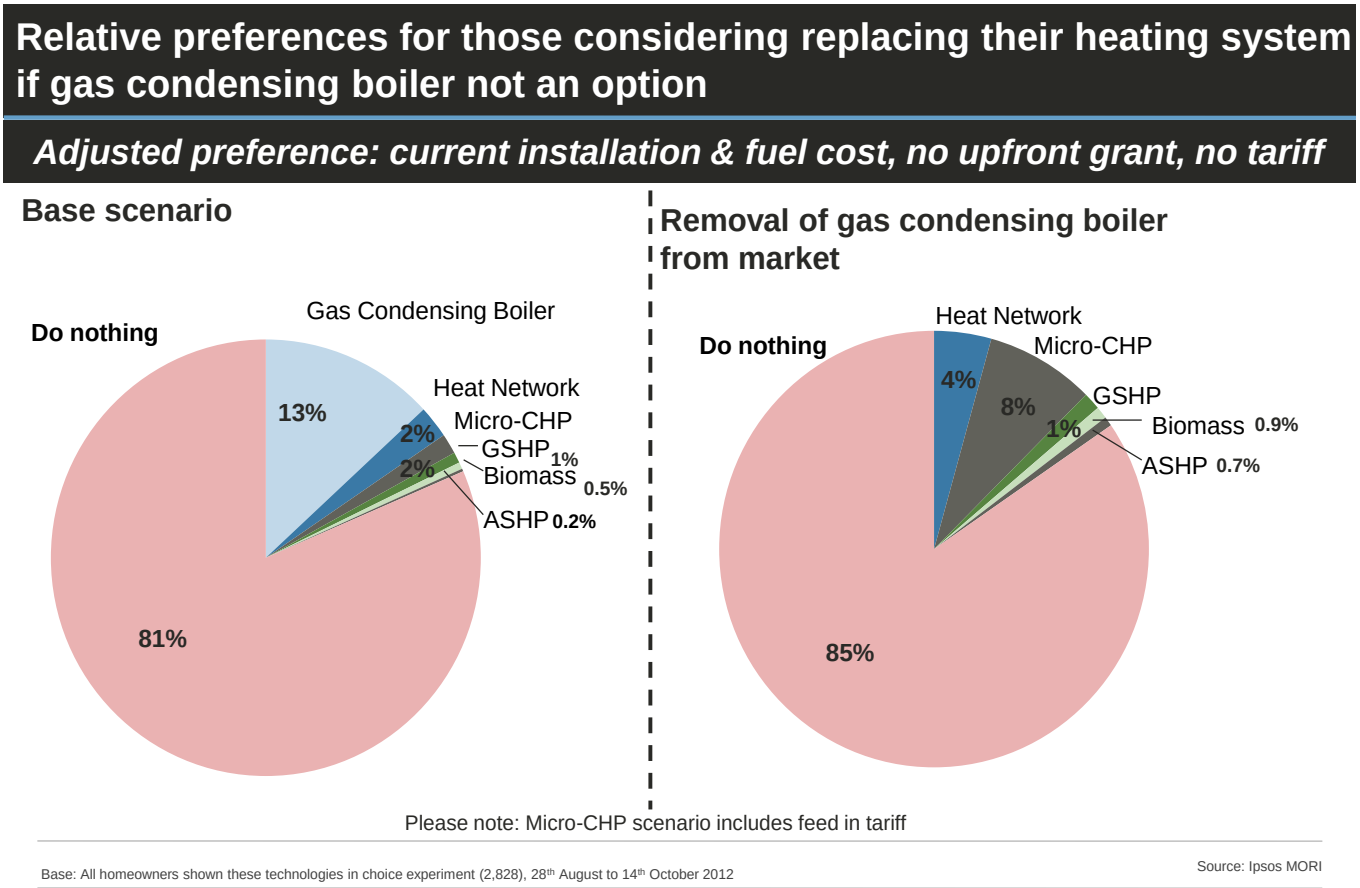


[33] It should be noted that in reality electricity prices are also likely to rise and so this scenario may overly penalise the financial attractiveness of gas-based technologies.

Preferences between more efficient heating options in non-emergency if gas condensing boiler was unavailable

In all of the non-emergency scenarios explored in this section the share of homeowners opting for micro-CHP has been very low compared to the proportion opting for the gas condensing boiler. However, micro-CHP was viewed fairly favourably during the main survey. The choice experiment model can be adjusted to remove the availability of one of the technologies from the 'market'. The results of this are shown in Figure 63. If the gas condensing boiler is removed the share of homeowners likely to take up micro-CHP in a non-emergency increases substantially (from 2% to 8% amongst those considering replacing in a non-emergency) This confirms that micro-CHP was a popular technology among the survey respondents, however, it is unlikely to be chosen ahead of a gas condensing boiler if that option is available.

Figure 63: Non-emergency scenario preferences among all survey respondents if gas condensing boiler not available



4.6.2 Preferences between more efficient heating technologies in an emergency situation

Following the choice experiment the survey respondents were asked how likely they would be to install each of the more efficient heating systems which were eligible for their property in an emergency situation. This was defined as where their existing heating system had completely broken down and they were unable to get any heating.

It is not possible to make a direct comparison between the survey results from the non-emergency and emergency scenarios. This is because the former were derived through trade-offs made in the choice experiment while the latter were stated in response to direct survey questions. However, it is evident that the order of preference between the more efficient technologies remained the same between these two

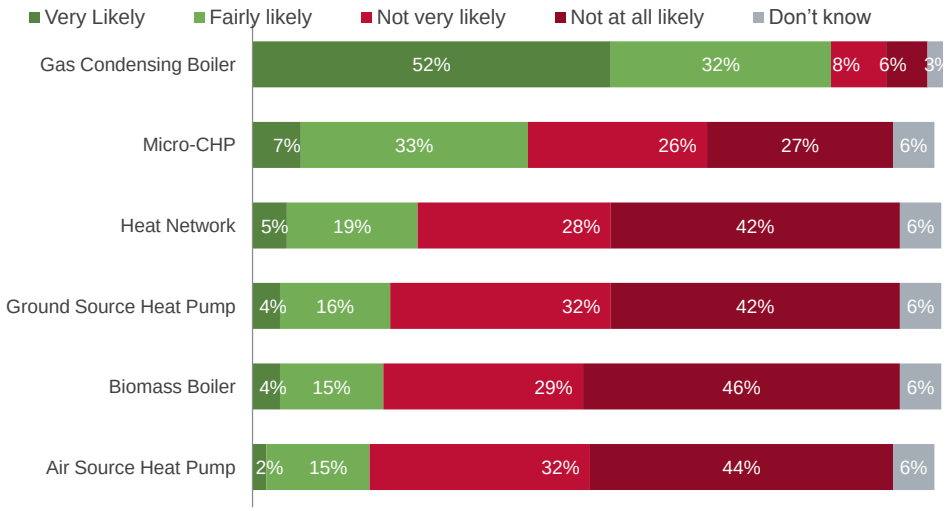
scenarios. The gas condensing boiler was the clear favourite for most on gas grid respondents in both an emergency and non-emergency, whilst the heat network and GSHP were the most appealing options for off gas grid respondents. The only change in the relative ranking of these technologies was the higher position of micro-CHP in an emergency compared to non-emergency scenario. However, this is not a fair comparison as analysis shows that micro-CHP would have been the most commonly selected technology in the choice experiment if the gas condensing boiler had been removed as an option. In the survey, which explored likely take up in an emergency, respondents were able to rate the appeal of the micro-CHP system separately to the gas condensing boiler (rather than in a trade-off) and so this reveals a far higher level of interest in it.

The survey responses given about the appeal of more efficient heating systems in an emergency situation are presented below.

Figure 64 shows that more than four in five on gas grid homeowners (84%) said they would be likely to install a gas condensing boiler in an emergency situation compared to 13% who said they would be unlikely. Only a minority of all survey respondents felt they would be likely to install any of the other heating systems in an emergency situation. This was highest amongst on gas grid homeowners for micro-CHP, which as discussed in section 4.3 was the second most positively received technology after a gas condensing boiler. Two in five on gas grid homeowners (41%) said they would be likely to install micro-CHP in this situation although this was still outweighed by the 53% who said they would be unlikely to. For all the other more efficient heating systems a far greater proportion of survey respondents said they would be unlikely to install it in an emergency than said they would be likely to. The difference was greatest for either an ASHP or biomass boiler with one in five (18%) saying they would be likely to, and three quarters (76%) saying they would be unlikely to install either of these. The results here closely correlate with those discussed in section 4.3 findings about the technology itself being the key driver of choice for most homeowners in the trade-off exercise.

Figure 64: Likelihood of survey respondents replacing their heating system with a more efficient heating system in an emergency situation (single response given)

I'd now like you to imagine that your current heating system has completely broken down and you are unable to get any heating. How likely, if at all, would you be to install each of the following heating systems in this situation?



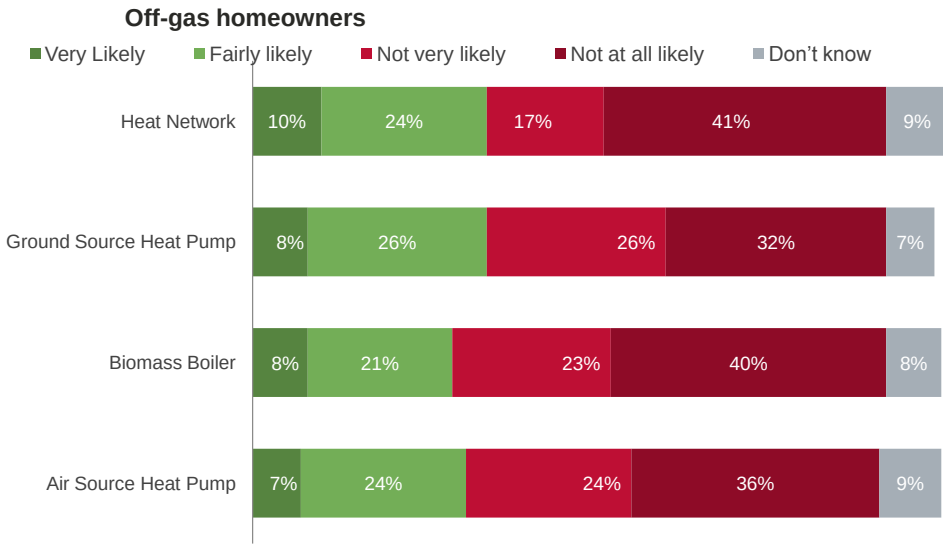
Base: *All respondents who live in a property eligible for this technology. For gas condensing boiler and micro-CHP this is only respondents connected to the gas grid. For ground source heat pump this is only respondents who own private outside space. Respondents were only asked this question for the heating systems they were shown in the choice experiment.*

Source: Ipsos MORI

Figure 65 shows the likelihood of off gas grid survey respondents replacing their heating system with a more efficient option in an emergency situation. Similarly to homeowners overall, the majority of off gas grid homeowners would be unlikely to install any of the more efficient heating systems if their own system had broken down and they were unable to get any heating. That said, a sizeable minority said they would be either fairly or very willing to do so in this situation. Figure 65 shows that off gas grid homeowners were equally likely to be willing to install a heat network and a GSHP (34% likely) with slightly fewer likely to install an ASHP or biomass boiler (31% and 29%). These findings closely reflect those for a non-emergency scenario where the heat network and GSHP were also the most popular options.

Figure 65: Likelihood of off gas grid survey respondents replacing their heating system with a more efficient heating system in an emergency situation (single response given)

I'd now like you to imagine that your current heating system has completely broken down and you are unable to get any heating. How likely, if at all, would you be to install each of the following heating systems in this situation?



Base: *All off-gas survey respondents who live in a property eligible for this technology. For ground source heat pump this is only respondents who own private outside space. Respondents were only asked this question for the heating systems they were shown in the choice experiment.*

Source: Ipsos MORI

The follow-up interviews provided further insight into the decision-making process during an emergency situation. Follow-up interview participants anticipated that they would be most likely to make a like-for-like replacement of their broken system. Homeowners felt they were generally unlikely to want to delay the replacement in such situations so would be inclined to go with what they know and what they would be certain would provide their heating and hot water needs. This suggests that raising levels of awareness of more efficient heating systems, and promoting them as a credible and reliable heating system, could be crucial to encouraging uptake of them during an emergency situation.

> *"Because I've got it [a gas condensing boiler] and I know it's good and I know it heats my house quickly, yes, and because when it does get warm in this house it stays warm...we don't really need to have the heating on for so long before this house is hot and that's what I love about it"*
> Follow-up interview participant, on gas grid homeowner, rural, large property, female, resp. 12

The '**Convertibles'** and '**Money savers'** were the groups of homeowners most likely to consider installing each of the more efficient heating systems in an emergency situation. For example, 35% and 33% respectively said they were likely to connect to a heat networks compared to 25% overall. '**Money savers'** were also significantly more likely than any other segment to say they would be likely to install a GSHP in an emergency situation (33% to 20% overall).

4.7 How appealing is solar thermal for homeowners?

Key observations 5 – Appeal of solar thermal

The appeal of solar thermal was tested separately to the main choice experiment. As it is a system which only provides hot water and not heating it is difficult to compare on a like-by-like basis with the other technologies.

- At current costs (without grant or tariff), the interest in solar thermal appeared low. Less than 1% would install it alongside their current heating system.
- The probability of respondents installing solar thermal increased significantly as the value of the upfront grant increased (up to 17% if a 100% upfront grant was offered).
- Any set-up of tariff payment also increased the proportion of respondents likely to install solar thermal alongside their current system – in particular if they were offered a higher annual payment for a short period i.e. over three, five or seven years as opposed to over 12 or 20 years (10.5% said they would install solar thermal with a three year tariff, compared to around 5% if it was spread over 12 or 20 years).
- Survey respondents were also asked to imagine they already had one of the more efficient heating systems installed in their home (if they did not already) and how likely they would be to install solar thermal alongside this system to provide them with hot water. Homeowners would be most likely to combine it with a gas condensing boiler, but the majority would be unlikely to install solar thermal alongside any type of more efficient heating system. No one of the renewable heating systems was felt to more or less suitable for combining with solar thermal than the others.

4.7.1 Reactions to solar thermal

Solar thermal was not included in the main choice experiment during either the workshops or the survey as it is a system which only provides hot water and not heating. This makes it difficult to compare on a like-by-like basis. Homeowners were therefore shown a factsheet for solar thermal and a set of costs separately to the other technologies. To test how the appeal of solar thermal changed as the installation cost, one-off grant and annual payment changed, five different cost scenarios were tested during the survey. Each homeowner was randomly assigned to one of the scenarios which each presented a different combination of upfront and ongoing costs. The factsheet and five cost scenarios are presented in Figure 66. These costs scenarios were chosen to reflect a range of grant and tariff levels.

Figure 66: Solar thermal factsheet and cost scenarios

Solar Thermal

Solar water heating panels on your roof absorb and retain heat from the sun. This generally provides around half of year-round hot water needs. The panels do not provide heat for your central heating.

Key Facts

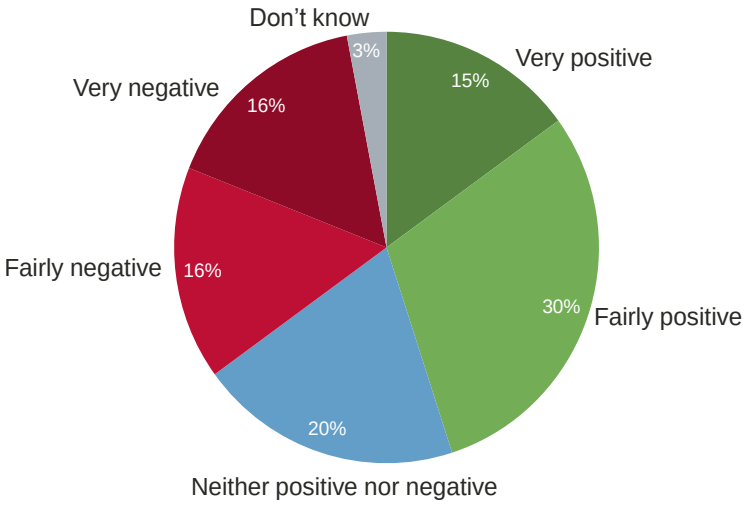
- Estimated to last 20 years.
- Typically takes 2 days to install.
- Uses renewable fuel source.
- No routine servicing or maintenance necessary.
- Space is needed for a hot water tank.

	Combination 1	Combination 2	Combination 3	Combination 4	Combination 5
Installation cost	Medium	V low	High	M Low	Medium
Grant	None	65% of cost	10% of cost	None	100% of cost
Annual saving on fuel bill	Medium	High	Low	Medium	Low
Tariff level	Medium	Low	High	Medium	None
Tariff length	Medium	Long	V short	Short	n/a

On balance, the survey respondents were more positive than negative about using a solar thermal system to heat their water. Approaching half (45%) said they felt positively about it, whilst a third (32%) said they felt negatively. This level of appeal is more favourable than the proportion of respondents saying they felt positively about other renewable heating systems (GSHP – 38%, ASHP – 28%, biomass boiler – 26% as shown in Figure 39). It is similar to the level of appeal of micro-CHP recorded by the survey (46% positive) but is substantially lower than for gas condensing boilers (80%). However, when making these comparisons it should be noted that the solar thermal system was assessed by respondents having seen factual and cost information whereas the other technologies were rated based only on the factual information contained in the factsheets and no cost information (Figure 38).

Figure 67: Appeal of solar thermal across all survey respondents (single response given)

Having seen this information, how positive or negative do you feel about using a solar thermal system to heat your water? Would you say you are…



Base: All respondents who own the roof on their property (2,521)

Base: All respondents who own the roof on their property and do not current have solar thermal panels installed (2,510)

Source: Ipsos MORI

Figure 68 shows how the appeal of solar thermal changed depending on the cost scenarios shown in Figure 66.

Figure 68: Appeal of solar thermal among survey respondents based on cost information shown (single response given)

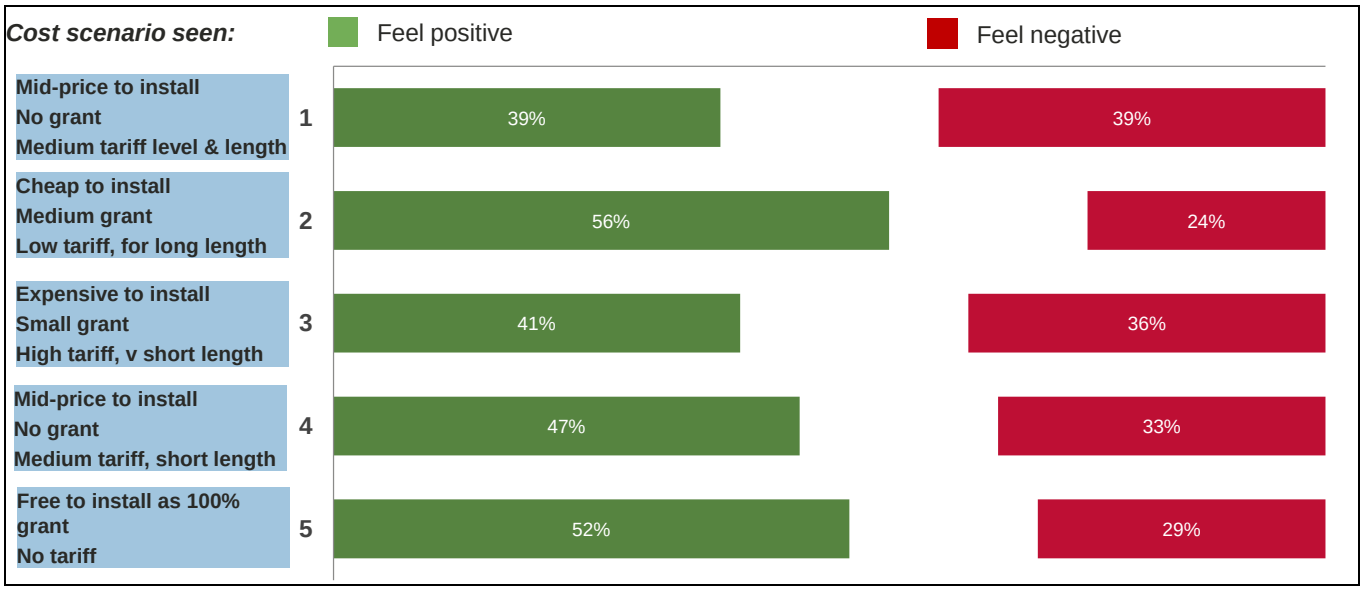


Figure 68 shows that homeowners were more likely to feel positively about solar thermal if they were shown an option with a low installation cost or high upfront grant (e.g. scenario 2 or 5). As discussed in section 4.5.1, the upfront grant was found to be a more influential driver of selections in the main choice experiment than an annual tariff. This is reflected here in the solar thermal results as the assumptions from the main experiment have been used to extrapolate between the solar thermal scenarios.

As discussed in section 4.2, solar thermal was spontaneously raised as a heating system of interest by some of the workshop participants. While many considered themselves to be familiar with this technology, it is possible that some were confusing it with solar PV. This also appeared to be the case amongst some follow-up interview participants, even though they had read the factsheet describing solar thermal. Based on the perceptions of workshop and follow-up interview participants, solar PV appears to have been both a hindrance and a help to the reputation of solar thermal. On the one hand it has increased awareness and trust in the technology. However, on the other hand, a few workshop participants had been put off exploring this option due to the hard-selling they had witnessed, or heard about, for solar PV. Many of the follow-up interview participants spoke about their assumption that solar panels would be very expensive to install and so it was a technology they instantly dismissed. This was especially true of follow-up interview participants who were only expecting to live in their current property for another two to three years. These homeowners believed the payback would not be quick enough to make solar thermal a worthwhile option. These views were still held by these homeowners after they had seen the solar thermal costs presented to them in the survey.

> *"Things like solar panels, unless you're going to live here for quite a long time, you're not really going to recoup your money back, well that's what I think anyway."*
> Follow-up interview participant, off gas grid homeowner, rural, large property, female, resp. 16

> *"The panels on your roof? No, it's an expensive job isn't it?"*
> Follow-up interview participant, on gas grid homeowner, suburban, small property, male, resp. 7

> *"[Not interested because...] I think because we have been told that they take a long time to pay for themselves."*
> Follow-up interview participant, off gas grid homeowner, rural, large property, female, resp. 18

Overall, homeowners in the qualitative workshops and follow-up interviews saw advantages and disadvantages to solar thermal which are set out below.

Solar thermal

- Most workshop and follow-up interview participants considered it to be a familiar and trusted technology which is reliable as it has been tried and tested.
- A solar thermal system was perceived by some workshop and follow-up interview participants to be easy and undisruptive to install, and simple to maintain.
- Some workshop participants had a perception that solar panels are relatively cheap to install (this view was given spontaneously prior to being shown any cost information).
- The use of a renewable fuel is appealing, primarily for cost reasons but also for a few as an environmentally friendly option.
- A few follow-up interview participants were positive about solar thermal being a useful addition to their heating system as it would offset some of their heating costs for hot water. These homeowners, correctly, assumed that in the summer their main heating system could be turned off entirely if they had solar thermal installed. A few also felt it would offer a cost-effective back-up system if their main heating system broke down ensuring they at least had hot water.

- A solar thermal system lost appeal for some workshop and follow-up interview participants when they discovered that it would provide 50% of hot water and no central heating. Most were keen to have a new system which provided 100% of heating and hot water as they considered a system which can do heating and hot water as easier, and more efficient, requiring less effort than managing multiple systems.
- Some workshop participants had an expectation that solar thermal technology would improve in future, and come down in cost, and that it is worth waiting rather than being among first to take it up.
- A few of the workshop participants, and many follow-up interview participants who would be unlikely to install solar thermal, were not keen on the aesthetics of the panels and considered them an eyesore. They were also concerned about damage to the roof.

  "They're not attractive…when you see them on houses they just don't look appealing. They might be very good but I wouldn't have one put on my house."
  On-gas grid homeowner, urban, large property, female, resp. 9 – follow-up interviews

- A few follow-up interview participants also noted that a hot water tank was needed, and this was taken as a negative due to the space it would occupy. It was also felt to be a step backwards for those who had a combination boiler.

  "I am not drawn to it, probably because you need to take up more space for the hot water tank which is something I really don't want to do because I am very limited for space in here anyway, especially with two children."
  Phase 3, on-grid homeowner, rural, large property, female, resp. 12

- Some workshop and follow-up interview participants queried the effectiveness of solar technology in the UK. This was particularly queried by follow-up interview participants without south facing roofs.
- A few workshop participants had questions about the ownership of the roof in apartment blocks and what planning permission would be required to install solar thermal. This led some homeowners to believe that solar thermal would be a better solution for a communal heat system rather than for individual households.

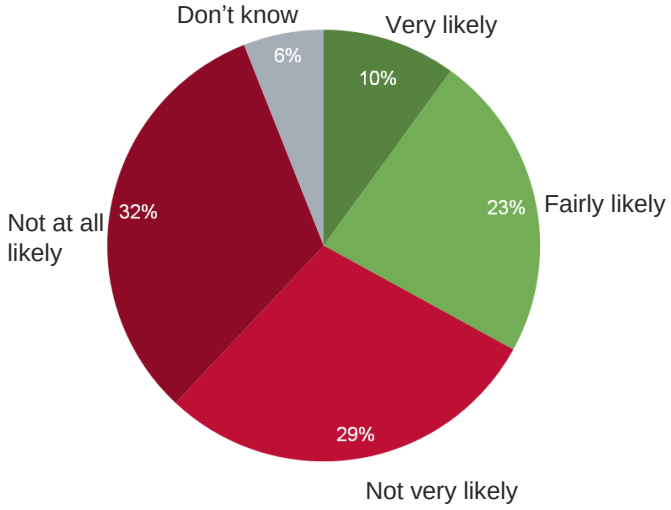
4.7.2 Likelihood of installing solar thermal

Likelihood of installing solar thermal alongside current system

The majority of homeowners involved in this research would be unlikely to install a solar thermal system alongside their current heating system. Three in five (61%) said this was unlikely compared to a third (32%) who felt it was likely. The reasons behind this response in the survey are likely to be those presented above which were given by workshop and interview participants.

Figure 69: Likelihood of survey respondents installing solar thermal alongside current heating system (single response given)

How likely, if at all, do you think you would be to install a solar thermal system if it was installed in addition to the heating system you currently use in your home?



Current heating system	Likely (%)	Unlikely (%)
Gas boiler - non-condensing, non-combi	29	66
Gas boiler - condensing, combi	36	59
Non-gas boiler (oil or LPG)	33	64
Electric heating	33	64

Base: Currently use - non-condensing, non-combi gas boiler(277), condensing combi gas boiler (676), non-gas boiler (605), electric heating (240)

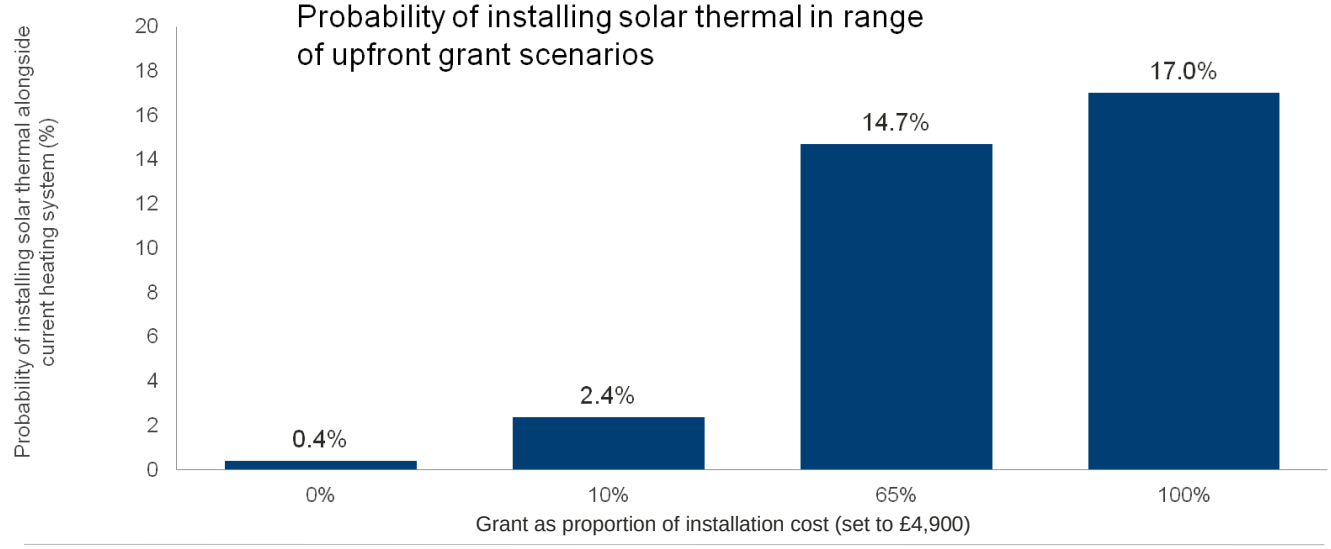
Base: All respondents who own the roof on their property and do not current have solar thermal panels installed (2,510)

Source: Ipsos MORI

The likelihood of homeowners installing a solar thermal system alongside their current heating system, if there was financial assistance available to do so (either a grant or a tariff), can also be modelled. The trade-offs made in the main choice experiment revealed how each homeowner reacted to different cost scenarios and which particular cost factor was the key driver of their choices (i.e. whether they were more driven by low installation costs or the provision of a tariff, for example). The solar thermal model assumes that a homeowner will have the same sensitivity to these different factors in relation to solar thermal. It can therefore be used to predict how homeowners would react to solar thermal cost scenarios they were not shown. Figure 70 shows that the probability of homeowners installing solar thermal increases significantly as the value of the upfront grant increases.

Figure 70: Likelihood of survey respondents installing solar thermal alongside current heating system in a range of upfront grant scenarios

How likely, if at all, do you think you would be to install a solar thermal system it if was installed in addition to the heating system you currently use in your home?



Base: All respondents who own the roof on their property and do not current have solar thermal panels installed (2,510)

Source: Ipsos MORI

It should be noted that extreme care should be taken when comparing the appeal of solar thermal in different grant scenarios (shown in Figure 70) and the appeal of the other more efficient heating technologies (shown in Figure 56). This is due to the different ways in which respondents were asked about these technologies[34]. Respondents were asked directly how likely they would be to install a solar thermal system or not, whereas they indicated their relative preference between a choice of two heating systems in the main experiment. Although the models have been developed on the same principles, ultimately one model is based on a decision where the homeowner needs to have at least some form of heating system, whereas the other is based on a discretionary decision. Comparisons should only be made where the full context of both choice situations are understood.

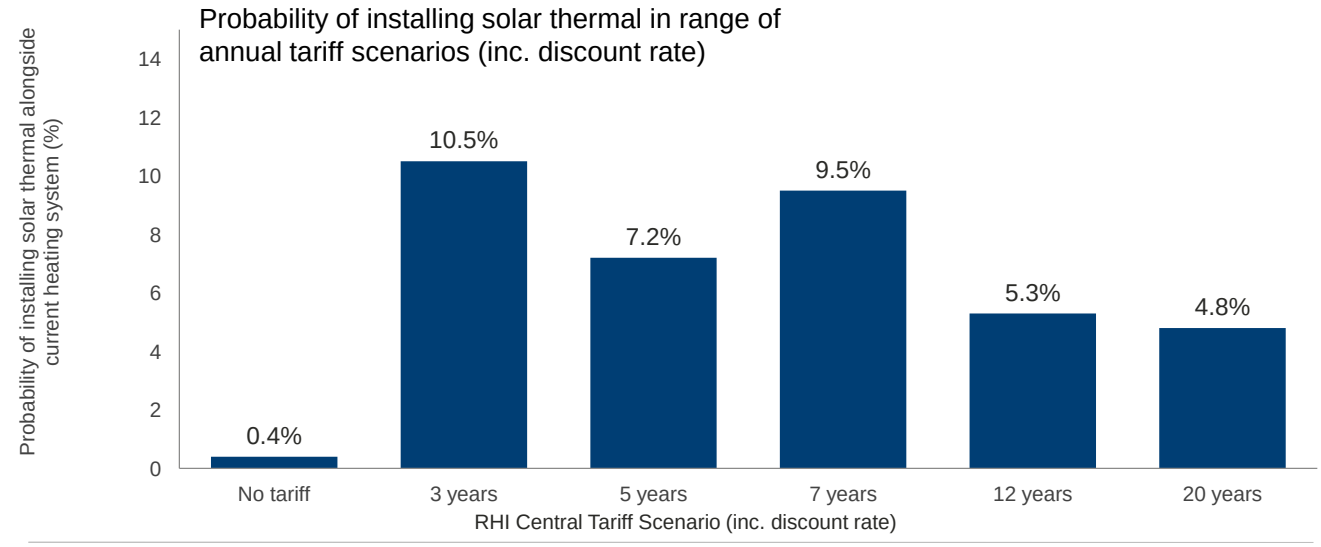
Figure 71 tests the impact of an annual tariff payment on the probability of homeowners installing solar thermal technology alongside their current heating system. It presents the results for an 'RHI 2012 consultation' tariff level paid over different time periods (including a discount rate)[35]. Figure 71 shows that any set-up of tariff payment would increase the proportion of homeowners likely to install solar thermal compared to the proportion likely to install if no financial help was available. However, it is clear that homeowners would be most likely to do so if they received a higher annual payment for a short period i.e. over three, five or seven years as opposed to over 12 or 20 years.

[34] A different design was necessary for solar thermal as it can only be used as a supplementary heating system given it only provides for hot water needs. The other heating systems tested in the main choice experiment can be used to meet a household's complete heating and hot water needs. Solar thermal could not therefore be included as a fair comparison within the main experiment.

[35] The results were produced using the following tariff scenarios: 3 years - £602, 5 years - £387, 7 years - £297, 12 years – £202, £20 years - £154. These were based on the 'RHI 2012 consultation' tariff level.

Figure 71: Likelihood of survey respondents installing solar thermal alongside current heating system in a range of annual tariff length scenarios

How likely, if at all, do you think you would be to install a solar thermal system it if was installed in addition to the heating system you currently use in your home?



Base: All respondents who own the roof on their property and do not current have solar thermal panels installed (2,510)

Source: Ipsos MORI

The main choice experiment which tested the appeal of other more efficient heating systems under different tariff scenarios found far less sensitivity to different tariff levels and lengths (see Figure 54). Whereas Figure 71 shows the set-up of the tariff had an impact on the appeal of solar thermal, the appeal of the other technologies was stable regardless of tariff length (aside from 20 years which showed some increase in appeal). This is likely to be because the technology type itself (rather than the costs associated with installing or running it) was the major driver of choices between the different options (see Figure 41). This meant that respondents were fairly insensitive to changes in the detail of the other attributes (e.g. tariff level and length) when considering the relative appeal of the other more efficient technologies. With solar thermal systems however, the choice is between taking action or not, and we would expect trade-offs to be in general more rational and focussed on speed of payback on investment.

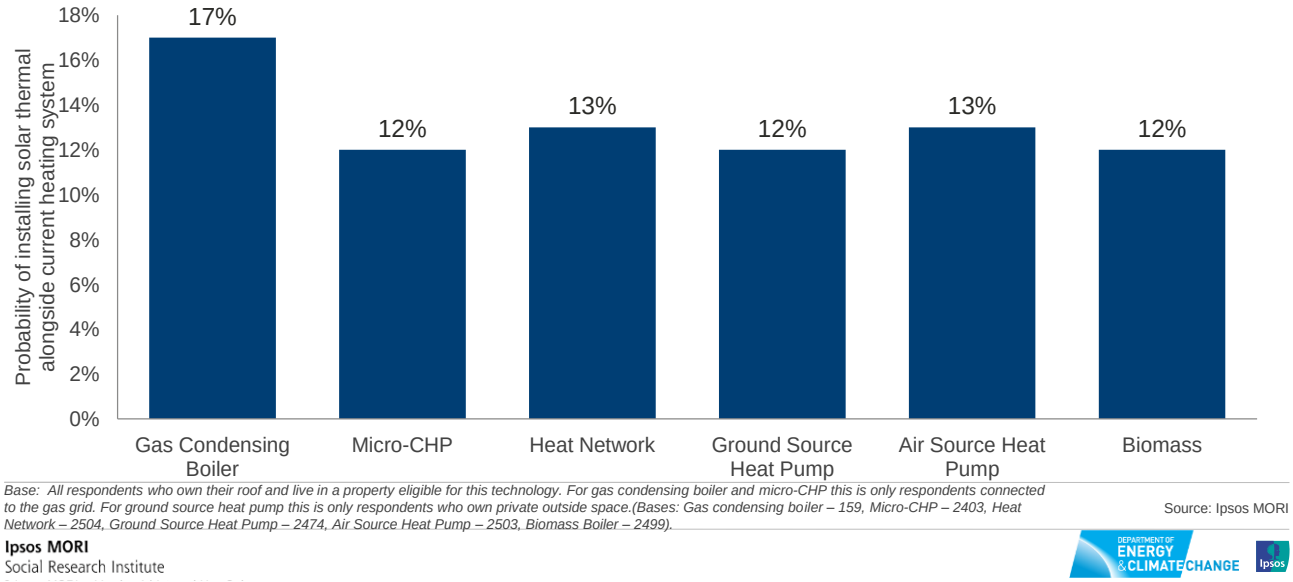
Likelihood of installing solar thermal alongside a more efficient heating system

Survey respondents were next asked to imagine that they already had one of the more efficient heating systems installed in their home. They were then asked how likely they would be to install solar thermal alongside this system to provide them with hot water. Please note that respondents who already had a gas condensing boiler or micro-CHP installed were excluded from this question. Respondents were also only asked to imagine they had installed one of the technologies which would be appropriate for their home i.e. off gas grid respondents were not asked to imagine they had a gas based heating system. The probabilities shown in Figure 71 are based on the range of different versions of the solar thermal proposition that were shown. They are not based on a particular combination of cost, grant, tariff etc.

Figure 72 shows that the majority of survey respondents would be unlikely to install a solar thermal system alongside any type of more efficient heating system, but most likely to combine solar thermal with a gas condensing boiler. It also shows that no one of the other more efficient heating systems was felt to be more or less suitable for combining with solar thermal than the others. A comparison of Figure 69 and Figure 72 shows that respondents were more likely to say they would consider installing solar thermal alongside their current heating system than any of the more efficient systems tested here.

Figure 72: Likelihood of survey respondents installing solar thermal alongside another more efficient heating system

I'd now like you to imagine that you already have one of the new heating systems we've discussed installed in your home. How likely, if at all, do you think you would be to install a solar thermal system to provide you with hot water alongside this system?



Base: All respondents who own their roof and live in a property eligible for this technology. For gas condensing boiler and micro-CHP this is only respondents connected to the gas grid. For ground source heat pump this is only respondents who own private outside space.(Bases: Gas condensing boiler – 159, Micro-CHP – 2403, Heat Network – 2504, Ground Source Heat Pump – 2474, Air Source Heat Pump – 2503, Biomass Boiler – 2499).

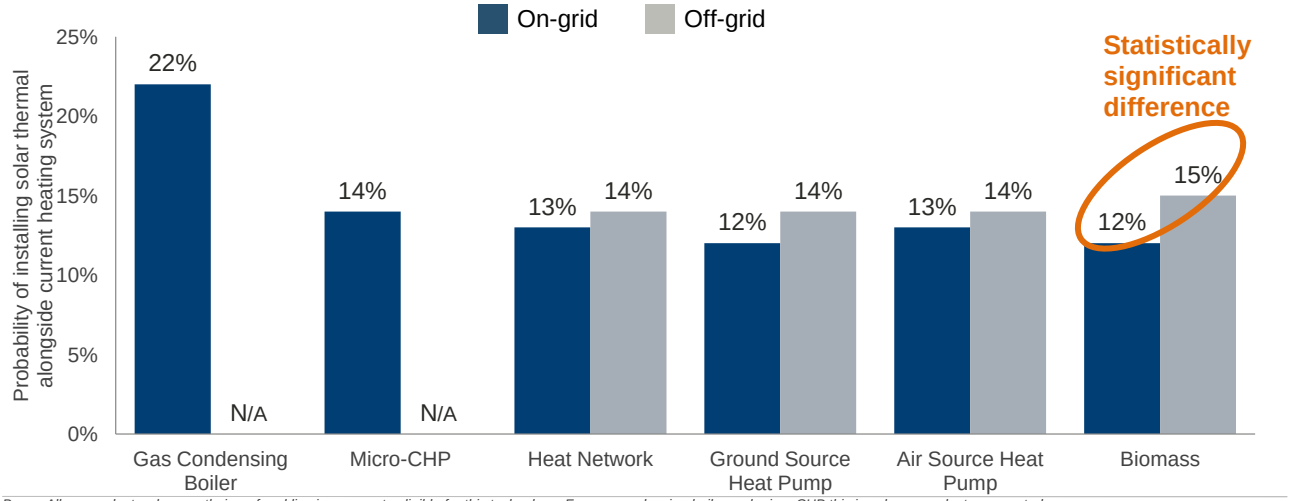
Source: Ipsos MORI

Ipsos MORI
Social Research Institute

Figure 73 suggests that off gas grid respondents were slightly more likely to consider installing solar thermal alongside another more efficient heating system compared with on gas grid respondents. However, the difference is only statistically significant for a biomass boiler.

Figure 73: Likelihood of survey respondents installing solar thermal alongside another more efficient heating system

I'd now like you to imagine that you already have one of the new heating systems we've discussed installed in your home. How likely, if at all, do you think you would be to install a solar thermal system to provide you with hot water alongside this system?



Base: All respondents who own their roof and live in a property eligible for this technology. For gas condensing boiler and micro-CHP this is only respondents connected to the gas grid. For ground source heat pump this is only respondents who own private outside space.(Bases: Gas condensing boiler – 159, Micro-CHP – 2403, Heat Network – 2504, Ground Source Heat Pump – 2474, Air Source Heat Pump – 2503, Biomass Boiler – 2499).

Source: Ipsos MORI

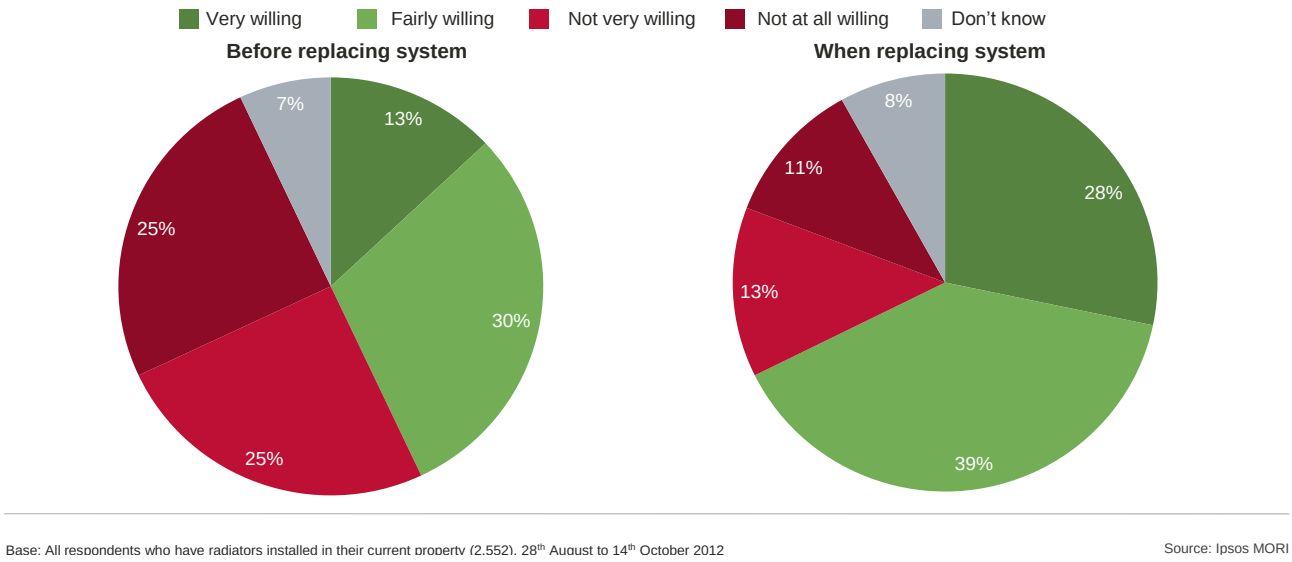
Ipsos MORI
Social Research Institute

4.7.3 Likelihood of replacing radiator system

A majority of survey respondents (67%) would be willing to install new upgraded radiators at the same time as replacing their heating system. The survey question informed these homeowners that taking such a step could improve the performance of their heating system and potentially reduce their fuel bills. However, a quarter (25%) said they would not be willing to do so. Fewer were willing to do this at a point before they were replacing their existing heating system (43% willing compared to 50% not willing).

Figure 74: Willingness to upgrade radiators (single response given)

Installing new upgraded radiators can improve the performance of your heating system, and potentially reduce your fuel bills. How willing, if at all, would you be to replace your existing radiators to get the best out of your heating system in the following circumstances?



Base: All respondents who have radiators installed in their current property (2,552), 28th August to 14th October 2012

Source: Ipsos MORI

During the 18 follow-up interviews homeowners explained the reasons they would be willing to replace their radiators:

- Some homeowners had replaced their radiators in the past and they had all experienced a warmer home as a result. These homeowners all said they would be willing to do it again as they found it credible that this could help improve the performance of their heating system and reduce their fuel bills.
- It was also felt to be credible that they would experience positive benefits from upgrading their radiators amongst most of those who had not replaced their radiators in the past.

  "Well I know from experience, we've had to replace radiators before and have had a better outcome with the heating. I know we had a radiator in the room I'm sitting in now and it was quite an old one and when we replaced it - what a difference!"
  Follow-up interview participant, off gas grid homeowner, urban, small property, female, resp. 4

Among the few follow-up interview participants who had said in the survey that they would not be willing to replace their radiators, most revealed that this would be conditional on how large they were and how they looked. These few follow-up interview participants would generally only be willing to replace their radiators if they were smaller and looked less intrusive than their current radiators. The rest of these homeowners had said they would not be willing to change their radiators due to a perception that this would involve a great deal of disruption.

Follow-up interview participants who had said in the survey that they would be willing to upgrade their radiators when they were replacing their heating system, but not before, explained this was because they would want to have all the installation carried out at the same time. This was to reduce the overall disruption of the upgrade.

4.8 How would homeowners finance a new heating system?

Key observations 6 – Financing new heating systems

- Many homeowners would opt to pay for a new heating system through their savings (47%), although a significant proportion did not have savings (14%) and so would need to rely on a range of finance mechanisms to cover the upfront cost. The most popular would be a mortgage (9%) or personal loan not secured to property (8%). However, the workshops and follow-up interviews revealed that most homeowners who felt they had insufficient savings would only take out finance if they were in an emergency situation as a last resort.

- During the follow-up interviews, more homeowners said they would be willing to take out finance on a short term loan (including some who have savings) if a one-off grant was available which was paid to them soon after installation of the new heating system. However, reassurances would need to be given about how guaranteed this grant was and how soon after the installation it would be paid. Homeowners were generally not willing to take out finance, if only a tariff payment was available, as this would not help them cover the upfront cost which was the major barrier to many being able to consider installing one of these technologies.

- When asked to consider a situation where they had agreed to the installation of a more efficient heating system, most homeowners (57%) were willing to remove their existing system or to install energy efficiency measures (70%) as a condition of receiving financial assistance. During the workshops and follow-up interviews most homeowners agreed with the principle of installing energy efficiency measures before replacing their heating system. However, this principle had not been put into practise in the past. There appeared to be little deliberate sequencing of household improvements in the past, with these mostly driven by the availability of discounted measures or the package of measures which was installed alongside the heating system.

4.8.1 How would homeowners expect to pay the installation cost?

More than two in five (44%) survey respondents had savings which they would use to pay for household improvements. However, a further one in five (21%) had savings but would not use them for this purpose. When asked explicitly how they would pay for their next heating system, nearly half (47%) said through savings and money put aside.

A significant minority (14%) of survey respondents said they did not have any savings, and when asked how they would pay for a new heating system one in ten (10%) said they would not be able to pay for it. A further one in five (19%) said they did not know how they would pay to replace their heating system.

Survey respondents classified as low income and vulnerable[36] were particularly likely to say they did not have any savings (30% compared to 21% overall) and that they did not know how they would pay for a new heating system (20% compared to 10% overall)

[36] These homeowners declared their household to have a total annual income before tax of less than £16,000 and to fall into one of the following categories: to have children under the age of 16 living in the household and/or receive child tax credits; to have someone aged 65 or older living in the household and/or receiving pension credit; or to have someone in the household living with a long-term illness, disability or infirmity and/or receiving work tax credits or Disability Living Allowance.

The most common financial mechanisms homeowners would use to pay for a heating system were either a mortgage or mortgage extension (9%) or a personal loan which was not secured to the property (8%).

Figure 75: How survey respondents would finance a new heating system (a) single response given, b) multiple responses given)

a) ***Please tell me which of the following best describes the savings that you have.***

b) ***When you next replace your heating system, which of the following payment options would you consider to pay for the total installation cost?***

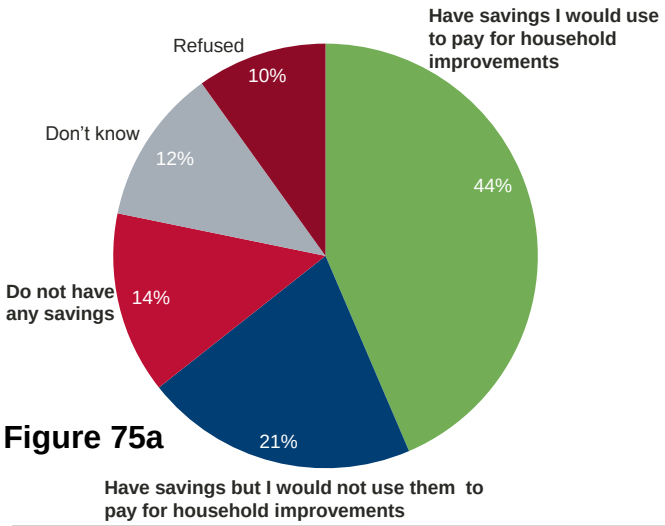


Figure 75a

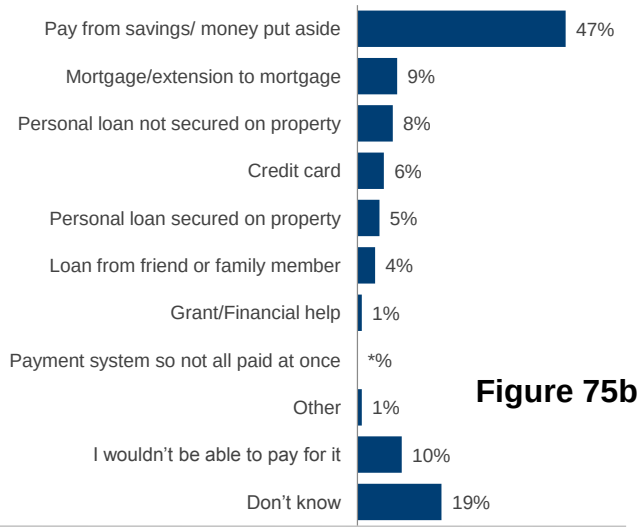


Figure 75b

Base: All respondents who do not currently heat their home through a more efficient heating system (2,848), 28th August to 14th October 2012

Source: Ipsos MORI

Most of the follow-up interview participants would pay the installation cost for a new heating system through savings. This was true of all follow-up interview participants aged 55 and over, but was also shared by some younger homeowners who shared this principle of not paying on credit. Some of the follow-up interview participants aged under 55 were prepared to take out a loan if they did not have enough savings to cover the initial installation costs. They would be most willing to do this if they knew they were receiving a one-off grant to help cover some of the cost soon after installing.

Some of the workshop participants spontaneously said they would look to the government to provide financial assistance to help them install a new heating system. This was not offered as a response at the survey although 1% did mention it to the interviewer. Many of the workshop participants expected this to be available if a more efficient heating system was being installed. There was reluctance across some workshop participants to take out a commercial bank loan due to an expectation of having high interest payments.

> *"The government would need to give you a loan to encourage you to do it."*
> Workshop participant, Scotland, on gas grid, male

> *"You don't want to get a bank loan or something like that. Because that seems to be... you know, you're paying all that money, plus you're paying all the interest and what have you."*
> Workshop participant, off gas grid homeowner, rural, small property, female

4.8.2 Willingness to remove current heating system in advance of installing new system

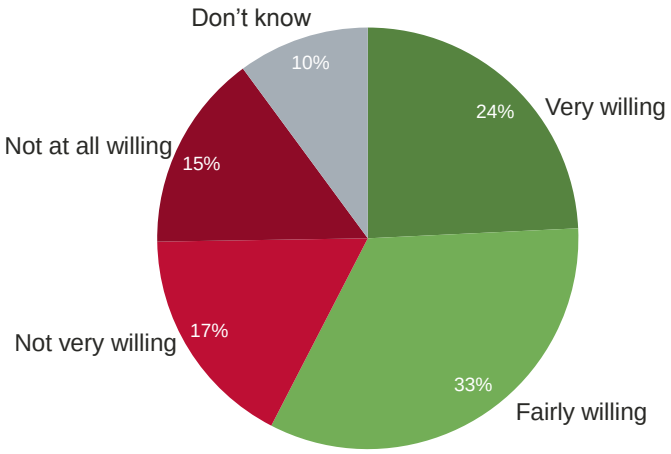
Approaching three in five (57%) survey respondents would be willing to remove their current heating system when they installed a new heating system in order to receive financial assistance to install and run the new system. However, a third (32%) would not be willing to do this (17% not very willing and 15% not at all willing).

The workshops and follow-up interviews provided some evidence to suggest that the survey results may include some degree of over claim about homeowners' willingness to remove an existing system however. This is discussed further Figure 76.

Figure 76: Willingness to replace their existing heating system in order to receive financial assistance to install a more efficient heating system

In some circumstances, householders could also be required to remove their current heating system when they install a new heating system in order to receive financial assistance.

How willing, if at all, would you be to remove your current heating system in order to receive financial assistance to install and run the new heating system?



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848) ,28th August to 14th October 2012

Source: Ipsos MORI

Widespread agreement with this principle was also uncovered in the workshops. However, the discussion around this issue revealed that the support was based on an assumption that any new heating system would meet all a household's heating and hot water needs. Homeowners were not considering the need to have a supplementary or back-up system and assumed that their existing system would be removed when the new system was installed. It is likely that similar assumptions were being made by survey respondents and so the results presented in Figure 76 may over-estimate the support for this policy.

While this could suggest confidence in the reliability of more efficient heating systems, it is more likely that it reflects an assumption that the more efficient heating system would only be installed once the homeowner was convinced it met the complete needs of their household. While generally homeowners did not question the reliability of these systems in the context of this question, some had raised fears about how well certain systems would work when discussing the appeal of the technologies. For example, the credibility of ASHP technology in winter months was frequently questioned (see section 4.3). Several follow-up interview participants made the point that they would need to know more about them before taking the step of removing their existing system.

"[For GSHP] I don't know whether you'd still need to have your boiler as back up, I don't know about that."
Follow-up interview participant, off gas grid homeowner, rural, large property, female, resp. 18

In addition, many workshop and follow-up interview participants, particularly in urban areas and smaller properties, were very concerned about space and so they would be very unlikely to want to have two systems in their homes.

The follow-up interviews suggested that some of the survey respondents saying they would be unwilling to remove their existing system may have said so as they interpreted this to be on the onus of the householder themselves. A few of the follow-up interview participants who interpreted it in this way felt it would be too much hassle.

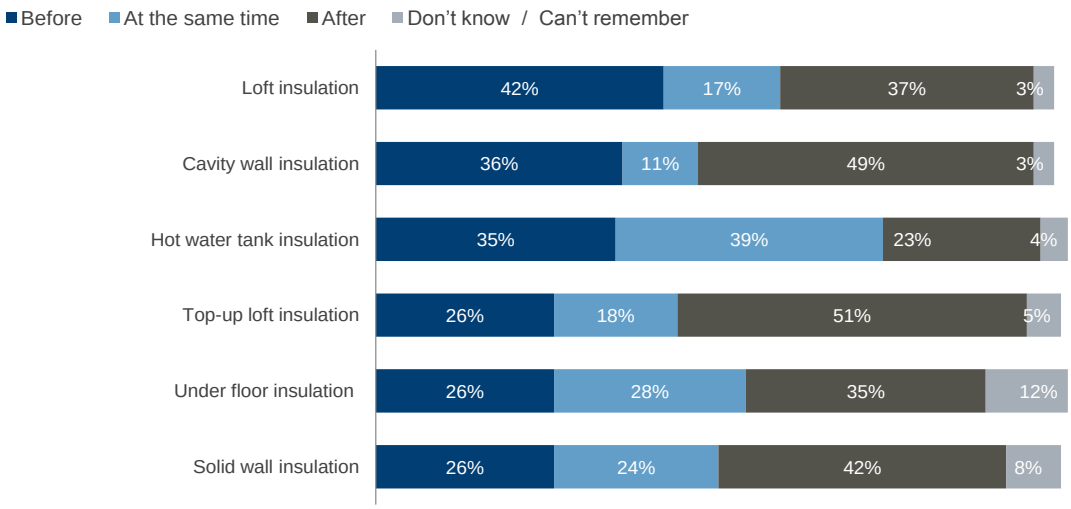
4.8.3 Willingness to install energy efficiency measures in advance of replacing heating system

Previous history of energy efficiency sequencing

Survey respondents who had replaced their heating system in the past, and had installed energy efficiency measures since moving into their current property, were asked the order in which they made these improvements. Figure 77 shows that the sequencing of energy efficiency improvements was not closely related to the time at which the heating system was replaced. For instance, while two in five (42%) installed loft installation before they replaced their heating system, a similar proportion (37%) did so afterwards.

Figure 77: Sequencing of insulation among survey respondents who have replaced their heating system

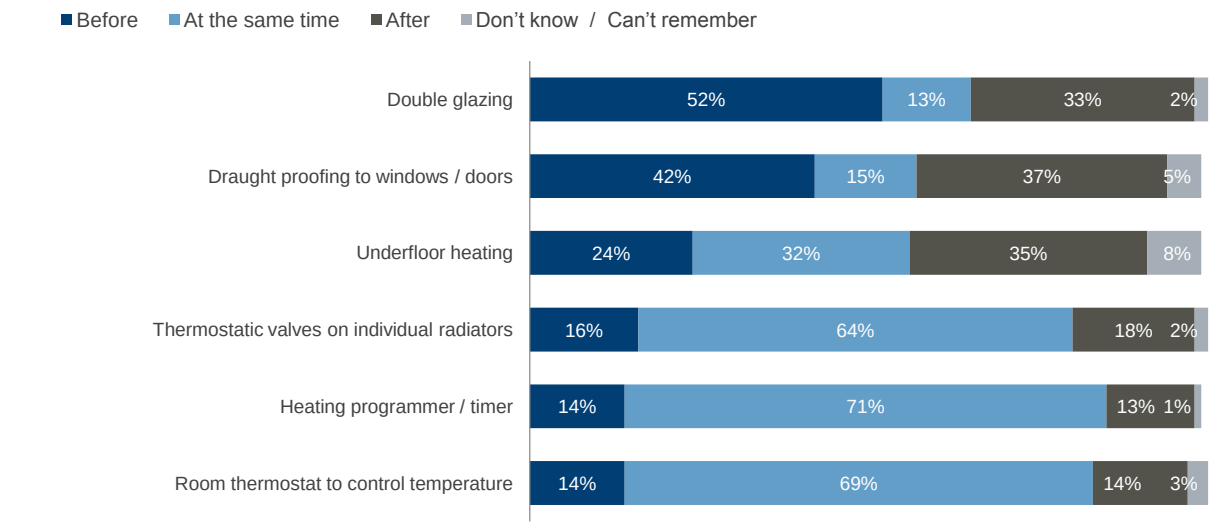
Did you install …before, after or at the same time as you changed your heating system?



Base: All respondents have replaced their heating system in the past and have installed the energy efficiency measures who since moving into their property, (Bases: Loft Insulation – 984, Cavity Wall Insulation – 508, Hot water tank insulation – 603, Top-up loft insulation – 910, Underfloor heating insulation – 118, Soil wall insulation – 104,)MI 28th August to 14th October 2012

Source: Ipsos MORI

Did you install … before, after or at the same time as you changed your heating system?



Base: All respondents have replaced their heating system in the past and have installed the energy efficiency measures who since moving into their property, (Bases: Double Glazing – 1099, Draught proofing to windows and door – 667, Underfloor heating - 101, Thermostatic valves on individual radiators – 1036, Heating programmer / timer – 1107, Room thermostat to control temperature – 890) 28th August to 14th October 2012

Source: Ipsos MORI

Ipsos MORI
Social Research Institute

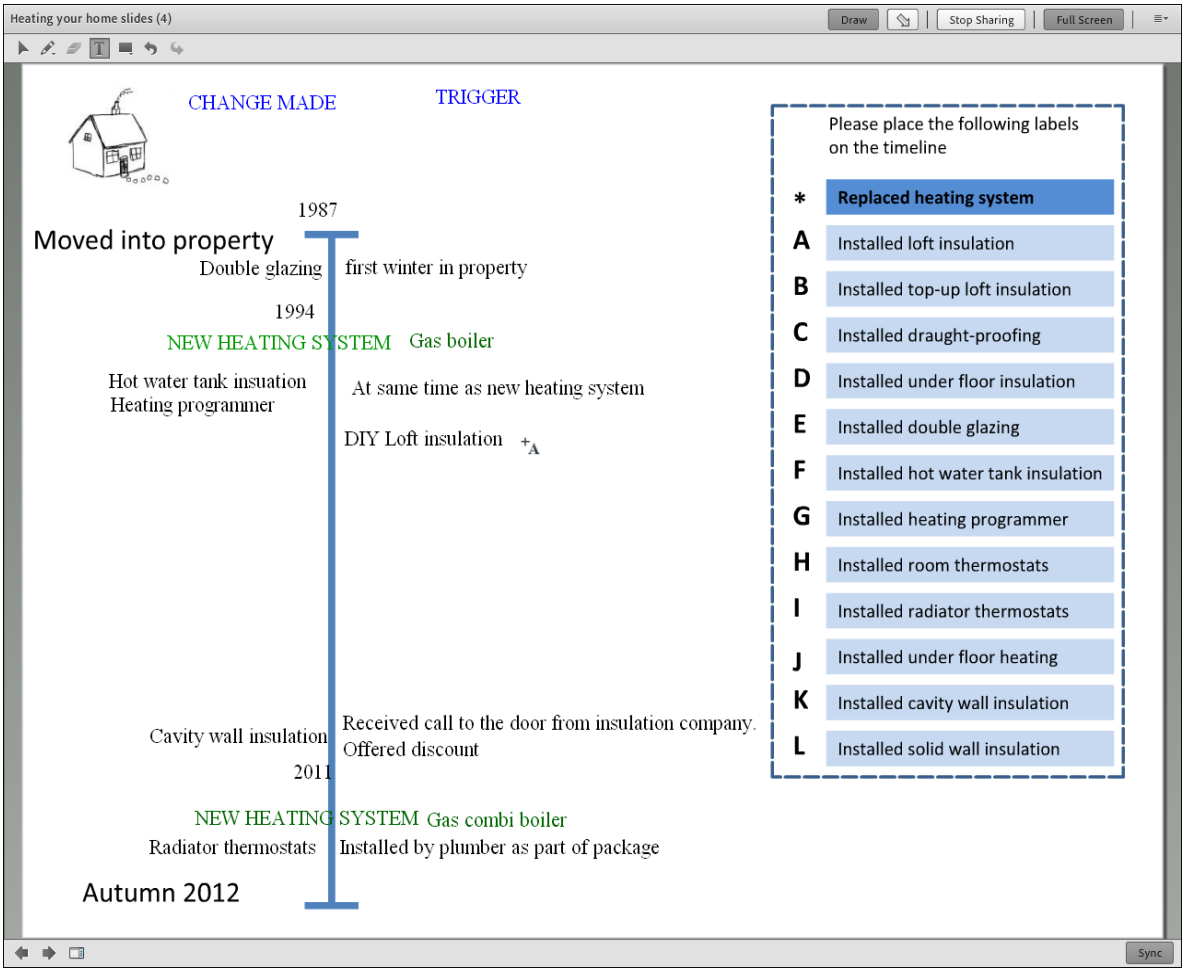
However, a few patterns do emerge looking between the different types of energy efficiency measures. Hot water tank insulation, thermostatic radiator valves, heating programmers and room thermostats were the most likely improvements to be installed at the same time as the heating system was replaced. The follow-up interview participants who this applied to said this was because these features were part of the package of improvements which were made by the company installing the new heating system.

The most likely change to be made prior to the replacement of the heating system was double glazing (52%) and follow-up interview participants explained that this was an improvement they made soon after moving into their property for many reasons, including aesthetics, noise insulation and security. It was not closely related to heating for the follow-up interview participants.

The timing of other energy efficiency improvements was generally driven by the availability of financial assistance to install them according to follow-up interview participants. This meant it had not often been linked to replacement of the heating system. Many follow-up interview participants explained that they had been triggered to install cavity wall insulation or solid wall insulation due to an approach from their energy company, or another installation company, offering them it discounted, or even free.

Figure 78 is a timeline created by one of the follow-up interview participants during the interactive interview. It shows the order in which they made improvements to their home and the triggers which led them to do so. Many of the energy efficiency improvements were made at the same time as the heating system was replaced as they were installed as part of the system package. The timeline also shows that cavity wall insulation was installed following an approach from an insulation company offering it at a discounted rate. This timeline was typical of many of the follow-up interview participants.

Figure 78: Example of energy efficiency sequencing timeline from follow-up interview.



Willingness to install energy efficiency measures to receive finance

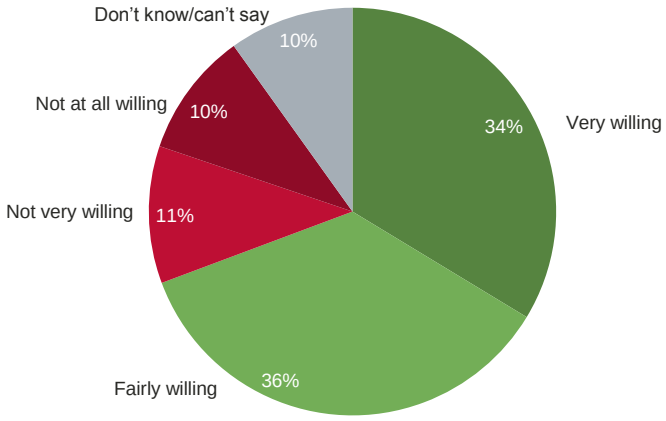
Homeowners in all phases of the study were also asked whether they would be willing to install energy efficiency measures, or to ensure any measures already installed met certain requirements, prior to installing a more efficient heating system. This was presented as a requirement that could be placed on them for receiving financial assistance to install and/or run the new system.

Figure 79 shows that the majority of survey respondents (70%) would be willing to install energy efficiency measures in these circumstances. One in five (21%) said they would not be willing however, and the same proportion (10%) said they did not know whether they would be willing or not.

Figure 79: Willingness to install energy efficiency measures to receive finance

In some of the scenarios you were shown there was financial assistance available to help you install and run these heating systems. In the future, householders could be required to have some energy efficiency measures (such as loft or wall insulation) installed before they can receive this financial assistance. It has been shown that installing energy efficiency measures is likely to help you to get the best out of a new heating system.

If this was the case, how willing, if at all, would you be to install the necessary energy efficiency measures?



Base: All respondents who do not currently heat their home through a more efficient heating system (2,848) ,28th August to 14th October 2012

Source: Ipsos MORI

Most workshop and follow-up interview participants also understood and agreed with the rationale behind making this a condition for receiving finance. They felt it was common sense to ensure the property was well insulated before investing in a new heating system. This was felt to be worthwhile not only from an environmental point of view, but primarily as it would help lower bills while keeping the home warmer. Most (67%) expected to reduce their energy bills by installing energy efficiency measures, and 57% expected this to make their home warmer and more comfortable.

> *"No point investing huge amounts of money into heating your home when the heat's just escaping."*
> Workshop participant, off gas grid homeowner, rural, small property, female

> *"Put the insulation in first and then you know how warm the house is going to be from the insulation so then you can decide which type of heating system you're going to put into it."*
> Follow-up interview participant, on gas grid homeowner, rural, large property, male, resp. 14

> *"If there wasn't any form of insulation in our loft that would have one of my first and foremost things to do because it just disappears and when I have done that in previous houses and you notice a massive different upstairs because the heat bounces back down...and cavity wall, obviously I don't have a problem here I have got neighbours on either side, but I have been in houses where there isn't any and that side of the wall is so horrendously freezing ...things like cavity wall or insulating from the inside or things like that, yeah they all help store the heat in your house a bit longer doesn't it?"*
> Follow-up interview participant, off gas grid homeowner, rural, large property, female, resp.16

Considering the willingness of homeowners in the six Green Deal segments to install energy efficiency measures, the survey showed that '**Convertibles'** and '**Money savers'** were the most likely to be willing (86% and 82% respectively compared with 70% overall).

'**Not on the radar'** homeowners and the '**Disengaged rejecters'** were significantly more likely than homeowners overall to say they would be unwilling to install energy efficiency measures in order to

qualify for financial assistance installing and running a new heating system (26% and 30% respectively compared to 20% overall).

There is no evidence in the survey results that homeowners who already have energy efficiency measures installed are more accepting of this requirement than those who do not have these measures installed.

However, some of the follow-up interview participants had their energy efficiency measures installed free of charge or at a discounted rate. It is possible that some of the survey respondents saying they would be willing to make these improvements were basing this on an assumption that they would also receive any new measures at a low cost. Although it should be noted that this was not explicitly stated by homeowners themselves.

Among a minority of these homeowners there were questions about the effectiveness of energy efficiency measures which led them to question the need for this to be a condition for finance.

> *"[My parents] should never have it [cavity wall insulation] done in the house. The house wasn't suitable and it created damp... So the government cannot say, you know, you have to have this insulation if it's not suitable for that..."*
> Workshop participant, off gas grid homeowner, rural, small property, male

A few of the follow-up interview participants were those who had said they were unwilling to install energy efficiency measures during the survey. They explained that they were against doing so on the grounds of cost. Indeed, even among the follow-up interview participants who said they would be willing to do this, for some it depended on whether they were still financially benefitting from the grant or tariff once the cost of making the energy efficiency improvements was factored in.

5. Summary of specific homeowner views

This chapter brings together the findings from this research for specific groups of homeowners. The findings it discusses have all been presented at various stages in this report and this chapter aims to provide an easy point of reference for homeowner-specific results.

5.1 On and Off Gas Grid Homeowners

This research was conducted with both on and off gas grid homeowners. Homeowners referred to as off gas grid were either living in properties which could not be connected to the mains gas grid, or in properties which could be connected but were not at the present time.

The workshops revealed that, overall, on gas grid homeowners were more satisfied with their current heating systems than off gas grid homeowners. They tended to assume that if they replaced their current heating system it would be with an upgraded boiler: To many on gas grid homeowners, this was a gas combination boiler, although once they discovered that a gas condensing boiler was the most modern form of boiler (through information provided to them on key fact sheets about the more efficient heating systems) this was a popular option.

Off gas grid homeowners involved in the workshops differed in their assessments of their current heating system depending whether they lived in rural or urban off gas grid areas. Urban off gas grid homeowners were more dissatisfied with their current heating system as their homes were all heated using electricity. Electric heating systems were disliked as these homeowners found them difficult to control and expensive to run. There was a higher level of satisfaction with the heating systems used by workshop participants from rural off gas grid properties. These respondents used a wider variety of heating systems than the urban off gas grid properties, including LPG, oil, wood stoves and Agas. Some of the homeowners living in rural areas were also using a range of heating systems to meet their needs rather than just one central system. Although overall the rural off gas grid homeowners seemed to be more satisfied than urban off gas grid homeowners, there were still a few who felt their current system was expensive and ineffective.

A potential barrier to some homeowners replacing heating systems they were dissatisfied with was a low level of awareness of the available alternatives. This was particularly apparent among workshop participants in off gas grid areas, especially those living in urban areas. Although many of these homeowners had aspirations for a different way of heating their homes, they generally believed their current electric system was the only possible solution for their property and area type.

All the homeowners involved in this research were given basic information about more efficient heating systems which they would be eligible for in their current property (i.e. off gas grid homeowners were shown biomass boilers and heat pumps but not gas condensing boilers or micro-CHP). During the workshops, off gas grid homeowners were the most likely to be positive about many of the options presented to them. The survey results showed that, in particular, homeowners living in off gas grid areas were the most likely to be positive about GSHPs (53% compared to 38% overall).

During the choice experiment, homeowners were asked to make trade-offs between the different more efficient heating systems. The gas condensing boiler was the most favoured technology by on gas grid homeowners. This was the case even if substantial financial incentives were available for the renewable heating systems (biomass boilers, ASHP and GSHP) and if the gas price was significantly higher than 2012 prices. The heat network was the most popular option among off gas grid homeowners, with very similar proportions of these homeowners selecting, and saying they would install, a GSHP, biomass

boiler or ASHP. Although heat networks are currently only likely to be available in high density areas, this demonstrates the appetite for this heating system across a broad range of homeowners. That said, the survey showed that homeowners living in very high density areas were the most likely to be positive about heat networks (43% compared to 34% overall).

Off gas grid homeowners were more likely to 'do nothing' in a non-emergency scenario than on gas grid homeowners. Nine in ten (91%) off gas grid homeowners would be likely to do nothing given a situation where their current heating system was still working but was perhaps coming towards the end of its life compared to four in five (80%) on the gas grid.

5.2 Homeowners living in different property types

This research found that size of property was consistently a factor which affected attitudes towards, and preferences between, more efficient heating systems.

Homeowners living in smaller properties placed greater concern on the size of the heating system, and the amount of space it needed for any additional parts or fuel storage. Smaller property owners were therefore less likely to find a GSHP or biomass boiler an appealing option. While a gas condensing boiler was popular with nearly all homeowners living in on gas grid areas, this was especially the case among terraced property owners (85% positive compared to 78% of detached and semi-detached owners). The same trend was true of micro-CHP (51% of terraced property owners positive compared to 46% overall). More efficient heating systems which required a hot water tank were however off-putting to many of these homeowners. Prior to receiving information about any of the more efficient options, most small property owners spontaneously said they would want to install a combination boiler in future to save space.

Off gas grid homeowners living in flats were the most likely to select a heat network and say they would be likely to connect to one in their current property in a non-emergency scenario. The workshops and follow-up interviews suggested that this is likely to be because these homeowners believed a heat network was a viable option for their area compared with those living in large detached properties in rural areas, who tended to assume it was not a realistic option for them.

Off gas grid homeowners living in detached properties were more likely to select, and be likely to install, a GSHP or biomass boiler than those living in smaller properties, particularly flats. This again matches the discussions at the workshops and follow-up interviews which found these homeowners more likely to feel they had the space needed, either inside or outside the property, for these technologies.

The size of property was also correlated with the age of the homeowner and the income of the household. For instance, flats tended to be occupied by younger and lower income homeowners whereas detached properties were more likely to be occupied by older and higher income families. The differences in results by both age and income are discussed below.

5.3 Homeowners of different ages

On the whole younger homeowners (aged 18 – 34) were less likely to have replaced their heating system in the past and were less likely to have the means to do so than older homeowners.

Three in five (59%) homeowners aged 18 to 34 had never replaced the heating system in their current property, compared to 36% overall. Homeowners aged 55 and over were the most likely to have replaced their heating system in their current property (75% compared to 64% overall). However, the eldest group of homeowners involved in this study (those aged 75 and above), were more likely than homeowners overall to have never replaced their heating system and to have never considered doing so (84% compared to 68% overall).

The youngest age group (aged 18-34) were the group most likely to say they did not have any savings (36% compared to 15% of those aged 55 and over). As such, they were mostly likely to feel that low upfront costs were of most importance when buying a heat system (18% compared to 10% overall). Apart from those on very low incomes or small state pensions, older homeowners aged 55 and over tended to have available capital and therefore prioritised the annual fuel bill over the upfront cost. Many of these homeowners in the workshops and follow-up interviews said they would replace their heating system through use of savings.

Older homeowners (aged 55 and over) were the most likely to voice reservations about some of the more efficient heating technologies shown to them. For instance, they were the most likely to feel negatively about micro-CHP (24% felt negatively about it compared to 9% aged 18 to 34 and 15% aged 35 to 54). The follow-up interviews suggested they were sceptical of the technology and had reservations about how reliable it would be.

The reliability and effectiveness of a heating system were identified as the most important factors for survey respondents aged 75 and over. One in five (19%) of these homeowners felt reliability was most important compared to 11% of 18 to 34 year olds and the same proportion (20%) identified effectiveness as most important, compared to 10% of the younger group.

5.4 Homeowners with different financial means

Lower income homeowners, and those with low savings, were less likely to have replaced their heating system in their current property and expected to do so less frequently than those on higher incomes. They were also less likely to install any of the more efficient heating options shown to them than those on higher incomes.

The most likely to have never replaced their heating system in their current property were homeowners who did not have any savings (45% compared to 36% overall). The most likely to have never replaced, and never *considered* replacing the heating system, were households where the chief income earner was classified as social grade D or E (77% compared to 68% overall) or was retired (86% compared to 68% overall). Lower income homeowners would also not expect to replace their heating system frequently. Those with total annual household incomes below £20,000 were the most likely to expect to make a replacement less frequently than every 20 years (23% compared to 16% overall and 11% of those with an annual total household income of £50,000 or more).

The most common reason homeowners involved in this study had replaced their heating system in the past was due to a breakdown situation (30%). The reasons that any homeowners had made a replacement before a breakdown were either due to the system showing signs it was close to breaking down, being in need of frequent repair or as part of a wider renovation they were making to their property. This was more likely to be the main reason behind the replacement for high income homeowners (with a total annual household income of £50,000 or higher) than lower income homeowners (23% compared to 13% overall).

The choice experiment showed that higher income on gas grid homeowners were more likely to want to install *any* of the more efficient heating systems in a non-emergency scenario. This was clearly demonstrated by the falling proportion of homeowners who would opt to ‘do nothing’ in this scenario as income increased (from 81% of those with a total household income before tax of less than £10,000 to 76% of those with an income over £50,000). These preferences are based on a scenario where no financial incentives are available to install these systems. The workshops and follow-up interviews found that in this situation, many lower income homeowners felt they could not afford, or did not want to prioritise capital, to replace their current system in a non-emergency situation.

When considering the most important factors for a heating system, low income and vulnerable homeowners[37] cited cost factors, either in the form of low energy bills or being cheap to run and buy. Follow-up interview participants who had no, or limited, savings placed greatest importance on the upfront grant when they were asked to assess the relative appeal of this financial incentive against an annual tariff payment. The grant was more attractive to them as without this they would not be able to pay for the installation. In nearly all cases, these homeowners would prefer to receive the grant than take out a loan or mortgage to cover the upfront cost and then claim an annual tariff.

The annual tariff payment was the preferred form of financial incentive for follow-up interview participants with higher incomes and greater savings however. These homeowners were willing to use their capital to pay the upfront cost and placed greater priority on lowering their annual fuel and maintenance costs.

5.5 Green Deal segments

All the survey respondents have been assigned to one of the six Green Deal segments developed by DECC[38]. A summary of the attitudes and demographics which define each of these segments is presented below.

[37] These homeowners declared their household to have a total annual income before tax of less than £16,000 and to fall into one of the following categories: to have children under the age of 16 living in the household and/or receive child tax credits; to have someone aged 65 or older living in the household and/or receiving pension credit; or to have someone in the household living with a long-term illness, disability or infirmity and/or receiving work tax credits or Disability Living Allowance.

[38] GfK NOP and Kantar Research, 2012, *Green Deal Segmentation,* DECC. Available at http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/green-deal/7057-research-report-green-deal-segmentation.pdf

Carbon Savers:	**Young professionals who are particularly interested in the environmentally friendly benefits of making their homes more energy efficient through the Green Deal.**
Convertibles:	**High income working families who were already considering making energy efficiency improvements. The Green Deal could help them get over barriers including distrust of installers and confusion over conflicting information.**
Not on the Radar:	**Average households for whom energy efficiency is not a priority at present.**
Disengaged Rejecters:	**Older homeowners who are not planning on making their homes more energy efficient. They do not appear to want to consider the Green Deal at all.**
Overstretched:	**While they could potentially benefit from the Green Deal, this segment is strongly put off by the costs of improvements.**
Money Savers:	**Families on low incomes who are especially interested in the cost-saving features of the Green Deal to help them make energy efficiency improvements.**

'Carbon Savers:

'Carbon Savers' were more likely to consider reliability of a heating system as the most important factor than many other homeowners. For example, this was mentioned by17% of 'Carbon savers' compared to 10% of the 'Overstretched' group. By contrast, they were less likely to rate cost as the most important factor (59% compared to 66% of 'Overstretched).

'Carbon savers' were more likely than others to expect to replace heating system more frequently than every 20 years. However, 'Carbon savers' were also more likely to say they would not replace their heating system in the next five years (78%).

'Convertibles':

As stated in the chart above, the 'Convertibles' segment is populated by households who are already considering making energy efficiency improvements. The survey in this research confirmed that people in this segment were the most likely to be willing to install these measures if this was a condition for receiving financial assistance to install a more efficient heating system. More than four in five (82%) 'Convertibles' would be willing compared with 70% overall.

'Convertibles' were among the most likely to say they would probably replace their heating system in the next five years (23% compared with a total of 16%). They were also the homeowners most likely to say they would replace their heating system if energy prices increased dramatically (51% compared with 36% overall).

They tended to be more positive than homeowners overall about many of the more efficient heating systems presented to them. This was the case for micro-CHP (60% to 46% overall); heat networks (47% to 34%); GSHPs (48% to 38%); ASHP (36% to 28%); and for biomass boilers (37% to 26%). The 'Convertibles' were the groups of homeowners most likely to consider installing each of these more efficient heating systems in an emergency situation. For example, 35% said they were likely to connect to a heat networks, compared to 25% overall.

'Convertibles' were a higher income segment which tallies with the discussion above about higher income homeowners being more likely to consider replacing their heating system than those on lower incomes.

'Not on the Radar':

As stated in the chart above, the 'Not on the radar' segment is populated by households who do not consider energy efficiency a priority. The survey results from this study confirmed this attitude with these homeowners significantly more likely than homeowners overall to say they would be unwilling to install energy efficiency measures in order to qualify for financial assistance installing and running a new more efficient heating system (26% compared to 20% overall).

This segment were less likely to expect to replace their heating system in the near future. Nearly four in five (78%) said they would be unlikely to do so in the next five years compared with 71% of 'Money Savers' and 69% of 'Convertibles'. This group were also more likely to say they would not replace their heating system in the next ten years (74% compared with 65% of 'Money savers and 58% of 'Convertibles').

'Disengaged Rejecters':

'Disengaged Rejecters' were the segment in the Green Deal study with the least interest in the scheme. In this study they were among the most likely to say they would not replace their heating system in the next ten years (73%). They were consistently more likely to say they would not replace their heating system in any of the scenarios probed e.g. if their current system needed repairs, if they were told parts for it were soon not available or if the warranty ran out.

'Disengaged Rejecters' were also significantly more likely than homeowners overall to say they would be unwilling to install energy efficiency measures in order to qualify for financial assistance installing and running a new heating system (30% respectively compared to 20% overall).They were the most likely to be negative about most of the more efficient heating systems shown to them.

'Overstretched':

The 'overstretched' group were the most likely to consider cost as the most important factor for a heating system (either in form of low energy bills, being cheap to run or cheap to buy). Two thirds (66%) of these homeowners stated cost compared to 59% of 'Carbon Savers'. The 'Overstretched' group were those put off the Green Deal by the cost of improvements which fits with cost being the most critical factor for them in relation to a heating system.

'Money Savers':

'Money Savers' were the homeowners most likely to say they would probably replace their heating system within the next five years (21% compared with a total of 16%). They were also among the most willing to install energy efficiency improvements in order to qualify for financial assistance with the replacement (86% compared with 70% overall).

‘Money savers’ were the group of homeowners most likely to consider installing each of the more efficient heating systems in an emergency situation. For example, 33% said they were likely to connect to a heat networks compared to 25% overall. ‘Money savers’ were also significantly more likely than any other segment to say they would be likely to install a GSHP in an emergency situation (33% to 20% overall).

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