Department of Energy & Climate Change

Analysis of customer data from phase one of the renewable heat premium payments (RHPP) scheme

Research Report

Prepared by AECOM

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Executive Summary

The Renewable Heat Premium Payment (RHPP) Scheme provides a one-off grant to help householders with the cost of installing renewable heat technologies. This report presents findings from the analysis of householder questionnaire data collected as part of RHPP1.

Background

The Renewable Heat Premium Payment (RHPP) Scheme is a government scheme that provides a one-off grant to help householders[1] with the cost of installing the following renewable heat technologies:

- Air Source/Air-to-water heat pump (ASHP)[2];
- Ground-source or water-source heat pump (G/WSHP)[3];
- Biomass boiler; and
- Solar thermal hot water.

RHPP is an interim scheme to support renewable heat installations before the Renewable Heat Incentive (RHI) is expanded to cover the domestic sector. The RHPP Scheme has been administered in two phases:

- The first phase of the scheme, RHPP1, ran from 1st August 2011 to 31st March 2012 and included both a householder scheme and a social landlord competition.
- The second phase, RHPP2, opened in April 2012 and was due to close in March 2013 but has been extended until the end of March 2014 ahead of the RHI scheme for householders and social landlords.

The scope of this report is restricted to the analysis of householder questionnaire data collected as part of RHPP1 only. A separate evaluation of RHPP2 is in progress, and is due to report in autumn 2014.

The Department of Energy and Climate Change (DECC) commissioned AECOM to undertake quantitative analysis and reporting of private householder questionnaires to learn about consumers' motivations and experiences of installing and using renewable heat technologies. The Energy Saving Trust (EST) administered questionnaires to voucher recipients who had installed renewable heat technologies (RHT) as part of the scheme.

Methodology: post-installation and follow-up questionnaire

Two separate questionnaires were designed for owner-occupiers[4] applying through the householder voucher scheme. The questionnaires used for the research were designed by

[1] Subject to meeting eligibility requirements

[2] Air-source heat pumps exclude air-to-air and exhaust-air heat pumps

[3] Ground-source heat pumps (or ground-to-water heat pumps) is used to mean a heat pump that collects heat from the ground, water in the ground, or surface water.

[4] The questionnaire was designed by DECC for owner-occupiers to record motivations for installing renewable technologies and how it was used in practice. Although private landlords and tenants could apply, the questions were not wholly applicable to them so data from these groups were not analysed or presented in this report.

DECC and administered by the Energy Saving Trust in the form of an online census[5]. All private householders who redeemed their RHPP1 voucher following the installation of a renewable heat technology were sent a web link to the relevant questionnaire.

The first questionnaire, a post-installation (PI) questionnaire[6], was issued immediately after installation and consisted of 50 questions that focused on motivations for taking part in the scheme and experiences of installation. The second questionnaire, the follow-up (FU) questionnaire, was similar in length and focused on experiences and patterns of use.

The follow-up questionnaire was issued four to nine months later to allow all participants to experience the use of the renewable heating system for a period of time during the winter before answering it. In practice, follow-up questionnaires were issued in May/June 2012 (Wave 1) for renewable heating technologies installed up to 31 January 2012, with the remainder being issued in January and February 2013 (Wave 2). Data collected up to 19th February 2013 was included in the analysis.

Multiple applications could be made for RHPP1, where, for example both a heat pump and solar thermal system were being installed. Seven per cent of private households installed more than one type of technology and received a voucher for each, and therefore were invited to complete post-installation and follow-up questionnaires for each[7].

RHPP1 resulted in 4,959 renewable heat technology installations at 4,623 addresses of owner-occupiers, which provided:

- 3,958 post-installation questionnaires, returned by 3,772 owner occupiers; and
- 2,734 follow-up questionnaires, returned by 2,694 owner occupiers.

Note:

Results in this report are based on responses to two stages of questionnaire completed by owner-occupiers who installed one or more renewable heat technologies under the RHPP1 scheme. For the first questionnaire the response rate was 80% and for the second, 55%. Tests show no bias arose from non-completion, hence the results can be assumed to be representative of all installations.

The data from both questionnaires was appended to the scheme administration data using a unique reference number. The resulting data set is complex, and includes several populations, who may be termed as 'respondents', 'responses', 'technologies', 'systems' or 'installations' depending on the context and whether the results are from the post-installation (PI) or follow-up (FU) questionnaire, and whether we are considering households (i.e. individuals), or technology types. As far as practicable, the text in the report states the population being referred to for each result reported. Should the reader be unclear as to the base/source of population in question, please refer to the Terminology section in Chapter 1.

Objectives

[5] On-line completion was the only option offered. As all voucher recipients were expected to complete the questionnaires, the exercise is considered as a census rather than a survey.

[6] Copies of the questionnaires are included in Appendix A

[7] Therefore respondents may have completed up to four questionnaires; two at each stage

The report focuses on the following research questions:

- What are the characteristics of those returning the post-installation questionnaire (PI respondents) and how do they compare to the eligible populations for each renewable heat technology?
- What are the motivations behind the decision to install a renewable heat technology, including if, when and how RHPP1 influenced the choice?
- What was the experience of installation, and what are the views on any guidance provided?
- What are the views on the performance of renewable heat technology in relation to expectations, and have these views developed over time?
- What is the experience of renewable heat technology in practice, including fuel sourcing and use of additional heating and energy?
- What lessons can be learned to influence take up of renewable heat technology to the wider population?

Profile of respondents and how they compare to the eligible populations

The eligible[8] population for solar thermal under RHPP1 was households in England, Scotland or Wales (GB). Where the renewable heating technology being installed was ASHP, G/WSHP or a biomass boiler, the RHPP1 scheme was only open to households in England, Scotland or Wales that were not connected to the gas grid.

Compared with the respective eligible populations for RHPP1, PI respondents lived in larger houses that were much more likely to be detached. They were less likely to be aged over 65, and more likely to be in employment. Average incomes were estimated[9] to be 10 to 20% higher amongst PI respondents than the eligible populations.

PI respondents shared many common characteristics regardless of the type of technology they had installed:

- Over half (56%) were aged between 45 and 64, and 18% were aged 65 or over;
- 68% were in employment;
- Almost half (46%) had incomes below £41,600, and almost a quarter (23%) had incomes over £72,000. The average household income[10] was estimated to be £55,000;
- Over four fifths, (83%) lived in detached properties and 13% lived in semi-detached properties;
- Less than half (44%) lived in two person households;

[8] Additional criteria, for all the types of technology, applied to meet eligibility, including: the property having loft insulation to 250mm and cavity wall insulation where practical; the product and installer being certified under the Microgeneration Certification Scheme (MCS) (or equivalent).

[9] It has not been possible to ascertain robust data on incomes of home owners amongst the eligible off-grid population; hence a range has been estimated based on a combination of census and housing data.

[10] As the questionnaires recorded income bands and not raw data, average incomes are estimated from the proportions in each band.

- 38% lived in four bedroom houses and 29% lived in houses with five or more bedrooms. The average number of bedrooms was 4.0;
- Almost half (45%) had lived in the property for less than three years;
- A third (33%) of properties dated from 1990 or later.
- Key differences in the profiles by the type of technology installed are presented below;

A quarter of PI **ASHP** respondents lived in the East Midlands and East regions and a further fifth (22%) in the South West of England. Compared with the off-grid population in the north of England there were relatively few ASHP installations.

The average household income was £51,500; the average number of bedrooms was 3.8 and over four fifths (81%) lived in detached properties. Over half (51%) had lived in their homes for less than three years. Most (69%) were not planning on moving while a fifth (20%) expected to move within ten years. Homes were relatively new; 38% of buildings dated from 1990 or later.

More than a quarter (29%) of PI **biomass boiler** respondents lived in Scotland, and a further 22% in the South West.

Almost three quarters (73%) were employed, and the average household income was £53,500. Most (85%) lived in detached properties and a further 12% in semi-detached buildings. The average number of bedrooms was 4.1. Almost half (47%) of the properties were built before 1900, and just 21% were built since 1990.

More than a third (34%) had lived in their property for less than three years, and more than a fifth (22%) had lived there more than 16 years. Only 10% planned on moving within the next ten years and 68% did not plan to move at all.

Almost a fifth (18%) PI **G/WSHP** respondents lived in the East of England (East Midlands and East region) and a further 10% in Wales.

Almost three quarters (74%) were employed, and the average household income was £61,500. Most (92%) lived in detached properties. The average number of bedrooms was 4.1; 34% lived in houses with more than four bedrooms. While almost a third (31%) of the properties were built before 1900, over half (51%) were built since 1990. Almost a quarter (23%) had yet to move in to the property at the time of completing the questionnaire, and a further 36% had lived in their property for less than a year. At least 40% of PI respondents who installed a G/WSHP did so in a new self-build property.

Almost a quarter (23%) of PI **solar thermal** respondents lived in the South West, and a further 19% lived in the South East.

Almost two thirds (65%) were employed, and average household incomes were around £54,500. Most (80%) lived in detached properties and a further 14% in semi-detached buildings. Over a third (35%) of properties were built between 1950 and 1989, and a further 24% were built since 1990.

Almost half (45%) lived in four bedroom houses and a further 24% in houses with three bedrooms. Almost a third (31%) had lived in their property for less than three years, and more than a fifth (21%) had lived there more than 21 years. Only 16% planned on moving with the next ten years and 61% do not plan to move at all.

What are the motivations for installing a renewable heating technology[11]

Environmental factors, including self-sufficiency, were high on the list of factors influencing the decision to install a renewable heating system. However, saving money, off-setting rising fossil fuel prices and the availability of funding were all contributing factors:

- Almost four fifths (79%) of renewable heating technology installations were motivated by rising fuel prices;
- A similar percentage (78%) resulted from a desire to help the environment;
- A wish to save money was an influential factor for just under three-quarters (72%) of installations;
- Two thirds (68%) of installations arose from a desire to reduce dependence on fossil fuels;
- Three fifths (60%) of installations were motivated by the perception that it was a more efficient heating technology compared to a previous heating system.

How has RHPP1 influenced the decision?

The availability of a grant and/or funding was a key motivation to install 53% of renewable heating technologies. However, it is not clear whether this referred specifically to the RHPP1 voucher payment or future RHI payments. Almost half (44%) of installations were 'fairly likely' and a further 30% 'very likely' to have gone ahead without a grant. The cost of renewable heating systems was largely met through savings.

When was the decision taken to install a renewable heating technology?

A fifth (21%) of respondents took the opportunity to install renewable heating system while building a new home (this proportion was much higher, at 40% where G/WSHP was installed). Similar numbers installed their renewable heat technology as part of a refurbishment or upgrade to their homes. Almost a third (31%) of respondents needed to replace their existing heating systems, and a quarter (25%) wished to make their homes warmer.

Almost half (49%) of respondents installed their renewable heating system in spite of their previous systems working well, while just six per cent were replacing broken systems, indicating that overall the decision to install a renewable heat technology was planned, rather than as a result of an emergency.

[11] Results based on responses to post-installation questionnaire

It would appear that moving to a new home can be a catalyst for replacement of heating systems or, in the case of new-build, taking the opportunity to install renewable heat technologies.

What are the experiences of installation?[12]

The majority (73%) of installations were easy to arrange, but least easy for G/WSHP installations (61% found it easy) and most easy for solar thermal systems (82%).

Support was generally provided for 86% of installations, usually in a written format, but for a fifth (21%), it was felt more information or support was needed to get the best out of the system.

Two fifths (40%) of PI respondents said they had loft insulation and/or cavity wall insulation installed in their home at the same time as the renewable heating technology in order to meet the eligibility requirement. Most respondents had previously addressed home insulation in advance of installing their renewable heat technology: 84% already had loft insulation, 52% of respondents had cavity wall insulation.

What are the views on the performance of renewable heat technology, and have these views developed over time?

Satisfaction with the renewable heating technology was high, at both the PI and FU stages, 91% and 92% respectively.

At the follow-up questionnaire stage:

- Advice or guidance had been required for 54% of installations, including how to get the best out of the system (31%)
- 9% of installations had experienced manufacturing faults (5% in Wave 1, and 16% in Wave 2);
- 14% of installations had experienced installation faults (9% in Wave 1, and 21% Wave 2);

At the follow-up questionnaire stage, for renewable heating systems that provided heating for the home (ASHP, G/WSHP and biomass boilers);

- The systems were perceived to provide enough heat; around 89% said the temperature was about right even on the coldest nights and 88% were satisfied with the time taken to get to the desired temperature in winter.
- However, over the slightly colder winter of 2012/13, there was an increase in the proportion of FU ASHP and FU biomass boiler respondents who said they had been too cold on the coldest days.

More than a quarter (27%) of FU solar thermal respondents were dissatisfied with the amount of hot water from their panels in winter, but this may be that their expectations were unrealistic.

Propensity to recommend renewable heat technology to others

[12] Results based on responses to post-installation questionnaire

At the follow-up stage, 90% would recommend renewable heat technologies to others, albeit with some words of caution, including installing it in a suitably designed property with a good standard of insulation, and being prepared for a long payback period in some cases.

There was a slight reduction in the proportion who would recommend renewable heat technologies from the post-installation stage (91%) to 90% when the renewable heating system had been used for some time, including over a winter period.

Are perceived benefits being realised?

When asked what impact installing a renewable heat technology could have had on the value of their house, more than half (54%) of FU respondents thought that the value of their property had been positively affected. Responses also indicated that there had been both positive and negative changes in fuel bills, reflecting the change in energy mix used, but the data does not show whether the total amount spent is more or less, or by how much.

How is renewable heat technology being used?

Actions taken when too hot/cold,

Of FU respondents with a renewable heating system (ASHP, G/WSHP or biomass boilers):

- Almost half (48%) said they would put on additional layers of clothing if they felt too cold;
- 41% would turn up the thermostat in the event of feeling too cold;
- More than half (57%) had used supplementary heating systems in addition to their renewable system in order to achieve a comfortable temperature.

Wood burning stoves were the most usual type of supplementary heating used during winter; 838 (43%) had used one, and when used, usage was regular, with seven per cent using one for more than a few hours per day. However, comments indicated that the use of supplementary heating was not necessarily an indication that their heating needs were not being met by their renewable heating system, but there were other benefits, including a boost of heat for a particular room, or just for 'cosiness', for example;

> *"...more for the cosiness of the wood burning stove rather than a need for extra heat"* (G/WSHP, very satisfied)

How are they sourcing fuel (biomass)?

Of FU biomass boiler respondents:

- 72% use just pellets to fuel the system, 25% use just logs, and 3% use both sources;
- A third (n=98) of log users collect their fuel locally, including 45 people who have their own forest or woodland.

Has renewable heat technology influenced how energy is being used and considered?

When asked whether installing a renewable heat technology had changed the way energy in the home was used, over half (55%) of FU respondents said that they now gave a lot of thought to saving energy in their home. A further 43% gave this a fair amount of thought.

What lessons can be learnt to influence the take up of renewable heat technology to the wider population?

Most installations were planned, rather than emergency replacements. It would appear that moving to a new home can be a catalyst for replacement of heating systems or, in the case of self-build, taking the opportunity to install a renewable heat technology. Installing at this stage is likely to maximise the benefits:

- By minimising any disruption from installation works; and
- By the fuel cost savings justifying the initial investment, providing these people stay in their homes for a long time.

For those completing the questionnaires, the value of their home was not a major motivation for change, although they hoped value would increase.

There has been sense to the location of where technologies have been applied, with biomass and ground source heat pump systems more widely used in rural areas than air source heat pumps and solar thermal. Solar thermal is also more prevalent in the south where hours of sunshine tend to be greater.

The majority of installations appear to have been successful, as the owners are happy with their systems. However there is a small number of cases where respondents are not satisfied, and this could threaten a poor reputation for the sector whilst it is still developing.

There were a number of installations with faults at early stages (14%). This hopefully is due to the systems being relatively new. However it suggests a need for substantial effort to improve installer training to reduce the number of problems caused by installation rather than the equipment itself.

The provision of information on operation of the systems can also be improved, although some information was provided to nearly all users. Help to make best use of the systems is the main need; some respondents commented that the installers didn't fully understand all aspects the systems they were installing.

In operation, most users are content with the heat being delivered. Some concerns remain for the coldest weather, and this is greatest for ASHP systems. This makes sense as their performance is weakest under these conditions. Some users were also disappointed with the delivery of solar thermal systems in winter, which may reflect a lack of understanding of their potential.

Most users of biomass systems were happy with the effort required to re-fuel the system. It is too early to know if maintenance becomes an issue for any of these systems over time.

The data from the questionnaires in terms of running cost is from very early stages of use of the technologies, and it is unclear to what extent bills have increased or decreased. However study of whether heat pumps are delivering any cost savings will be very important, as qualitative evidence suggests that some users are concerned over the size of their electricity bills.

1. Introduction

Background

The Renewable Heat Premium Payment (RHPP) Scheme is a government scheme that provides a one-off grant to help householders with the cost of installing the following renewable heat technologies:

- Air Source/Air-to-water heat pump (ASHP)[13];
- Ground-source or water-source heat pump (G/WSHP)[14];
- Biomass boiler; and
- Solar thermal hot water.

RHPP is an interim scheme to support renewable heat installations before the Renewable Heat Incentive (RHI) is expanded to cover the domestic sector. The RHPP Scheme has been administered in two phases:

- The first phase of the scheme, RHPP1, ran from 1st August 2011 to 31st March 2012 and included both a householder scheme and a social landlord competition.
- The second phase, RHPP2, opened in April 2012 and was due to close in March 2013. The RHPP2 Scheme included a householder scheme, a social landlord competition and communities competition. The RHPP2 (Extension) scheme has been extended until the end of March 2014 ahead of the RHI scheme for householders and social landlords.

The scope of this report is restricted to the analysis of householder questionnaire data collected as part of RHPP1 only. A separate evaluation of RHPP2 is in progress, and is due to report in autumn 2014.

The Department of Energy and Climate Change (DECC) commissioned AECOM to undertake quantitative analysis and reporting of private householder questionnaires to learn about consumers' motivations and experiences of installing and using renewable heat technologies. The Energy Saving Trust (EST) administered questionnaires to voucher recipients who had installed renewable heat technologies (RHT) as part of the scheme.

The six key objectives of the RHPP1 scheme were to;

- Achieve high levels of penetration of domestic renewable heat technologies ahead of the domestic Renewable Heating Incentive (RHI) tariff payments;
- Learn about these heat technologies and the way consumers use them;
- Avoid a hiatus which hurts the sector and damages supply chains and manufacturing;
- Contribute to the renewable energy target;
- Reduce carbon emissions; and

[13] Air-source heat pumps exclude air-to-air and exhaust-air heat pumps

[14] Ground-source heat pumps (or ground-to-water heat pumps) is used to mean a heat pump that collects heat from the ground, water in the ground, or surface water.

- Make some contribution to tackling fuel poverty.

Eligible populations for RHPP1

The eligible[15] population for solar thermal under RHPP1 was households in England, Scotland or Wales (GB). Where the renewable heating technology being installed was ASHP, G/WSHP or a biomass boiler, the RHPP1 scheme was only open to households in England, Scotland or Wales that were not connected to the gas grid[16].

Applications could be made for more than one type of technology, for example ASHP and solar thermal.

Research Objectives

The analysis for the final report is focussed on the RHPP1 experience[17], described as follows:

- **Who are RHPP1 respondents?**
- **Why have they decided to install renewable heat technology?**
- **What are the experiences of installation?**
- **What are the initial views on their recently installed renewable heat technology?**
- **What are the views on their renewable heat technology several months after installation?**
- **How are they using their renewable heat technology?**
- **What lessons can be learnt to influence take up of renewable heat technology to the wider population?**

Although landlords and tenants could apply for RHPP1, the scope of the analysis was private householders i.e. owner-occupiers.

Methodology: post-installation and follow-up questionnaire

Two separate questionnaires were designed for owner-occupiers[18] applying through the householder voucher scheme. The questionnaires used for the research were designed by DECC and administered by the Energy Saving Trust in the form of an online census[19]. All private householders who redeemed their RHPP1 voucher following the installation of a renewable heat technology were sent a web link to the relevant questionnaire.

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[15] Additional criteria, for all the types of technology, applied to meet eligibility, including: the property having loft insulation to 250mm and cavity wall insulation where practical; the product and installer being certified under the Microgeneration Certification Scheme (MCS) (or equivalent).

[16] We refer to this throughout the report as 'off-grid'.

[17] See Appendix B for comprehensive list of research questions

[18] The questionnaire was designed by DECC for owner-occupiers to record motivations for installing renewable technologies and how it was used in practice. Although private landlords and tenants could apply, the questionnaires were not wholly applicable to them so data from these groups were not analysed or presented in this report.

[19] On-line was the only option offered for completion. As all voucher recipients were expected to complete the questionnaires, the exercise is considered as a census rather than a survey.

The first questionnaire, a post-installation (PI) questionnaire[20], was issued immediately after installation and consisted of 50 questions that focused on motivations for taking part in the scheme and experiences of installation. The second questionnaire, the follow-up (FU) questionnaire, was similar in length and focused on experiences and patterns of use. The follow-up questionnaire was issued four to nine months later to allow all participants to experience the use of the renewable heating system for a period of time during the winter before answering it. In practice, RHPP1 customers[21] who installed their renewable heating technology up to 31 January 2012 were issued with the follow-up questionnaire in May/June 2012 (Wave 1), with the remainder being issued in January and February 2013 (Wave 2). Data collected up to 19th February 2013 was included in the analysis.

Multiple applications could be made for RHPP1, where, for example both a heat pump and solar thermal system were being installed. Seven per cent of private households installed more than one type of technology and received a voucher for each, and therefore were invited to complete post-installation and follow-up questionnaires for each[22].

Applications received; questionnaires distributed; and returned questionnaires

While the scope of the study only includes owner-occupiers, for completeness the following section presents information on the total number of applications, installations and returned questionnaires at each stage, as detailed in Tables 1.1, 1.2 and 1.3 respectively. As shown in Table 1.1, a total of 6,129 owner-occupiers applied under the scheme, together with 222 landlords and 53 tenants.

Table 1.1 Number of households applying for vouchers under RHPP1 by technology

	Owner-occupiers	Landlords and tenants	Total
Number of households applying for vouchers under RHPP1 scheme	**6,129**	**275**	**6,403**
Applications by renewable heat technology			
Air Source Heat Pump	2,316	189	2,505
Biomass Boiler	942	35	977
Ground or Water Source Heat Pump	1,290	69	1,359
Solar Thermal	2,324	88	2,412
Total number of applications	**6,872**	**381**	**7,253**
Applications rejected	378	33	411
Vouchers expired	1,535	77	1,612

RHPP1 resulted in a total of 5,230 renewable heat technology installations and hence, the distribution of 5,230 questionnaires, as shown in Table 1.2. Of these, 4,959 questionnaires were sent to owner-occupiers, at 4,623 addresses, that is, 7% of owner-occupied households had more than one type of technology installed.

[20] Copies of the questionnaires are included in Appendix A

[21] In this report, people who received vouchers for their renewable heat installation are referred to as customers; people who completed the questionnaires are referred to as respondents.

[22] Therefore respondents may have completed up to four questionnaires; two at each stage

Table 1.2 Installations under RHPP1 by technology

	Owner-occupiers	Landlords and tenants	Total
Households issued with questionnaires	**4,623**	**201**	**4,824**
Applications by renewable heat technology			
Air Source Heat Pump	1,709	128	1,837
Biomass Boiler	707	26	733
Ground or Water Source Heat Pump	944	56	1,000
Solar Thermal	1,599	61	1,660
Number of questionnaires issued (installations under RHPP1 scheme)	**4,959**	**271**	**5,230**
Proportion of households with more than one voucher/installation per address	7%	26%	8%
Note: questionnaires were issued for each installation made			

Table 1.3 shows the number of questionnaires returned:

- 3,958 post-installation questionnaires were returned by 3,772 owner occupiers; and
- 2,734 follow-up questionnaires were returned by 2,694 owner occupiers.

Table 1.3 Post-installation and follow-up questionnaires returned

	Owner-occupiers	Landlords and tenants	Total
Number of households returning post-installation questionnaire	**3,772**	**137**	**3,909**
Responses by renewable heat technology			
Air Source Heat Pump	1,370	76	1,446
Biomass Boiler	602	20	622
Ground or Water Source Heat Pump	771	34	804
Solar Thermal	1,215	39	1,254
Total number of Post-installation questionnaires completed	3,958	168	4,126
Proportion of households with more than one completed questionnaire per address	5%	31%	6%
Number of households returning follow-up questionnaire	**2,694**	**65**	**2,759**
Responses by renewable heat technology			
Air Source Heat Pump	999	30	1,029
Biomass Boiler	446	13	459
Ground or Water Source Heat Pump	531	13	544
Solar Thermal	758	9	767
Total number of Follow-up questionnaires returned	2,734	65	2,799
Proportion of households with more than one completed questionnaire per address	1%	*	1%

Note: * denotes proportion greater than zero but less than 1%

Terminology

Please note: this report makes no further reference to data collected for landlords or tenants.

The results in this report are based on the responses to the two stages of questionnaire. Response rates for returned questionnaires were high and tests imply no bias arose from non-completion, hence the results in this report can be assumed to representative of renewable heat technologies installed under the RHPP1 scheme by owner-occupiers.

As shown in Table 1.3, the RHPP1 data set is complex, and includes several populations, who may be termed as 'respondents', 'responses', 'systems', or 'installations' depending on whether we are considering households, or technology types and whether the results are from the post-installation or follow-up questionnaire. Furthermore, the follow-up questionnaire was distributed in two waves, and results for these populations are disaggregated in some analyses. Results from the post-installation stage are termed 'PI' and from the follow-up stage, 'FU'.

For sections of the report that discuss characteristics of those who responded, for example age group, housing type, we refer to:

> **PI respondents** where results are based on the 3,772 households returning one or more post-installation questionnaires.

Where results are presented by a type of technology, each questionnaire response represents a person (respondent). The terminology is as per the following example:

> **PI ASHP respondents** refers to the 1,370 people who completed a post-installation questionnaire in relation to their Air Source Heat Pump.

Depending on the context, where results are presented for 'responses' or 'installations', this refers to the number of questionnaires returned:

> 3,958 PI responses or 3,958 PI installations; and
>
> 2,734 FU responses or 2,734 FU installations.

Sections of the questionnaires were aimed at sub-groups or particular types of renewable heat technology, for example, many questions only related to the technologies that provided heating for the home (i.e. ASHP, G/WSHP and biomass boilers). For these sub-groupings the number of respondents is the same as the number of technologies:

> 2,743 PI respondents where results are based on the ASHP, G/WHSP and biomass boiler installations; and
>
> 1,976 FU respondents where results are based on the ASHP, G/WHSP and

biomass boiler installations.

To further aid clarification, bases shown below charts and tables also define the population that is being referred to and from which questionnaire the results are derived.

Response Rates

A total of 4,959 post-installation questionnaires were issued, and 3,958 returned giving a response rate of 80%. Of the 4,959 follow-up questionnaires issued, 2,734 were returned giving a response rate of 55%. For those follow-up questionnaires issued in Wave 1 (May/June 2012) the response rate was slightly lower, at 54% compared with the 57% for Wave 2 (January/February 2013), as shown in Table 1.4.

The response rates differed slightly by the type of technology; 76% of those who received a post-installation questionnaire in connection with their solar thermal system returned it, while 85% of those who had installed a biomass boiler system had returned the questionnaire.

Table 1.4 Response rates by survey and technology

		Post-installation	Follow-up		
			Wave 1	Wave 2	All
Issued/ payments made	Air Source Heat Pump	1,709	1,068	641	1,709
	Biomass Boiler	707	409	298	707
	Ground or Water Source Heat Pump	944	578	366	944
	Solar Thermal	1,599	1,061	538	1,599
	Number of questionnaires issued (installations under RHPP1 scheme)	**4,959**	**3,116**	**1,843**	**4,959**
Questionnaires returned	Air Source Heat Pump	1,370	628	371	999
	Biomass Boiler	602	261	185	446
	Ground or Water Source Heat Pump	771	310	221	531
	Solar Thermal	1,215	491	267	758
	Total number of questionnaires returned	**3,958**	**1,690**	**1,044**	**2,734**
Response Rate	Air Source Heat Pump	80%	59%	58%	58%
	Biomass Boiler	85%	64%	62%	63%
	Ground or Water Source Heat Pump	82%	54%	60%	56%
	Solar Thermal	76%	46%	50%	47%
	Average Response Rate	**80%**	**54%**	**57%**	**55%**

Further detail on response rates can be found in Appendix B.

Using the scheme administration data, house type and other characteristics (for example, region of residence) of respondents to the post-installation and follow-up questionnaires has been compared to all households that were sent questionnaires, to understand whether there was any bias likely to arise from non-response. The results show that the proportions match very well for both questionnaires and it is concluded that there is no bias.

To test for any attitudinal bias amongst those who did and did not respond to the follow-up questionnaire at each wave, a comparison has been made of their level of satisfaction with the renewable heat technology at the post-installation questionnaire stage. There were no significant differences and no bias was detected. Further detail on this analysis can be found in Appendix C.

Limitations

Where more than one technology (typically one heating system plus solar thermal) had been installed, 56% of households responded to the post-installation questionnaire sent for each technology. Where just one questionnaire was returned this was generally for the renewable heating system in preference to the solar thermal technology (see Appendix C for details). This means that of the questionnaires distributed for solar thermal installations, the proportion returned was slightly smaller compared with the other technologies, but the differences are small and the study findings are unaffected.

Due to the drop in response rate for the follow-up questionnaire, it has not been possible to track perceptions of all households over time; however, the data from both questionnaires has been linked to track satisfaction levels at each stage.

The timing of the distribution of the follow-up questionnaire ensured a winter period was experienced before the questionnaire was completed. For those completing in May to July 2012 it may have been more difficult to recall performance and satisfaction with the renewable heat technology during the winter than those completing in January and February 2013.

A comparison of the characteristics of those households who have responded (to each questionnaire) and those who have not (non-response analysis) is provided in Appendix C. This does not suggest any bias, in either of the questionnaires, but it should be remembered that respondents were self-selecting.

Free text comments by some respondents suggested that in some areas, the questionnaire design had not allowed qualification to some answers provided, and there were instances where the respondent would have answered “not applicable” had that been an option. In particular, the data did not make clear which households were ‘new/self build’.

These questionnaires only covered an early part of the life of the installations. It will also be valuable to re-visit these households after a longer period, to understand whether the systems are performing reliably.

It is important to note that the questionnaire data reflects the householder’s perceived performance of renewable heat technologies. This research does not corroborate perceptions with actual performance data generated through the metering of heat pump installations which was beyond the scope of this study.

Analysis

The data from both questionnaires were appended to the scheme administration data using the unique voucher reference; hence the responses at the follow-up stage were matched with those from the post-installation questionnaire. The data was cleaned and validated, and secondary data sources were appended. Analysis was conducted using SPSS[23]. The approach to the analysis has been at different levels:

A) at the technology level: for example when looking at perceptions of biomass boilers, the base being the number of questionnaires returned for each of the technology types; and

[23] SPSS is one of the most widely used programs for statistical analysis in social science.

B) at the household or respondent level: for example when looking at demographics, the base being the number of individuals who returned one or more questionnaires[24].

For some analysis, the bases may be lower than the totals presented in Table 1.4 and this may be due to questionnaire routing where questions were not applicable, or questions were not answered. Significance tests have been applied, for example, to measure whether differences found between the different types of technology were statistically significant.

Margins of error around results increase as the number of cases reduces as shown in Table 1.5. More detail is provided in Appendix B. Differences between subgroups that are statistically different are stated as being 'significant' in the text.

Table 1.5: Example margins of error for a given number of cases

Number of cases	Margins of Error
2,401	2%
1,067	3%
600	4%
384	5%

Tables in this report presenting proportions show figures to no decimal places. Where columns do not sum to 100%, or sub-totals of figures do not apparently match precisely, this is due to rounding. Where more than one answer could have been given to a question (multiple response) the column proportions may sum to more than 100%. Where proportions are greater than zero but less than 0.5% these are denoted by *, while proportions equal to zero are denoted as 0%.

Several open ended questions were asked, including the reasons why renewable heating systems might be recommended, and advantages and disadvantages with the technologies. Where appropriate, the analysis is supported with quotes from respondents to illustrate key findings.

Report Structure

The report is structured around the following research questions:

Chapter 2 – Profile of PI respondents

- What are the characteristics of those returning the post-installation questionnaire and how do they compare to the eligible populations for each renewable heat technology?

Chapter 3 – Motivations for installing a renewable heating technology

- What are the motivations behind the decision to install renewable heat technology, including if, when and how RHPP1 influenced the choice?

Chapter 4 - Experiences of installation

- What was the experience of installation, and what are the views on any guidance provided?

Chapter 5 - Performance of renewable heat technology

[24] The SPSS data is in the format of one case per voucher/installation. Where results are applicable at the household or respondent level (for example, in analysis of demographic information), weights have been applied to the data for those households with multiple technologies, for example, where there are two technologies, a weight of 0.5 was applied, while those with one technology have a weight of 1. Further details can be found in Appendix B

- What are the views on the performance of renewable heat technology in relation to expectations, and have these views developed over time?

Chapter 6 - Living with renewable heat technology

- What is the experience of renewable heat technology in practice, including fuel sourcing and use of additional heating and energy?

Chapter 7 - Lessons learnt

- What lessons can be learned to influence take up of renewable heat technology to the wider population?

Further information and outputs from the analysis can be found in the Appendices.

2. Profile of Post-Installation (PI) Respondents

Compared with the eligible population for RHPP1, PI respondents lived in larger houses that were much more likely to be detached. They were less likely to be aged over 65, and more likely to be in employment. Average incomes were estimated to be 10 to 20% higher amongst PI respondents than the eligible population.

An overview of PI Respondents

PI respondents shared many common characteristics regardless of the type of technology they had installed:

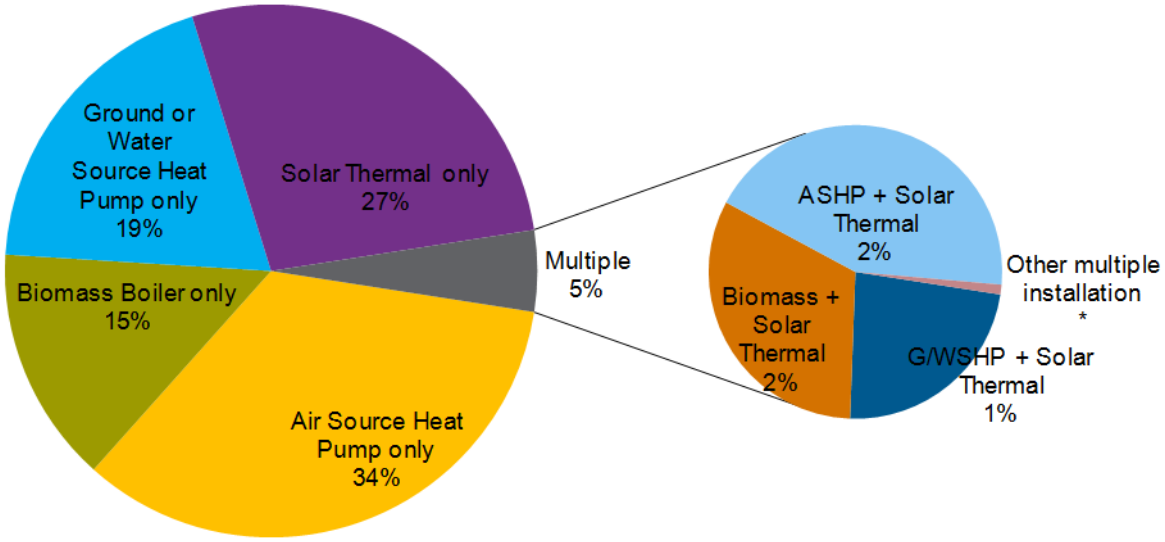
- Over half (56%) were aged between 45 and 64, and 18% were aged 65 or over;
- 68% were in employment;
- Almost half (46%) had incomes below £41,600, and almost a quarter (23%) had incomes over £72,000;
- Over four fifths, (83%) lived in detached properties and 13% lived in semi-detached properties;
- Less than half (44%) lived in two person households;
- 38% lived in four bedroom houses and 29% lived in houses with five or more bedrooms;
- Almost half (45%) had lived in the property for less than three years;
- A third (33%) of properties dated from 1990 or later.

In this section, the characteristics of PI respondents are investigated, and compared with the eligible populations for renewable heating technologies. The basis of the analysis is the 3,772 people who completed one or more post-installation questionnaires (PI respondents) unless otherwise stated.

Types of renewable heat technology

Figure 2.1 shows the response to post-installation questionnaires. One in twenty (5%) had multiple technologies, including 2% with both ASHP and solar thermal, and a further 2% with both biomass and solar thermal. Just over a third (34%) had just an ASHP, 27% had just solar thermal and 19% had just G/WSHP.

Figure 2.1 Questionnaire completion by type of technology
Source: PI questionnaire, Base: 3,772 PI respondents



Where more than one type of technology was installed (n=186), more than half (56%) completed a post-installation questionnaire for each. Where just one questionnaire of the two was completed this was most often for the heating system rather than the solar thermal. For example, of the 88 households sent questionnaires for both a G/WSHP and solar thermal, 43 returned a post-installation questionnaire for both technologies, while 26 returned a post-installation questionnaire for the G/WSHP only and just four people returned only the questionnaire relating to solar thermal.

Eligible populations for Renewable Heat Technology

The eligible[25] population for solar thermal under RHPP1 was households in England, Scotland or Wales (GB). To compare PI solar thermal respondents with the eligible population, data on home owners has been used, chiefly housing surveys, together with other data sources such as the Census.

Where the renewable heating technology being installed was ASHP, G/WSHP or a biomass boiler, the RHPP1 scheme was only open to households in England, Scotland or Wales that were not connected to the gas grid.

To compare the eligible population with respondents who had installed ASHP, G/WSHP or a biomass boiler, again, data on home owners from housing surveys has been used, as there is no single data source which fully describes the off-grid eligible population.

Gas meter data has been used to define areas as 'off-grid', based on the ratio of gas to electricity meters. Together with census data, this suggests that the proportion of owned homes in Great Britain (GB) that are off-grid is 7%. This varies by region, from 3% in the East Midlands, to 15% in South West England, 11% in Wales and 16% in Scotland.

[25] Additional criteria, for all the types of technology, applied to meet eligibility, including: the property having loft insulation to 250mm and cavity wall insulation where practical; the product and installer being certified under the Microgeneration Certification Scheme (MCS) (or equivalent).

Characteristics including age, employment status, income and housing stock of PI respondents have been compared with owner-occupier data taken to be representative of the eligible population.

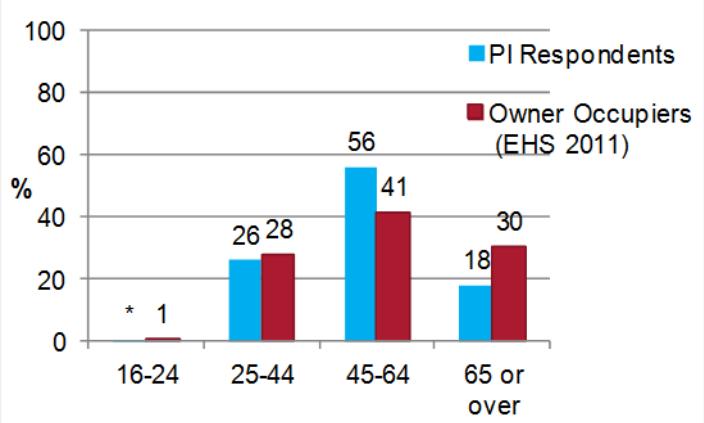
The geographic distribution of PI respondents is compared to the respective eligible populations, off-grid[26] and all GB.

PI Respondent characteristics compared with eligible population

Figure 2.2 shows the age groups of PI respondents, together with those for owner-occupiers (EHS 2011[27]). This shows that the proportion of PI respondents aged 45-65 is much higher (56% compared with 41%) than that of the eligible population. The proportion aged 65 or over is 18% for PI respondents, lower than the 30% for the eligible population.

Figure 2.2 Comparison of age of RHPP customers and owner occupiers in the EHS (2011)

Source: PI questionnaire,
Base 3,734 PI respondents; 38 refused to answer



The age profile of PI respondents is broadly consistent with their employment status; 68% are in employment and 26% are retired, compared with findings from the EHS which show 64% of the eligible population in employment and 32% as retired.

Average household incomes of PI respondents were estimated at £55,000 per annum[28], higher than the respective eligible populations[29] by between 10% and 20%.

PI respondents' housing characteristics

Comparing the size, age, and type of housing of PI respondents with the eligible population shows there were some differences.

[26] In the absence of robust data defining off-grid areas, for the purpose of this report, the ratio of gas to electricity meters within areas has been used. An area with a gas/electricity meter ratio of 0.8 or less is defined as off-grid. A map illustrating the distribution is presented in Appendix E. This does not however mean that houses in areas shown as on-grid necessarily have access to mains gas.

[27] EHS – English Housing Survey 2011 taken to represent GB

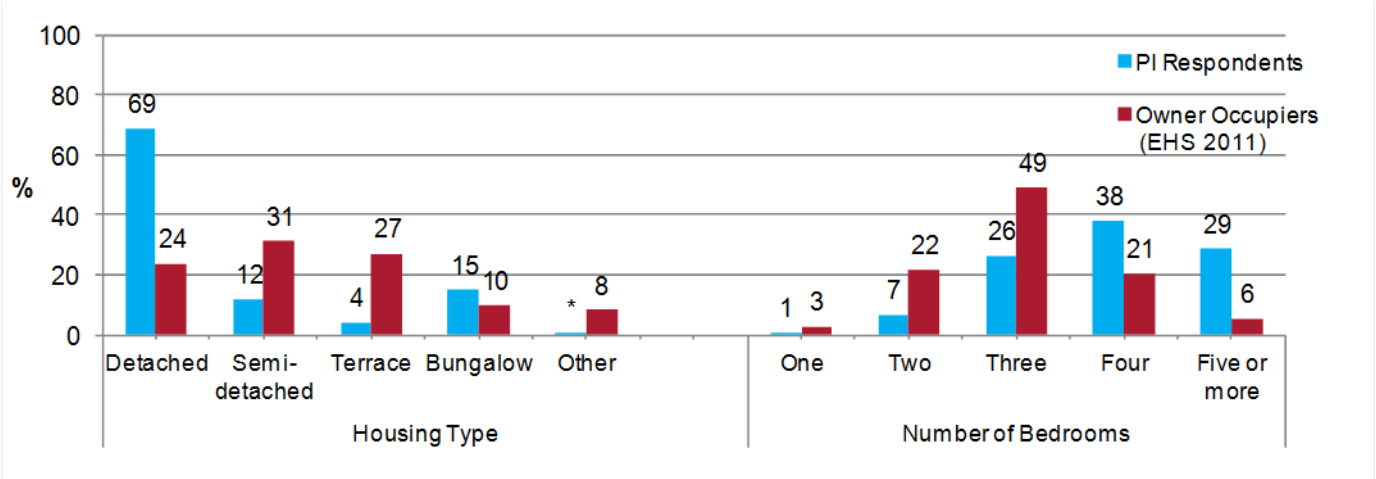
[28] As the questionnaires recorded income bands and not raw data, average incomes are estimated from the proportions in each band.

[29] Income data for home owners is available in general, but not broken down by on/off grid. For all individuals, rather than home owners, income has been estimated at being 8% higher for off-grid than for on. Hence the difference in incomes between the PI respondents and the eligible populations can only be estimated.

A third (33%) of PI respondents' houses were built since 1990; this is a much higher proportion than the 13% in the EHS. However, there was also a higher proportion of older houses, 28% of PI respondents' houses were built pre-1900 compared with 20% pre 1919 in the EHS.
The housing stock profile is very different for PI respondents than for owner-occupiers across England; 83% lived in detached properties (69% in detached houses and a further 14% in detached bungalows), compared with just 24% of detached houses in the eligible population. Other building types were under-represented by PI respondents, and especially terraced housing as shown in Figure 2.3.

Average house size was also much larger for PI respondents than would be expected from the EHS, as shown in Figure 2.3. Over a third (38%) of PI respondents lived in four bedroom houses and a further 29% in houses with five or more bedrooms; these proportions were much higher than for housing stock in England, where just 27% had more than three bedrooms.

Figure 2.3 Comparison of property type and number of bedrooms between RHPP customers who completed a post installation questionnaire and the owner occupiers in the EHS (2011)
Source: PI questionnaire, Base 3,772 PI respondents



Off Grid -PI heat pump and biomass boiler respondents - region of residence

More than three quarters (78%) of PI respondents with ASHP, biomass boilers or G/WSHP lived in rural areas, while the proportion of the rural off-grid homes eligible for these technologies is estimated at 65%. PI respondents appear to be over-represented in rural areas.

The regional distribution is shown in Figure 2.4. One in seven (14%) PI respondents with heat pumps or biomass boilers lived in Scotland, comprising;

- 4% PI G/WSHP respondents (shown in blue);
- 4% PI ASHP respondents (shown in yellow); and
- 6% PI biomass boiler respondents (shown in green).

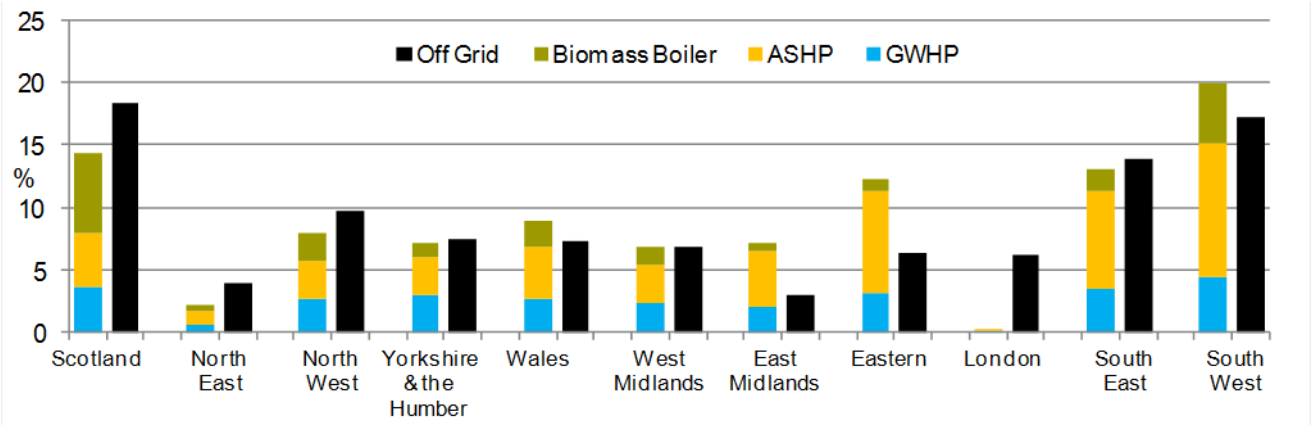
Almost a fifth (18%) of eligible (off-grid) homes are in Scotland (shown in black), a higher proportion than all PI respondents with heat pumps or biomass boilers, showing that these respondents are under-represented in Scotland. They are also under-represented in the North

East, North West, and in London[30]. However, PI respondents with heat pumps or biomass boilers are over represented in the South West, Eastern England, and the East Midlands.

The chart illustrates that PI ASHP respondents were relatively more prevalent in the south and east relative to PI G/WSHP and PI biomass boiler respondents, and PI biomass boiler respondents were relatively prevalent in Scotland.

Figure 2.4 Region of residence of RHPP customers compares to the off-gas population in Great Britain

Base Off Grid= Great Britain owned households, Base renewable heat technology= 2,557 households completing post-installation questionnaire where a renewable heat technology installed – excludes solar thermal



Post-installation solar thermal respondents in Great Britain - region of residence

Less than half (44%) of PI solar thermal respondents lived in rural areas, a much higher proportion than the 9% of eligible households in rural areas[31].

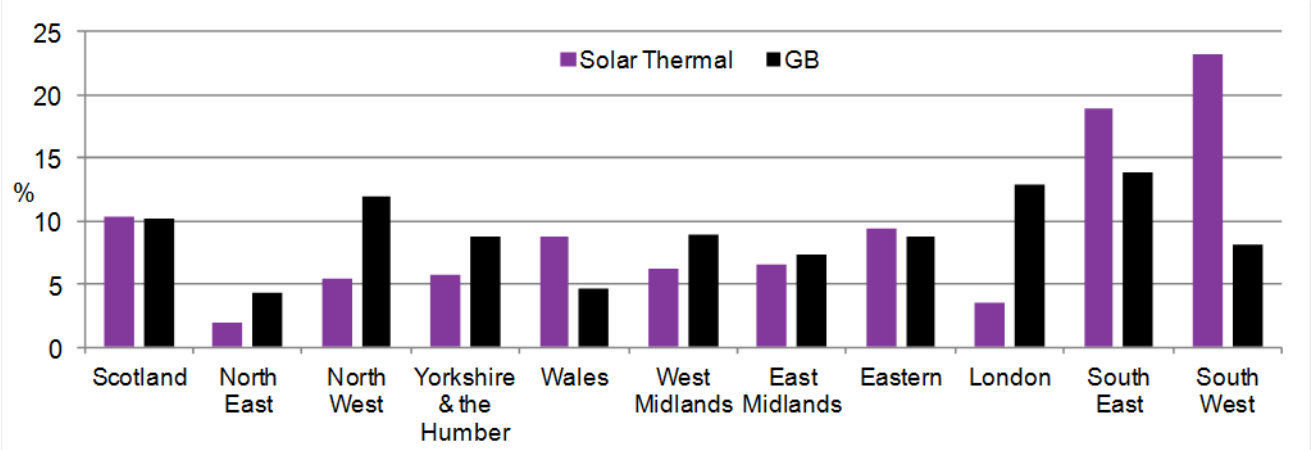
Figure 2.5 shows the distribution of PI solar thermal respondents (in purple), together with that for the eligible population (in black). This shows that PI solar thermal respondents were particularly over represented in the South West region, with 23% of respondents who installed solar thermal living there, compared with 8% by population.

PI solar thermal respondents were also over represented, but to a lesser extent in the South East, and Wales, and under-represented in the north of England (North East, North West, Yorkshire and the Humber).

[30] Note that the proportion of 'off-grid' properties in London includes high rise flats etc not connected to the gas grid

[31] Figures for England and Wales

Figure 2.5 Region of residence for solar thermal compared to all Great Britain owner occupied households
Base GB= Great Britain owned households, Base = 1,215 PI Solar Thermal respondents



Key characteristics of respondents installing each technology

In the following section, the key characteristics of PI respondents are explored for each of the technologies separately. The geographic distribution of the eligible populations is compared with distributions for each technology type.

Plots depict the distribution of those who completed the post-installation questionnaires.
In Appendix F, details can be found of the analysis[32] of household characteristics that are associated with the different types of technology.

Key Characteristics of PI Respondents with Air Source Heat Pumps

A quarter of PI ASHP respondents were located in the East Midlands and East regions and a further fifth (22%) in the South West of England, while compared with the off-grid population in the north of England, there were relatively few.

Over half (54%) were aged 45-64; almost two thirds (65%) were employed, and the average household income was £51,500.

Over four fifths (81%) lived in detached properties and a further 14% in semi-detached buildings. Homes were relatively new; 38% of buildings dated from 1990 or later. Over half (51%) had lived in their homes for less than three years. Most (69%) were not planning on moving while a fifth (20%) expected to move within ten years.

More than a third of (36%) lived in four bedroom houses and a further 31% in three bedroom houses. Almost half (48%) lived in two person households, and in 9% of households there were five or more people sharing the home.

[32] Based on logistic regression modelling (see Appendix F for details).

Key Characteristics of PI Respondents with Biomass Boilers

The distribution of PI Biomass Boiler respondents is shown on the plot (right). More than a quarter (29%) lived in Scotland, and a further 22% in the South West.
Over half, 59% were aged 45-64; almost three quarters (73%) were employed, and the average household income was £53,500.

Most (85%) lived in detached properties and a further 12% in semi-detached buildings. Almost half (47%) of the properties were built before 1900, and just 21% were built since 1990.

More than a third (34%) had lived in their property for less than three years, and more than a fifth (22%) had lived there more than 16 years. Only 10% planned on moving with the next ten years and 68% did not plan to move at all.

More than a third (37%) lived in four bedroom houses and a further 25% in houses with three bedrooms. Just over a quarter (26%) lived in four person households and 12% in households with more than five people.

Key Characteristics of PI Respondents with Ground or Water Source Heat Pumps

Almost a fifth (18%) of PI G/WSHP respondents lived in the East of England (East Midlands and East region) and a further 10% in Wales.

Over half, 55% were aged 45-64; almost three quarters (74%) were employed, and the average household income was £61,500.

Most (92%) lived in detached properties and a further 6% in semi-detached buildings. While almost a third (31%) of the properties were built before 1900, over half (51%) were built since 1990.

Almost a quarter (23%) had yet to move in to the property at the time of completing the questionnaire, and a further 36% had lived in their property for less than a year.

At least 40%of PI respondents who installed a G/WSHP did so in a new self-build[33] property.

More than a third (37%) of PI G/WSHP respondents lived in four bedroom houses and a further 34% in houses with more than four bedrooms. A quarter lived in four person households and 42% in two person households.

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[33] Note: it is not possible to be certain of the proportion of new self-build properties as this was not recorded in the questionnaire; however, the proportion shown is estimated from responses to other questions, including open comments which made reference to the property being new build.

Key Characteristics of PI Respondents with Solar Thermal

Of the 1,215 PI solar thermal respondents, almost a quarter (23%) lived in the South West, and a further 19% lived in the South East.

Over half (57%) were aged 45-64; almost two thirds (65%) were employed, and average household incomes were around £54,500.

Most (80%) lived in detached properties and a further 14% in semi-detached buildings. Over a third (35%) of the properties were built between 1950 and 1989, and a further 24% were built since 1990.

Almost half (45%) lived in four bedroom houses and a further 24% in houses with three bedrooms. Almost half (44%) lived in two person households and almost a quarter (23%) in four person households.

Almost a third (31%) had lived in their property for less than three years, and more than a fifth (21%) had lived there more than 21 years. Only 16% planned on moving with the next ten years and 61% do not plan to move at all.

3. Motivations for installing a renewable heating technology

Environmental factors, including self-sufficiency, were high on the list of factors influencing the decision to install a renewable heating system. However, saving money, off-setting rising fossil fuel prices and the availability of funding were all contributing factors.

An overview of Motivations

- Almost four fifths (79%) of renewable heating technology installations were motivated by rising fuel prices;
- A similar percentage (78%) resulted from a desire to help the environment;
- A wish to save money was an influential factor for just under three-quarters (72%) of installations;
- Two thirds (68%) of installations arose from a desire to reduce dependence on fossil fuels;
- Three fifths (60%) of installations were motivated by the perception that it was a more efficient heating technology compared to a previous heating system;
- The availability of a grant and/or funding, was a key motivation to install 53% of renewable heating technologies. However, it is not clear whether this referred specifically to the RHPP1 voucher payment or future RHI payments;
- However, most (74%) installations were likely to have gone ahead without a grant. The cost of renewable heating systems was largely met through savings.

In this section, the motivations for switching to renewable heat technologies are explored. The results are based on the 3,958 post-installation questionnaire responses.

What are the motivations for installing a renewable heat technology?

The PI questionnaire presented a comprehensive list of possible factors which may have been influences or motivations to install a renewable heating system as part of the RHPP1 Scheme. All applicable responses could be chosen from the list.

The full list of responses is given in Table 3.1. This is colour coded, showing highest proportions in green and smallest proportions in red. The responses are grouped around themes (environment, self-sufficiency, saving money, preference, opportunity), and are shown for each type of technology as well as for all technologies combined.

As shown in Table 3.1, almost four fifths (79%) of installations of a renewable heat technology were motivated by rising fuel prices. A similar percentage (78%) were driven by a desire to help the environment. A wish to save money was an influential factor for just under three-quarters (72%) of installations. For two thirds (68%) of installations, a desire to reduce dependence on fossil fuels was a motivation. Three fifths (60%) of installations arose from a perception that a

renewable heating was a more efficient heating technology than a previous systems. The availability of a grant and/or funding, for example the RHPP1 voucher payment and future RHI tariff, was a key motivation for over half (53%) of renewable heat technology installations.

The top five reasons in order of importance by type of renewable heating technology are summarised below;

PI **Biomass Boiler** Respondents

- Rising prices of fossil fuels (85%);
- It helps the environment (84%);
- Reduce my dependence on fossil fuels (78%);
- Save money (73%);
- Could get funding/grant and reduce carbon emissions (68%).

PI **G/WSHP** Respondents

- It helps the environment (77%);
- Rising prices of fossil fuels (77%);
- It's more efficient (68%);
- Save money (67%);
- Reduce my dependence on fossil fuels (64%).

PI **ASHP** Respondents

- Rising prices of fossil fuels (78%);
- It helps the environment (73%);
- Save money (72%).
- It's more efficient (69%);
- Reduce my dependence on fossil fuels (65%).

PI **Solar Thermal** Respondents

- It helps the environment (83%)
- Rising prices of fossil fuels (77%);
- Save money (76%);
- Be more self-sufficient (73%)
- Reduce my dependence on fossil fuels (69%).

Figure 3.1 Reasons for installing renewable heating systems by technology

Theme		G/WSHP %	ASHP %	Biomass boiler %	Solar thermal %	All technologies %
Environment	Reduce my dependence on fossil fuels	64	65	78	69	68
	Diminishing global supply of fossil fuels (e.g. oil)	46	44	58	49	48
	It helps the environment	77	73	84	83	78
	Reduce my carbon emissions	49	56	68	62	58
Self-Sufficiency	Able to generate my own energy	37	26	22	62	39
	Be more self sufficient	60	41	47	73	55
Saving money / financial	Save money	67	72	73	76	72
	Rising prices of fossil fuels (e.g. gas, oil)	77	78	85	77	79
	Had funding available	22	20	23	29	23
	Could get funding/grant	54	54	68	45	53
	Free installation	0	*	0	*	*
Preference	As a more reliable energy supply	48	43	44	24	38
	It's more efficient	68	69	58	44	60
	I like the technology	43	42	45	42	43
	Liked the look of it	8	7	16	4	8
	Recommended by friend	11	10	6	7	9
	Recommended by plumber or installer	10	15	12	7	11
	Saw technology in action elsewhere	15	16	17	12	15
	Make my home warmer	31	26	37	9	24
Opportunity	Needed to replace heating system	27	35	42	19	29
	Building a new home	40	22	6	11	20
	Upgrading home	24	27	29	34	29
	Refurbishment	22	20	19	15	19
	Local community project	0	*	*	1	*
	Other, please specify	5	7	7	6	6
Base		**771**	**1,370**	**602**	**1,215**	**3,958**

Source: Post installation questionnaire, Base 3,958 responses/installations
Respondents were able to select more than one option or factor, hence proportions sum to more than 100.
Colour scale shows highest proportions in green and smallest proportions in red

As shown in Table 3.1, environmental factors, including self-sufficiency, were high on the list of factors influencing the decision to installing renewable heating systems. However, saving money, off-setting rising fossil fuel prices and the availability of funding were all contributing factors. These are explored below.

Environment

More than half (51%) of PI respondents strongly agreed that they were concerned about the impact of carbon emissions on the environment, and a further 37% agreed. Similarly, 42% strongly agreed that they would 'like to be green', with a further 42% agreeing with this.

As shown in Table 3.2, there were some differences amongst respondents with different technologies. PI solar thermal and PI biomass boiler respondents were significantly more likely to agree with each statement than PI G/WSHP or PI ASHP respondents.

Figure 3.2 Environmental motivations of PI Respondents

	I am concerned about the impact of carbon emissions on the environment				I like to be green			
	G/WS HP %	ASHP %	Biomass boiler %	Solar thermal %	G/WS HP %	ASHP %	Biomass boiler %	Solar thermal %
Strongly agree	48	47	59	55	38	39	48	45
Agree	39	41	34	33	43	44	39	41
Neither agree or disagree	11	11	7	10	17	15	12	13
Disagree	1	1	1	1	1	1	1	1
Strongly disagree	1	1	0	1	1	1	0	1
Base	**771**	**1,370**	**602**	**1,215**	**771**	**1,370**	**602**	**1,215**

Source: Post installation questionnaire, Base 3,958 responses/installations

Saving money

As shown in Table 3.3, saving money was a very important consideration in 48% of installations and important for a further 45%. As well as environmental concerns, the majority (79%) of PI respondents strongly agreed that they were concerned about fuel prices, with a further 19% agreeing.

Figure 3.3 How important a consideration was saving money when you decided to install your renewable heating system?

	G/WSHP %	ASHP %	Biomass boiler %	Solar thermal panels %	All technologies %
Very important	50	51	46	43	48
Important	43	43	45	47	45
Not important	6	5	8	9	7
Not at all important	1	*	*	*	*
Don't know	1	*	1	*	*
Base	**771**	**1,370**	**602**	**1,215**	**3,958**

Source: Post installation questionnaire, Base 3,958 responses/installations

Almost one in five (18%) of PI biomass boiler respondents were not sure if their renewable heating technology would save them money in the long run, while 79% thought it would and 3% thought it would not. PI solar thermal respondents were most confident that their renewable heat technology would save them money; 86% thought it would and just 12% did not know, as shown in Table 3.4.

Figure 3.4 Do you think your new heating system will save you money in the long run?

	Ground or water source heat pump %	Air source heat pump %	Biomass boiler %	Solar thermal panels %	All technologies %
Yes	82	80	79	86	82
No	2	2	3	3	2
Don't know	16	17	18	12	16
Base	**771**	**1,370**	**602**	**1,215**	**3,958**

Source: Post installation questionnaire, Base 3,958 responses/installations

Availability of Funding

While saving money in the long run was important, the availability of funding or a grant towards the installation cost was an important factor in over half (53%) of all renewable heat technology installations. This proportion was higher (68%) for PI biomass boiler respondents.

It is worth noting that it is not clear whether availability of funding or a grant referred specifically to the RHPP1 voucher payment or future RHI payments. What is clear is that an incentive of some sort did influence the decision to take up a renewable heat technology. However, almost three quarters (74%) of installations were likely to have gone ahead without the premium payment from RHPP1, as shown in Table 3.5.

In the absence of RHPP1, 24% of renewable heating installations were unlikely to have gone ahead. The availability of an RHPP1 grant made more of a difference to PI biomass boiler respondents; 35% reported that they would have been unlikely to have made the installation without it.

Figure 3.5 Likelihood of installation without RHPP1 by renewable heat technology

	Ground or water source heat pump %	Air source heat pump %	Biomass boiler %	Solar thermal panels %	All technologies %
Very likely	29	30	21	36	30
Fairly likely	43	46	43	42	44
Fairly unlikely	18	16	24	15	17
Very unlikely	7	6	10	6	7
Don't know	3	3	2	2	2
Base	**771**	**1,370**	**602**	**1,215**	**3,958**

Source: Post installation questionnaire, Base 3,958 responses/installations

The perceived costs of the renewable heating systems (including the cost of the technology and the cost of installation[34]) are shown in Table 3.6. The mean and median costs, together with the 5th and 95th percentiles, which represent the band between which 90% of installation costs fell are shown.

Nine out of ten G/WSHP installations cost between £7,000 and £43,000; this renewable heat technology had the highest mean installation cost (£21,000). Half of PI ASHP respondents reported costs of more £9,000, and one in twenty PI ASHP respondents had installation costs of £20,000 or more. For biomass boilers, the mean cost was £14,000, and for solar thermal installations the mean cost was £5,000, with 90% of installations costing between £2,000 and £8,000. The proportion of the cost covered by the RHPP1 voucher[35] varied widely, but compared to the mean, it covered approximately nine per cent of the installation cost.

[34] Based on 1,880 PI respondents where cost information was validated (i.e. outliers removed).

[35] The value of the vouchers were: £300 for solar thermal; £850 for ASHP; £950 for biomass boilers; and £1,250 for G/WSHP.

Figure 3.6 Distribution of installation costs by renewable heat technology

	Ground or water source heat pump %	Air source heat pump %	Biomass boiler %	Solar thermal panels %
Mean	£21,000	£10,000	£14,000	£5,000
Median	£19,000	£9,000	£13,000	£4,000
Fifth percentile	£7,000	£5,000	£5,000	£2,000
95th percentile	£43,000	£20,000	£27,000	£8,000
Base	**252**	**608**	**308**	**712**

Source: Post installation questionnaire, Base: 1,880 PI respondents who provided cost information
Shown to nearest £1000

As well as the RHPP1 voucher payment, other funding sources used to purchase and install a renewable heat technology were savings, used by 81% of PI respondents, mortgages (16%) or another type of loan/borrowing (7%).

Opportunity to install a renewable heat technology

As shown earlier in Table 3.1, the opportunity to install a renewable heat technology while building a new home was a motivation for around a fifth (20%) of installations.

A similar number of installations were undertaken as part of a refurbishment (19%) or upgrade (29%) to the home. Two fifths (40%) of PI G/WSHP respondents said they decided to install a renewable system because they were building a new home.

More than a quarter (29%) of renewable heat technologies were installed when an existing heating system needed to be replaced[36]. However, almost half of installations (46%) were made in spite of the previous system working well, while just six per cent of installations replaced broken systems, indicating that the decision to install a renewable technology was planned, rather than as a result of an emergency.

More than a third (34%) of PI respondents had lived in their property for less than a year. It would appear that moving to a new home can be a catalyst for replacement of heating systems or, in the case of new (self)-build, taking the opportunity to install a renewable heat technology.

[36] Recent analysis shows that people prefer to replace their existing or current heating system with a newer version of the one they currently have.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191541/More_efficient_heating_report_2204.pdf

4. Experiences of Installation

The majority of installations were easy to arrange. The provision of information on operation of the systems could be improved, although some was provided to nearly all users. Help to make best use of the systems is the main need.

An Overview of Installation Experience

- 73% of installations of renewable heating systems were perceived to be easy;
- Support was provided by suppliers for 86% of installations, usually in a written format, but more information or support was needed for a fifth of installations (21%);
- Most PI respondents had previously already addressed home insulation prior to replacing a renewable heating system: 85% already had loft insulation, 52% of households had cavity wall insulation.

In order to achieve increased levels of penetration of domestic renewable heat technologies, it is important to learn from the experiences of those who have installed them. In this section, the experiences of installation are summarised, based on the 3,958 responses to the post-installation questionnaire.

Ease of arranging installation

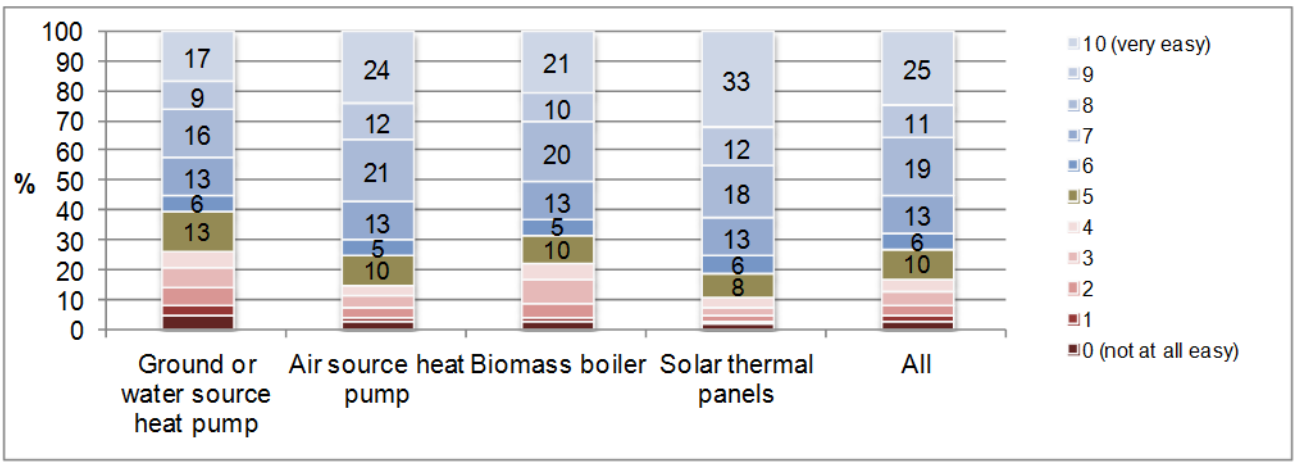
Experiences of arranging installation show that this is not a barrier to the uptake of a renewable heat technology. On a scale of ease of arranging installation from 0 to 10, a quarter of installations were rated as 'very easy' (rating 10); a further 30% were scored at 8 or 9 and 18% at 6 or 7, giving 73% overall being considered as 'easy' (scores 6 to 10). Just three per cent of installations were found to be not at all easy (score of 0).

Figure 4.1 shows the relative ease of arranging installation for the renewable heating systems, and shows that compared with 73% of all technologies found easy[37] to arrange:

- More (82%) PI solar thermal respondents found installation easy to arrange;
- Fewer (61%) PI G/WSHP respondents rated installation easy to arrange;
- Fewer (69%) PI respondents who were installing a renewable heat technology in a new (self) building found it easy to arrange; and
- Fewer (57%) PI G/WSHP respondents who were installing their system in a new (self) building rated installation easy to arrange.

[37] Scores of 6 to 10 are aggregated as equivalent to 'easy'

Figure 4.1 Ease of arranging installation of a renewable heat technology



Bases 771, 1370, 602, 1215, 3958

Source: Post installation questionnaire, Base 3,958 responses/installations

Information received

A handbook had been provided with 72% of installations, and more than one type of written information had been provided with 35% of installations.

Some form of written information on how to use the renewable heating system had been provided with 86% of installations, and where provided, it was felt to be sufficient in 72% of cases, but not sufficient for 21% of installations.

Of the 89% of PI biomass boiler respondents who received written information, the proportion feeling it was not sufficient was significantly higher, at 24%, suggesting that their information needs were greater.

A personal explanation from the supplier/installer was given for 91% of installations at the time of installation, ranging from 87% for PI G/WSHP respondents, to 96% of PI biomass boiler respondents.

Most (82%) PI biomass boiler respondents were satisfied with the level of explanation while 14% were not; very similar to the proportions of PI solar thermal respondents, but satisfaction with the level of explanation was lower for:

- PI G/WSHP respondents; 74% satisfied and 20% not satisfied; and
- PI ASHP respondents; 75% satisfied and 19% not satisfied.

Overall this suggests that there was some room for improvement in the provision of useful information by installers, but as this is a relatively new industry it is possible that improvements have been made since the questionnaires were completed.

Energy Efficiency Measures

One of the eligibility criteria for RHPP1 was that the property should have loft insulation to 250mm and cavity wall insulation where practical. Two fifths (40%) of PI respondents said they had one or both of these measures installed in their home at the same time as the renewable heating technology in order to meet this requirement.

For those PI respondents who had not installed either measure at the time:

- 90% had loft insulation prior to applying for RHPP1;
- 58% had cavity wall insulation prior to applying for RHPP1.

After installation of their renewable heating system, 97% of PI respondents had loft insulation in place. Of the three per cent that did not apparently have any loft insulation, about half were in new self-build properties, leaving up to one per cent of post-households with apparently no loft insulation[38].

Overall, 52% of PI respondents already had cavity wall insulation, and 13% said they installed it at the same time as installing renewable heating systems. A further three per cent had not yet moved in and eight per cent had previously installed solid wall insulation. Allowing for properties built pre-1930, which were unlikely to have cavity walls, it appears that up to seven per cent of PI respondents have not installed cavity wall insulation where possible, and as required to meet the eligibility requirements of the RHPP1. These findings could be as a result of respondents misunderstanding or incorrectly completing the questionnaire.

[38] Note: some open comments recorded on the questionnaire indicated that the property type or age meant that the questions were not applicable or needed qualification which was not possible when completing the questionnaire; hence the apparent proportions without insulation may be overstated.

5. Performance of Renewable Heat Technology

Satisfaction with the renewable heating technology was high; 91% shortly after installation, and 92% some time afterwards.

An overview of experiences of performance

At the follow-up questionnaire stage:

- Advice or guidance had been required for 54% of installations, including how to get the best out of the system (31%);
- 9% of installations had experienced manufacturing faults (5% in Wave 1, and 16% in Wave 2);
- 14% of installations had experienced installation faults (9% in Wave 1, and 21% Wave 2).

At the follow-up questionnaire stage, for renewable heating systems that provided heating for the home (ASHP, G/WSHP and biomass boilers);

- The systems were perceived to provide enough heat; around 89% said the temperature was about right even on the coldest nights and 88% were satisfied with the time taken to get to the desired temperature in winter;
- However, over the slightly colder winter of 2012/13, there was a slight increase in the proportion of FU ASHP and FU biomass boiler respondents who said they had been too cold on the coldest days.

More than a quarter (27%), of FU solar thermal respondents were dissatisfied with the amount of hot water from their panels in winter, but this may be that their expectations were unrealistic.

Most (90%) of FU respondents would recommend renewable heat technologies to others, albeit with some caveats in some cases.

In order to achieve increased levels of penetration of domestic renewable heat technologies, it is valuable to learn from experiences of users. In this section, initial views on the recently installed renewable heat technology are examined, in terms of ease of use and propensity to recommend to others, and how perceptions have changed, if at all, several months after installation. Results in this section are drawn from both the PI and FU questionnaires.

Overall satisfaction

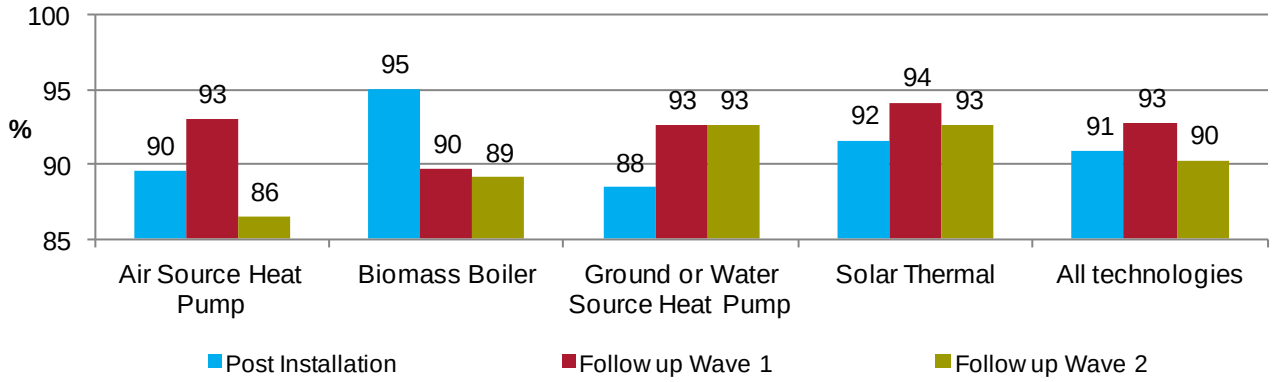
Satisfaction levels[39] were high, both when responding to the post-installation questionnaire (91% satisfied) and after several months at the follow-up questionnaire stage, as shown in Figure 5.1, but with an overall drop for FU biomass boiler respondents over time, and an overall increase for FU solar thermal and G/WSHP respondents. The differences however are very small, and vary between Wave 1 and Wave 2 of the follow-up questionnaire[40].

[39] The proportion 'satisfied' is the sum of those saying very satisfied and fairly satisfied

[40] The proportion 'satisfied' is the sum of those saying very satisfied and fairly satisfied

Comparing satisfaction over the two waves, satisfaction was slightly lower (90%) for those responding following winter of 2012/13 (when the average temperature was slightly lower[41]) than for winter 2011/12 (93%), except for FU G/WSHP respondents where it remained at 93% for both Waves.

Figure 5.1 Proportion (chart) and counts (table) of householders satisfied with renewable heat technology after installation



Bases /Source	Post-installation	Follow up Wave 1 Following winter 11/12	Follow up Wave 2 Following winter 12/13
Air Source Heat Pump	1,370	629	370
Biomass Boiler	602	262	184
Ground or Water Source Heat Pump	771	313	218
Solar Thermal	1,215	494	264
All responses	3,958	1,690	1,044

Dissatisfaction was low; just 2% (n=60) at the PI stage, and 4% (n=112) at the FU stage.

Tracking respondents over both questionnaires, by proportion:

- 66% had no change in their level of satisfaction since completing the post-installation questionnaire;
- 17% had an increase in their level of satisfaction; and
- 17% had a decrease in the level of satisfaction.

Analysis of data over both questionnaires has shown that there were some factors that could be associated with the decreases in satisfaction observed, including the need to seek advice, and especially where the advice was not satisfactory, and where there were faults with the systems. However, the proportions affected by these issues were in a minority. Experiences of performance are now explored.

Ease of operation

At the post-installation stage, for almost two fifths (39%) of installations, operating the renewable heating system was found to be easier than the previous fossil fuel system and more difficult for 14% of installations as shown in Table 5.1. However, these proportions differed for PI biomass boiler respondents; 27% found it easier and 26% found it more difficult.

[41] Source: metoffice.gov.uk/climate: mean temperature Dec/Jan/Feb 2011/12 4.5 degrees C, Dec/Jan/Feb 2012/13 3.3 C

Table 5.1 Reported ease of use (compared to previous system) by technology

	G/W heat pump	Air source heat pump	Biomass boiler	Solar thermal panels	All technologies %
Much easier	21	20	14	19	19
Easier	22	19	13	22	20
About the same	30	37	44	46	40
Difficult	12	15	24	7	13
Very difficult	2	2	2	*	1
Don't know	14	7	4	6	8
Base	**771**	**1,370**	**602**	**1,215**	**3,958**

Source: Post installation questionnaire, Base 3,958 responses/installations

The type of fuel displaced impacted significantly on the perceived comparative ease of operation of the newly installed renewable heat technology, see Table 5.2. Modern biomass systems appear to be easier to operate than older solid fuel systems, but not as easy as older oil central heating. Heat pumps were regarded as easier than the systems replaced, especially where this was solid fuel.

In 75% of the installations where solid fuel had previously been used, the renewable heating system was felt to be easier to operate. Where oil central heating had been previously used, ease of operation was easier for 30% of installations, about the same for 44%, and more difficult for 19% of installations. Where biomass boilers had replaced oil however, the proportion of installations found to be more difficult to operate was 31%.

Table 5.2 Ease of operation compared to oil central heating and solid fuel

	G/W heat pump		Air source heat pump		Biomass boiler	
	Oil central heating %	Solid fuel %	Oil central heating %	Solid fuel %	Oil central heating %	Solid fuel %
Much easier	17	43	15	53	6	54
Easier	20	33	19	20	11	21
About the same	37	8	45	14	50	13
Difficult	12	5	14	7	29	4
Very difficult	1	0	2	1	2	1
Don't know	13	10	5	6	3	6
Base	**466**	**60**	**826**	**87**	**386**	**67**

Source: Post installation questionnaire, Base 1,678 installations where oil replaced, 214 installations where solid fuel replaced

Guidance and advice on system

As shown in Table 5.3, advice or guidance had been required for over half (54%) of installations when questioned at the FU stage. This proportion was significantly lower for FU solar thermal respondents (31%), and higher for FU biomass boiler respondents (68%).

Table 5.3 Need for advice, guidance or assistance with the technology since installation

	G/W heat pump %	Air source heat pump %	Biomass boiler %	Solar thermal %	All technologies %
Not needed Advice	39	39	32	69	46
Needed Advice	61	61	68	31	54
Base (follow-up questionnaire)	**531**	**999**	**446**	**758**	**2,734**
Asked for more advice on getting the best out of the system	39	37	38	14	31
The installer/manufacturer contacted me to check everything was OK	11	10	16	6	10
Manufacturing fault	8	10	17	2	9
Installation fault	14	16	17	10	14
Other	12	12	15	8	11
Base	**531**	**999**	**446**	**758**	**2,734**

Type of advice requested was multiple response
Source: Follow-up questionnaire, Base 2,734 responses/installations

The type of advice most sought was how to get the best out of the system, by 14% of FU solar thermal respondents, and for between 37% and 39% for the other technologies.

Almost one in ten (9%) installations had experienced a manufacturing fault at the follow-up stage and 14% an installation fault. Analysis of the open comments made shows that the main issues mentioned by those FU respondents affected by installation or manufacturing faults included:

- A reluctance or inability from the installer/manufacturer to rectify problems;
- Poor after sales service; and
- A perception that installers were not as trained or competent as they should be.

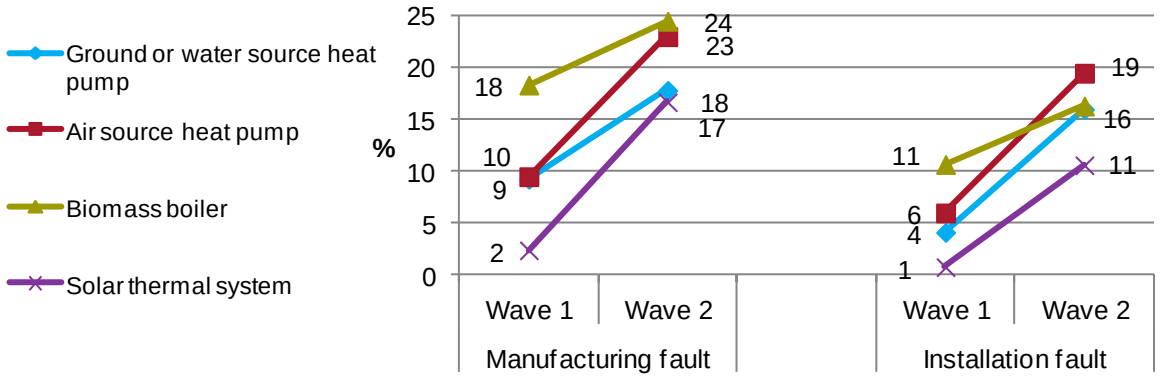
There were differences between Waves 1 and 2 in the proportion of installations where a need for guidance arising from manufacturing faults arose:

- 5% of 1,690 installations (Wave 1); and
- 16% of 1,044 installations (Wave 2).

Similarly, reports of installation faults increased from 9% to 21% of installations from Wave 1 to Wave 2. These increases were similar across all types of technology, as shown in Figure 5.2. This is possibly as a result of there having been a longer period of operation for the respondents in Wave 2[42].

[42] Respondents to Wave 1 of the follow-up questionnaire will have had installations for between 3 and 12 months; for Wave 2 the period between installation and responding to the questionnaire will have been at least 9 months. Distribution of the types of technology was very similar for both Waves.

Figure 5.2 Proportion of installations with faults by wave of follow-up questionnaire



Base	Ground or Water Source Heat Pump	Air Source Heat Pump	Biomass Boiler	Solar Thermal
Wave 1	310	628	261	491
Wave 2	221	371	185	267

Source: Follow-up questionnaire, Base 2,734 responses/installations

Issues with installation were in the minority, but occurred across all the technologies, for example.

> "One installer knew how to install solar panels, another installer knew how to install boilers and hot water tanks, but neither knew how best to set up a thermal store run from a solar panel with a boiler backup." (Solar thermal system, Hot water only, Fairly dissatisfied)

> "After 18 months, the system is still not giving out the heat needed at times when the outside temperature goes below 3-4 degrees Celsius". (Ground or water source heat pump, Heating and hot water, Very dissatisfied)

> "We continue to have significant problems with the basic functionality / reliability of the system (9 months after the installation). The installer has gone into liquidation before the system was debugged or commissioned, leaving us with many problems" (Air source heat pump, Heating only, Very dissatisfied)

The number of complete system failures amongst all follow-up questionnaire respondents was very small, (n=2) and, as shown in the following section, perceptions of renewable heat technologies were positive in many aspects.

A typical comment from a heat pump respondent on operation was:

> "Easy to use. Minimal amount of maintenance needed. No need to order gas or oil" G/WSHP

Performance of renewable heating systems (ASHP, G/WSHP and biomass boilers)

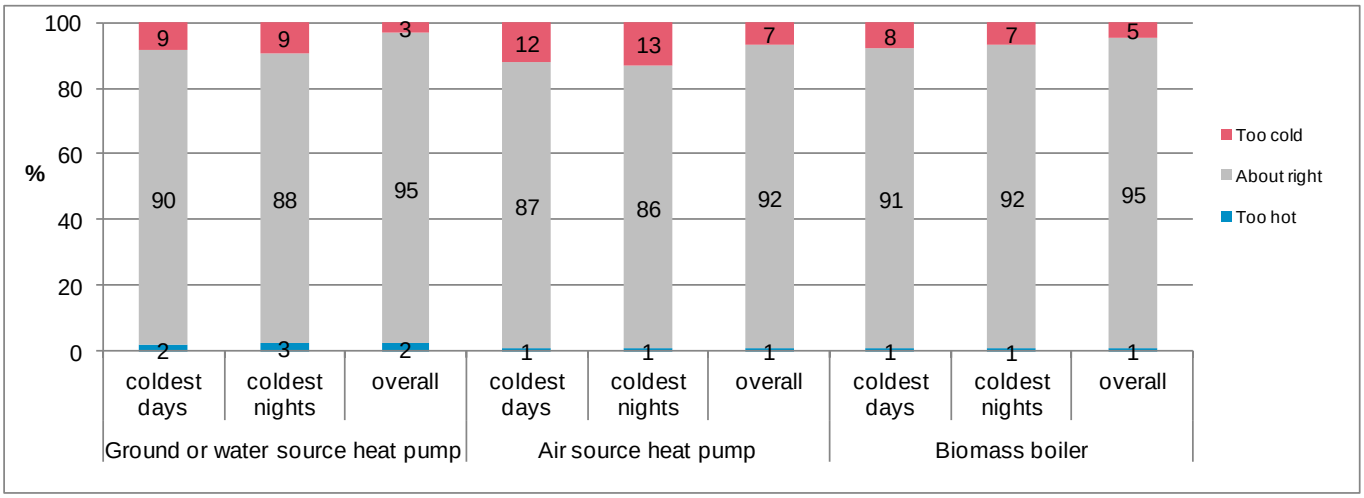
For 84% of systems that provided heating (i.e. ASHP, G/WSHP and biomass boilers) the time taken to achieve the desired level of comfort in winter was satisfactory[43].

[43] Based on the follow-up questionnaire

For achieving the right temperature, the renewable heating system had performed adequately in most cold conditions. As shown in Figure 5.3, each heat technology achieved the right temperature:

- For between 87% and 91% of FU respondents on the coldest days;
- For between 85% and 92% of FU respondents on the coldest nights; and
- For between 92% and 95% of FU respondents over all time periods.

Figure 5.3 Performance of renewable heat technology – achieving temperature



Base	499	493	508	962	945	967	436	431	439

Source: Follow-up questionnaire, Base: 1,976 FU respondents with heating technology (i.e. excluding solar thermal)

The heating technologies did not deliver sufficient heat in all cold conditions; 3% of FU G/WSHP respondents said they were too cold overall, but 9% were too cold on the coldest nights and the coldest days. The proportions were higher for FU ASHP respondents; 7% were too cold overall, and 13% on the coldest nights and days.

When broken down by the time of answering, the proportions who felt too cold increased between Waves 1 and 2 of the follow-up questionnaire:

- On the coldest days (12% Wave 2), compared with 9% for FU Wave 1 respondents; and
- Too cold overall (7% Wave 2), compared with 4% for FU Wave 1 respondents.

The performance of G/WSHP installations did not vary significantly between Waves 1 and 2 of the follow-up questionnaire. However, there were significant differences between Wave 1 and Wave 2 in the proportions feeling too cold for those with ASHP and biomass boilers, as shown in Table 5.4.

While 10% of FU Wave 1 ASHP respondents felt too cold on the coldest days, 15% of FU Wave 2 ASHP respondents did so. Similarly, 6% of FU Wave 1 biomass boiler respondents felt too cold on the coldest days, 15% of FU Wave 2 biomass boiler respondents did so. This may be that the winter of 2012/13 experienced by FU Wave 2 respondents was slightly colder than the previous winter experienced by FU Wave 1 respondents.

Table 5.4 Impact of winter temperature on perceived performance of ASHP and biomass boilers

Dec/Jan/Feb	Winter 2011/12		Winter 2012/13	
Average temperature (Deg C)	4.5 degrees		3.3 degrees	
Too cold / much too cold on...	ASHP %	Biomass Boiler %	ASHP %	Biomass Boiler %
The coldest days	10	6	15	11
The coldest nights	12	6	15	9
Overall	6	3	10	7
Base	**604**	**357**	**256**	**180**

Source: Follow-up questionnaire, Base: 1,445 FU respondents with ASHP or Biomass boilers

Satisfaction with the amount of hot water available

Around 90% of FU respondents with a heat pump or biomass boiler were satisfied with the amount of hot water available from their renewable heating system in winter, but this proportion was just 70% for FU solar thermal respondents.

More than a quarter (27%) of FU solar thermal respondents were dissatisfied with the amount of hot water available from their system in winter, including six per cent who were very dissatisfied. Almost one in ten (9%) FU solar thermal respondents were dissatisfied with the amount of hot water available in autumn/spring, but in summer, satisfaction was high, when 82% were very satisfied. These figures suggest that expectations of solar thermal may be unrealistic.

Fuel bills

When asked at the FU stage, almost half (49%) said they knew the approximate costs of their fuel bills, and a further 37% said they knew exactly. Those who were aware of how much (exactly or approximately) their fuel bills were, were asked if bills (electricity, oil, LPG etc.) had increased, decreased or stayed the same since the installation of their renewable heat technology .

They were not asked by how much bills had changed, hence the data is indicative only, but suggests that for 47% of those responding, one or more bills had increased, while 65% had seen reductions in one or more of their bills:

- FU ASHP respondents: 63% said electricity bills had increased, while 21% said electricity bills had decreased, and 33% said oil costs had decreased.
- FU biomass boiler respondents: the proportion who experienced decreases in bills exceeds those who experienced increases.
- FU solar thermal respondents had seen the fewest increases, and most reductions, including 38% who had seen a reduction in mains gas bills.
- FU G/WSHP respondents reported more increases than decreases, with 60% saying electricity bills had increased, and just 48% saying that fuel bills had decreased.

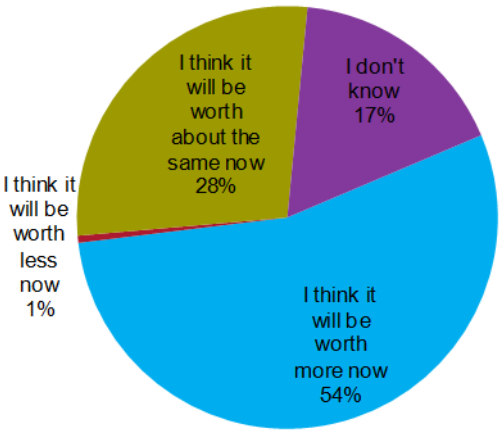
Perceived impact on house prices

When asked what impact installing a renewable heat technology could have had on the value of their house, more than half (54%) of FU respondents thought that the value of their property had been positively affected, with just one per cent thinking it would have reduced the value; 17% were unsure.

Significantly fewer (43%) of FU biomass boiler respondents thought their renewable heating system would add value to their property, while 63% FU G/WSHP respondents thought it would.

However in the motivation section this was not considered to be a major factor for installing a renewable heating system.

Figure 5.4 Perceived impact on house prices



Do you think that your renewable heating installation has affected the current value of your property

Source: Follow-up questionnaire, Base: 2,734

Recommending renewable heat technology to others

When questioned following installation, almost half of PI respondents said that they had friends or neighbours that were considering installing a renewable heat technology. Most, 92% PI respondents have already recommended or would recommend renewable heat technology to others.

PI biomass boiler respondents appear to be the most enthusiastic, with 84% recommending it to others. PI solar thermal respondents were also highly likely to recommend it to others; 81% said they have done so compared with 76% of PI G/WSHP and 78% of PI ASHP respondents.

FU respondents had experienced a longer period of operation than at the time of the post-installation questionnaire. The propensity to recommend renewable heat technology to others reduced slightly for FU respondents, 90% compared with 92% for PI respondents. Tracking the propensity to recommend across the PI and FU questionnaires, less than one per cent (n=11) FU respondents were more likely to recommend it. Two per cent (59 FU respondents) were less likely to recommend it, as it had not met their expectations, especially on cost: twenty two had found the system more expensive to run than anticipated (applicable to all technologies: ASHP n=10, biomass boilers n=5, solar thermal n=4, and G/WSHP n=3).

Five per cent of FU respondents commented that uncertainty over domestic RHI would prevent them from recommending the installation of renewable heat technologies to others, as the long term costs savings could not be fully determined.

Reasons for recommending a renewable heat technology

Personal recommendation is clearly important in the decision to install a renewable heating system. Findings in Chapter 3 showed that one in five installations were motivated by personal recommendation. Analysis of the text responses from the follow-up questionnaire for recommending to others has shown that there are three main reasons as to why they would recommend a renewable heating technology:

- Cost benefits, especially where LPG or oil were being replaced;
- Green reasons, especially biomass boilers and solar thermal; and
- Functional or operational reasons (especially where heat pumps installed, or where oil/LPG was displaced).

For each of the types of renewable heat technology, the following section summarises the reasons for recommendation[44], illustrated by quotes.

While there were many positive experiences behind the comments made, a number of the recommendations came with caveats, or pointed out some words of caution for those considering installing a renewable heat technology.

Air Source Heat Pumps (ASHP)

Nine in ten FU ASHP respondents would recommend it to others. The reasons given included its long term cost benefits (36%), its environmental credentials (20%) and its operational advantages over fossil fuels (28%). Specific reasons for recommending included:

- 12% who found it to be efficient;
- 5% who found it to be clean in operation; and
- 3% who found it easy to operate.

"Because it works well, is miles cheaper compared to LPG or oil, is virtually maintenance free, and is much more environmentally friendly"

Recommendations came with some words of caution however, for example, the quote below shows that one respondent suggested that homes needed to be properly insulated to ensure efficient performance, and that the building and heating system was suitably designed.

"Good for new build or conversion but not for existing properties with poor insulation"

"I am very happy to be free from erratic fossil fuel deliveries. The only "fuel" I use now is electricity. However, the cost of installing the new system was quite high. I would be honest about both aspects"

"Would recommend to anyone on LPG or electric boiler to think about heat pumps because it will save you money in the long term. [I would] Not recommend to people on mains gas or someone who might move house soon"

Ground/Water Source Heat Pumps (G/WSHP)

Nine in ten respondents FU G/WSHP respondents would recommend it to others. The reasons given included the long term cost savings (34%), and for operational reasons, including ease of use (27%). Specific reasons for recommending it included:

- 11% who found it to be efficient;
- 4% liked the warmth delivered; and
- 3% who said they would recommend it because it was easy to operate.

[44] The open comments have been grouped by themes of response

"If people are paying for oil I would absolutely recommend they stop and instead install a heat pump"

"The ground source heat pump that we had installed gives such a lovely even temperature all over the home, the hot water is always a perfect temperature. I like the idea that all this is coming from the ground and is un-polluting"

"Comfortable heat, no fuel deliveries, quiet operation, so far trouble free"

As -with ASHP, there were some caveats to some recommendations, including ensuring the building design and plot was appropriate, and considering alternative systems in relation to cost of installation.

"I would recommend where appropriate. The low constant temperature can suit houses like mine which lack cavity walls, keeping it dry at considerably less cost. I would not recommend to people who cannot afford the high capital cost of installation, or those who have already moved to biomass boilers".

"Only if they have suitable amount of land for the ground source array but if so then the system is very efficient"

"My own situation is with regard to being a new build and my answer is with this in mind. This is because the disruption factor is zero with it being a new build anyway, e.g. digging a trench for the ground loop"

Biomass Boilers (BB)

A high proportion (87%) of FU biomass boiler respondents would recommend them to others. The main reason given was the perceived long term cost benefits (43%). Environmental considerations were also behind one in three reasons for recommending biomass, and for a quarter, operational features, including 10% who found their boiler to be efficient, 4% thought it was clean to run and manage, and 5% easy to operate.

"I would recommend a biomass boiler to others based on the fuel savings, the ease of use and the positive effect on the planet by reducing CO2 emissions"

"We moved from oil to biomass. Although it was expensive to install c.£20k it seemed a wise investment. After 1 year it is looking likely to save us significant amounts against what we spent on oil, we also feel like we have control back over heating bills. The system is GREAT, we love it, works like a dream and house is much easier to keep warm. It was a big decision and we had to borrow money to do it, but we have no regrets"

FU biomass boiler respondents recognised that they were not for everyone; they would warn potential customers to be aware of the work needed to run some systems and the cost of fuel unless sourced locally.

"Under the right circumstances, i.e. for us with our own fuel it is ideal. If fuel has to be purchased we are not sure how cost effective it would be"

"Cheap to run. But needs a lot of space, and high installation costs"

"I'd recommend biomass to anyone who lives in an area where wood is plentiful, but would be wary about it where it isn't"

Solar Thermal (ST)

A high proportion, 91% of FU solar thermal respondents would recommend its installation to others. The reasons for recommending it were primarily cost (36%), and on environmental grounds (21%). Saving money in the long run was the reason for recommending it for a quarter who installed solar thermal.

> "Energy costs will only continue to rise, so it makes sense to get "free" energy when possible, and the sooner you do it, the more you save in the long term. It's also the morally right thing to do compared to burning fossil fuels or polluting our planet with lethal nuclear waste"

Other reasons included its efficiency and ease of operation, for example, low maintenance.

> "I would recommend solar thermal because of its long term low maintenance benefits of pre-heating and heating hot water for personal use"

Not all FU solar thermal respondents felt that they would save money with their system, and a lot thought it could take many years to give any cost benefit, but some accepted poor returns on their investment because of the perceived environmental benefits.

> "From an environmental point of view it is certainly worthwhile. On a purely cost basis I am much less convinced. This summer has on the whole been so miserable that on only a few occasions has the water been hot enough for a bath without a boost"

Some recommendations for solar thermal came with reservations, including recognition that pay back periods could be very long, or that pay back may not be realised at all. Other cautions included getting the system properly set up to maximise efficiency.

> "As long as you can afford the initial outlay, the long term gain of producing your own hot water using solar gain will save on your gas bills. However I would recommend a well-insulated house (cavity fill, loft insulation double glazing etc) as the first priority"

> "Breakeven point would depend on whether old system needed updating etc and how long you expected to be in the property"

6. Living with a Renewable Heat Technology

Satisfaction with reliability, understanding the system controls and ease of adjusting the controls was high (80% or more). Installation of the renewable heat technology has had a positive impact on energy saving tendencies; 55% of FU respondents said that they now gave a lot of thought to saving energy in their home.

An overview of experiences of living with renewable heat technology

Of FU respondents with a renewable heating system (ASHP, G/WSHP or biomass boilers):

- Almost half, 48% said they would put on additional layers of clothing if they felt too cold
- 41% would turn up the thermostat in the event of feeling too cold;
- More than half, 57% had used supplementary heating systems in addition to their renewable system in order to achieve a comfortable temperature.

Of FU solar thermal respondents:

- Almost a third, 31% said they had changed the times they used hot water as a result of their installation.

Of FU biomass boiler respondents:

- 72% use just pellets to fuel the system, 25% use just logs, and 3% use both sources;
- A third (n=98) of log users collect their fuel locally, including 45 people who

In this section, how renewable heat technology is being used is discussed, including managing temperatures, and any impacts on the use of energy arising from the installation. The results are drawn from the follow-up questionnaire.

Managing temperatures

When questioned about satisfaction with various aspects of their renewable heating technology, the majority were satisfied. Overall, 84% of FU respondents were satisfied with understanding the system controls, ranging from 79% of FU ASHP respondents to 90% of FU biomass boiler respondents. Similarly 80% overall were satisfied with how easy it was to adjust the controls, ranging from 78% of FU ASHP respondents to 88% of FU biomass boiler respondents. Satisfaction with reliability was high across all the renewable heat technologies; 89% of FU respondents were satisfied with how reliable it was.

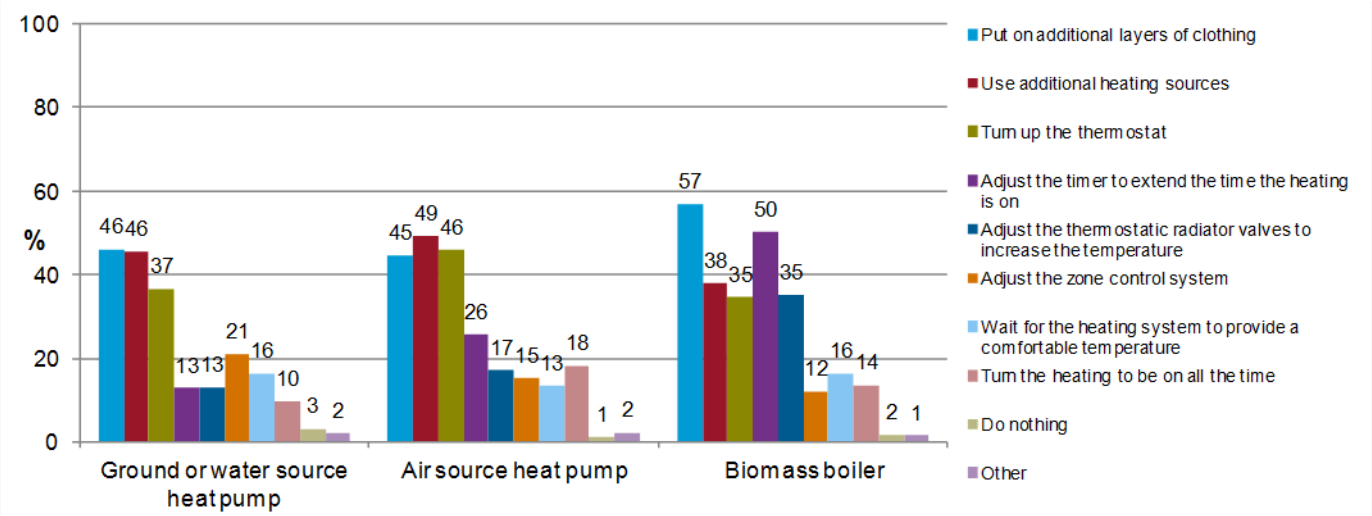
What happens if users of renewable heating systems (ASHP, G/WSHP and biomass boilers) feel too cold?

For those 1,976 FU respondents whose renewable heat technology provided heating for the home, the actions taken when it does not achieve the required level of comfort are presented in Figures 6.1, and are now discussed.

When feeling cold while using their renewable heat technology, almost half (48%) said they would put on additional layers of clothing to achieve their desired level of comfort. A similar proportion, (46%) said they would use one or more additional heat sources, for example, 43% said they would use a wood burner. Two in five (41%) would turn up the thermostat. There were no differences in the actions of respondents from the winter of 2011/12 from those of winter 2012/13.

FU biomass boiler respondents were those most likely to put on additional layers of clothing (57%) to achieve warmth if their system left them feeling too cold; and also were most likely to adjust the timer (50%), or adjust thermostatic radiator valves (35%). They were least likely to use additional heating (38%) or turn up the thermostat (35%) when feeling too cold.

Figure 6.1 Actions taken when feeling cold



Base	531	999	446	Multiple response

Source: Follow-up questionnaire, Base: 1,976 FU respondents with heating technology (i.e. excluding solar thermal).
Respondents could select up to three actions

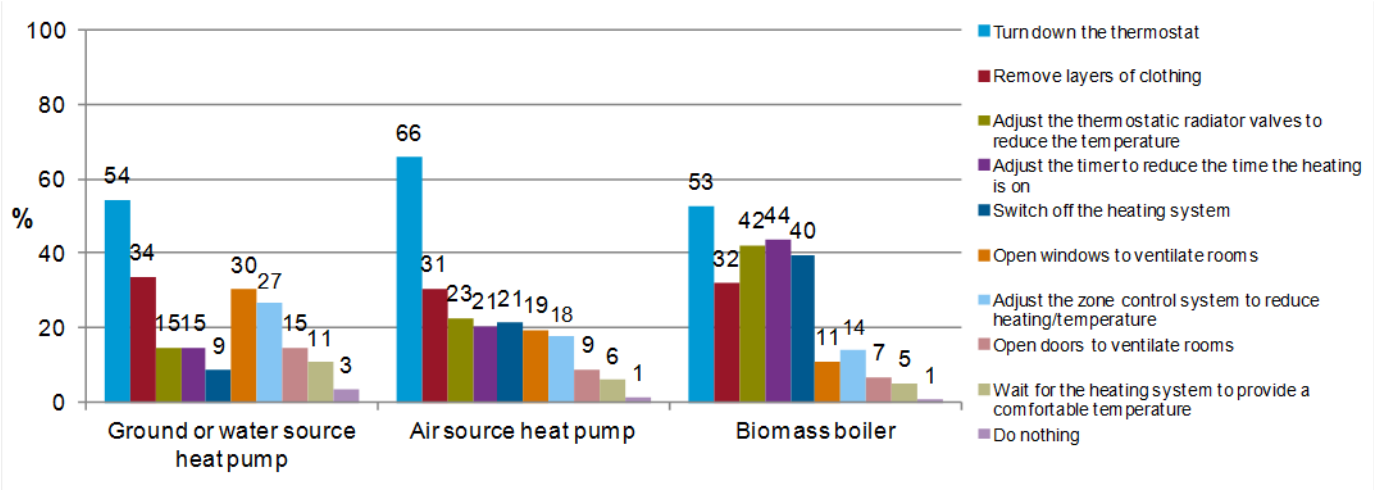
Some differences were observed by age group. A higher proportion (56%) of FU respondents aged 25-44, would put on additional clothing, compared with 46% of older FU respondents, while older FU respondents were more likely to use additional heating sources (48%) or turn up the thermostat (42%), than younger FU respondents (40% and 39% respectively).

What happens if users of renewable heating systems (ASHP, G/WSHP and biomass boilers) feel too hot?

For those 1,976 FU respondents whose renewable heat technology provided heating for the home, Figure 6.2 highlights differences in the actions taken if they felt hot when using their different renewable heat technologies. A significantly higher proportion (66%) of FU ASHP respondents said they would turn down the thermostat, FU biomass boiler respondents were significantly more likely to adjust the timer (44%), adjust thermostatic radiator valves (42%) and switch off the heating system (40%), compared with respondents with the other technologies.

Just nine per cent of FU G/WSHP respondents would switch off the heating system. A significantly higher proportion (27%) of G/WSHP respondents would adjust their zone control systems, and open doors (30%) and windows to ventilate rooms (15%).

Figure 6.2 Actions taken when feeling too hot



Base	531	999	446	Multiple response

Source: Follow-up questionnaire, Base: 1,976 FU respondents with heating technology (i.e. excluding solar thermal). Respondents could select up to three

Only one per cent (n=24) of FU respondents said they ever felt too hot when their renewable heating system was in use.

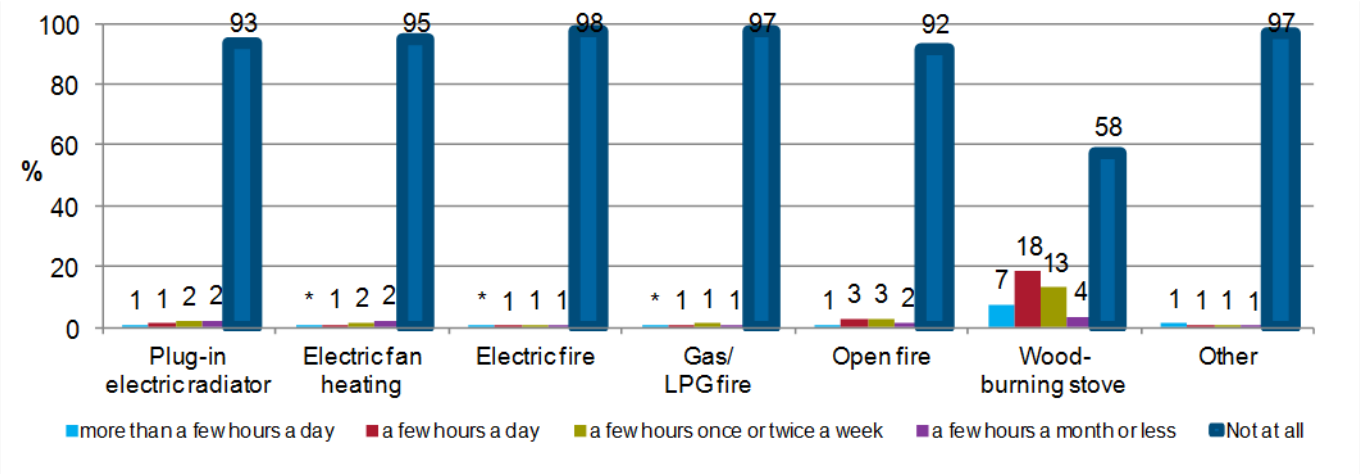
Use of supplementary heating to achieve a comfortable temperature (ASHP, G/WSHP and biomass boilers)

For those 1,976 FU respondents whose renewable heat technology provided heating for the home, when questioned about whether they had used supplementary heating systems during the winter period, over half (57%) had done so. When broken down by wave, more had used a supplementary source in Wave 2, as follows:

- 54% of FU G/WSHP respondents: 52% in Wave 1 and 56% in Wave 2;
- 58% of FU ASHP respondents: 57% in Wave 1 and 59% in Wave 2; and
- 58% of FU biomass boiler respondents: 54% in Wave 1 and 64% in Wave 2.

Figure 6.3 shows how frequently supplementary heating systems were used. Wood burning stoves were the most usual type of supplementary heating used during winter; 838 (43%) had used one, and when used, usage was regular, with seven per cent using one for more than a few hours per day.

Figure 6.3 Use of Supplementary Heating



Source: Follow-up questionnaire, Base: 1,976 FU respondents with heating technology (i.e. excluding solar thermal)
More than one type of heating could be specified

Three per cent had used an 'other' source of supplementary heating, typically a range cooker (e.g. Aga/Rayburn).

Comments from FU respondents whose renewable heat technology provided heating for the home suggest that the use of supplementary heating was not necessarily an indication that their heating needs were not being met by their renewable heating system, but there are other benefits, including a boost of heat for a particular room, or just for 'cosiness', for example:

> "...more for the cosiness of the wood burning stove rather than a need for extra heat" (G/WSHP, very satisfied)

How the use of their renewable heat technology has influenced respondents' use of energy and approach to energy saving is now explored.

Use of energy

When asked whether installing a renewable heat technology had changed the way energy in the home was used, over half (55%) of FU respondents said that they now gave a lot of thought to saving energy in their home. A further 43% gave this a fair amount of thought.

Additionally, as shown in Figure 6.4, most FU respondents agreed that:

- They consider the use of heating more (84%);
- They consider the way they use hot water more (76%); and
- They were careful to switch off lights and electric appliances now (73%).

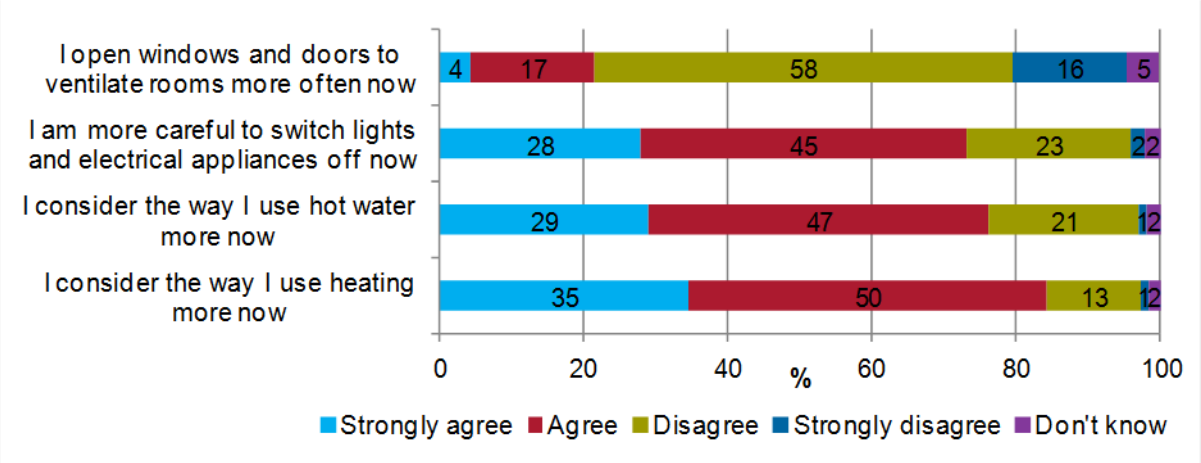
Just three FU respondents said they had given no thought to saving energy and 55 (two per cent) said they had not given it much thought. Comments from FU respondents revealed that the process of installing a renewable heat technology had raised their awareness of energy use:

"Not only does the system save money it provides more 'engagement' with the process of creating and using the heat. Rather than 'just switching on' heat we are now more aware of our use and needs." Solar Thermal

"Consideration for all aspects of heating efficiency. It makes you think about energy use and where it comes from" G/WSHP

Compared with the 76% of FU respondents who agreed that since installing renewable heat technology they consider the use of hot water more than previously, this proportion was significantly higher for FU solar thermal respondents (87%).

Figure 6.4 Consideration given to energy use



Source: Follow-up questionnaire, Base 2,734 FU Respondents

Using hot water – FU solar thermal respondents

Since installing a solar thermal system almost a third (31%) of FU solar thermal respondents said they had changed the times at which they used hot water.

Where this was the case, the main reasons given were that they time their usage so that it coincides with times of maximum solar yield, and where practical, to allow time for the tank to re-heat, as illustrated by the following comments:

"We use more at the end of the day rather than during it"

"We use hot water which has been heated free, so washing machine etc goes on at a different time and we have showers at a different time."

"Where practical, we plan showers/baths around forecast sunshine either to wait until the tank has heated sufficiently or to use water ahead of a good warming day."

These comments suggest that FU solar thermal respondents have understood the practicalities of their system, in terms of when to use hot water and get the best from their system.

Using biomass heating systems – FU biomass boiler respondents

The installation of a renewable heating system had led two fifths (40%) of FU biomass boiler respondents to say they strongly agreed that they now considered their use of heating more, a significantly higher proportion than for FU respondents with other renewable heat technologies.

Possible reasons for this are now explored, including how they source their fuel, and management of their system.

Almost three quarters of FU biomass boiler respondents used pellets alone (72%) to fuel the boiler; 3% used pellets as well as logs , while 23% used logs only. The remainder used other sources, mainly woodchips, scrap wood or timber.

When asked how satisfied they were with operational aspects of using their biomass system, almost all FU biomass boiler respondents were satisfied with the following, regardless of the type of fuel used (base n=421):

- Space to keep the fuel, 91%;
- Time taken to feed the boiler, 93%;
- Keeping the fuel clean, 97%;
- Keeping the fuel dry, 97%; and
- Keeping the fuel safe, 98%.

Examples of comments on the operation of their system support the high levels of satisfaction:

> "Clean, efficient fuel, pellets are auto-fed to boiler"
>
> "Operates automatically with very little attention. Requires servicing once a year. House heating zones are monitored. Fuel is wood"

However, as illustrated in the following comment, biomass boilers using logs are not for everyone, as they can involve a lot of work:

> "The work involved with preparing and storing logs can be off putting. You have to be fairly active and willing to give up a couple of hours a week or a weekend to prepare logs (splitting so that they season) in readiness for next winter. This all cuts down on the cost of the fuel. Obviously it all depends on how much you want to save. There is a bit of work stoking the log boiler which can be nightly or less in the warmer days and this can be easily become a chore. Planning ahead is essential whether it is to organise the fuel or to decide if the accumulator tank needs to be topped up by a burn."

Sourcing of pellets does not appear to have been a problem, with six per cent (n=17) of FU biomass boiler respondents who used pellets finding them difficult to obtain. A higher proportion, 12% (n=13) of those who used logs found them difficult to obtain, including two per cent (n=2) who said it was very difficult.

The fuel for biomass boilers was delivered via a local supplier for 43% (n=49) of FU biomass boiler respondents using logs and 45% (n=142) of pellet users. Almost a third (n=98) of pellet users bought their fuel on the internet, while just eight per cent (n=9) of log users did so. A third (n=98) of log users collect their fuel locally, including 45 people who have their own forest or woodland.

FU biomass boiler respondents were asked about monthly costs of fuelling their systems. As shown in Table 6.1, more than a fifth of FU respondents with biomass boilers who use logs, spent nothing on fuel, while half spent £67 per month or more (based on the median fuel spend). The median cost for those who used pellets was £125 per month, but seven per cent said they spend more than £300, and a further 10% spend between £200 and £300.

Table 6.1 Estimated spend on fuel for biomass boiler (per month)

	Pellets %	Logs %
Nothing	0	22
£1 to £70	17	29
£71 to £100	25	16
£101 to £150	27	12
£151 to £200	15	9
£201 to £300	10	8
£301 or more	7	3
Base: Follow-up questionnaire respondents	**290**	**107**
Mean	£163	£97
Median	£125	£67

Source: Follow-up questionnaire, Base: 387 FU respondents with biomass boiler who provided cost information

The median cost for biomass fuel increased with size of house, as shown in Table 6.2; from £87 in 1-2 bedroom houses up to £167 in properties with more than 6 bedrooms (note: the bases are small).

Table 6.2 Estimated spend on fuel for biomass boiler (per month) by number of bedrooms

	How many bedrooms does your home have?				
	1 to 2	**3 to 4**	**5 to 6**	**More than 6**	**Total**
Mean	£117.97	£135.38	£169.34	£172.58	£145.53
Median	£87.08	£100	£127.5	£166.67	£108.33
Minimum £	26	0	0	0	0
Maximum £	346.67	1,500	2,000	400	2,000
Base	21	241	110	15	387

Source: Follow-up questionnaire, Base: 387 FU respondents with biomass boiler who provided cost information

Although obvious extremes have been excluded from the analysis, there remain very large ranges within these numbers, in part reflecting the variation in size of homes. There is the possibility that they represent winter heating costs rather than a settled annual average, as they appear to be relatively high. Further research into running costs, over a longer period would be required to provide reliable information in this area.

7. Lessons Learnt

The analysis has identified what lessons can be learnt to influence uptake of renewable heating technologies to the wider population.

Types of people

Analysis of the RHPP1 data provides insight into the early adopters of these renewable heat technologies. These people are generally relatively wealthy compared with home-owners in general, in employment, undertaking installations with savings, and tending to live in relatively large homes. They intend to stay in the same home for many years. They are also highly motivated to take actions to address environmental concerns.

Motivations

It is interesting that most changes are planned installations, rather than emergency replacements.

It would appear that moving to a new home can be a catalyst for replacement of heating systems or, in the case of self-build, taking the opportunity to install a renewable heat technology.

For those completing the questionnaires the value of their home was not a major motivation for change, although they hoped value would increase.

Differences between where technologies have been used

There has been sense to the location of where technologies have been applied, with biomass and ground source heat pump systems more widely used in rural areas than air source heat pumps and solar thermal. Solar thermal is also more prevalent in the south where hours of sunshine tend to be greater.

Problems with installation and operation of systems

The majority of installations appear to have been successful, as the owners are happy with their systems, for example, at the follow-up stage, 92% were satisfied and 90% would recommend a renewable heating technology to others. However there is a small number of cases where respondents are not satisfied, and this requires attention.

Of most concern were a small number of cases where an expensive system had been installed, was not working and the contractor had gone into liquidation. Here the industry needs a back-up scheme to ensure that problems are solved. Examples were reported for each technology, so this is not a problem exclusively for one of them alone.

There were a number of installations with faults at early stages (14%). This hopefully is due to the systems being relatively new. The provision of information on operation of the systems can also be improved, although some was provided to nearly all users. Help to make best use of the systems would be beneficial.

In operation, most users are content with the heat being delivered. Some concerns remain for the coldest weather, and this is greatest for ASHP systems. Some users were also disappointed with the delivery of solar thermal systems in winter, which may reflect a lack of understanding of their potential.

Most users of biomass systems were happy with the effort required to re-fuel the system. It is too early to know if maintenance becomes an issue for any of these systems over time.

Costs and benefits

The data from the questionnaires in terms of running cost is from very early stages of use of the technologies, and it is unclear to what extent bills have increased or decreased.

Appendix A1 – Post-installation Questionnaire

Renewable Heat Premium Payment Scheme - Survey 1

In order to help us learn more about renewable heating we ask you to complete this short survey. The results will help us better understand people's reasons for installing renewable heating and their experience of doing so. This will allow Government to design future policies to support renewable energy in homes more effectively and based on actual experience.

This survey is fairly short and should only take 15-20 minutes to complete.

Data you provide in this survey is being collected for research purposes only. Data may be shared with the UK Government, or others acting on their behalf, for the purpose of research and to inform the development of Government policy. Data may be linked to other surveys or datasets and may be published, but it will not be possible to identify any particular person, household or address from the published data.

Thank you for your time and cooperation with this important piece of research.

[Routing options are indicated in red for the purposes of this document. Routing will occur automatically in the online version of the questionnaire].

---

1) * Which renewable heating technology have you installed with help from the Renewable Heat Premium Payment scheme?

- ○ Solar thermal panels
- ○ Ground or water source heat pump
- ○ Air source heat pump
- ○ Biomass boiler

---

2) * Which of these best describes the property that your renewable heat technology is installed in?

- ○ Detached property
- ○ Semi-detached property
- ○ Terraced property
- ○ Flat
- ○ Maisonette
- ○ Other, please specify [ ]

---

3) * Roughly when was your home built?

- ○ Pre-1900
- ○ 1900 - 1929

- 1930 - 1949
- 1950 - 1989
- 1990 or later
- Don't know

---

4) * How many bedrooms does your home have?

1 2 3 4 5 6 7 8 9 10+

---

5) * How long have you lived in your home?

- Not moved into it yet
- Less than one year
- 1-2 years
- 3-4 years
- 5-10 years
- 11-15 years
- 16-20 years
- 21 years or more
- Don't know

---

6) * Roughly how long do you think you and your household will stay in your home?

- Currently moving
- Up to one year
- 1-2 years
- 3-4 years
- 5-10 years
- 11-15 years
- 16-20 years
- 21 years or more
- Not planning on moving

If you have installed a heat pump or biomass system please go to question 7.

If you have installed a solar thermal system please go to question 14.

7) [Please answer if you have installed a heat pump or biomass system] * Before you installed your renewable heating system did you use the same heating system to heat your hot water and home?

Yes No Don't know

If you answered 'yes' or 'don't know' to question 7 please go to question 8.

If you answered 'no' to question 7 please go to question 9.

8) [Please answer if you have installed a heat pump or biomass system and previously used the same system to heat your hot water and your home] * What was the main heating system?

- Gas
- Oil central heating
- Electric heaters
- Solid fuel
- Bottled gas/ paraffin
- Storage radiators
- Gas fires
- Communal or district heating
- Other, please specify

---

9) [Please answer if you have installed a heat pump or biomass system and did not previously use the same system to heat your hot water and your home] * What was the main heating system you used to heat your hot water?

- Gas
- Oil central heating
- Electric heaters
- Solid fuel
- Bottled gas/ paraffin
- Storage radiators
- Gas fires
- Communal or district heating
- Other, please specify

---

10) [Please answer if you have installed a heat pump or biomass system and did not previously use the same system to heat your hot water and your home] * What was the main heating system you used to heat your home?

- Gas
- Oil central heating
- Electric heaters

- Solid fuel
- Bottled gas/ paraffin
- Storage radiators
- Gas fires
- Communal or district heating
- Other, please specify

---

11) [Please answer if you have installed a heat pump or biomass system] * When you installed your renewable heating system, did you remove your old heating system?

- Removed the old system
- Disconnected the old system, but left it in place
- Kept the old system in place and still use it

---

12) [Please answer if you have installed a heat pump or biomass system] * Overall, how satisfied were you with your previous heating systems?

- Very satisfied
- Fairly satisfied
- Neither satisfied or dissatisfied
- Fairly dissatisfied
- Very dissatisfied

---

13) [Please answer if you have installed a heat pump or biomass system] * What state was your previous heating system in when you decided to install your renewable heating system?

- Working well
- Broke down occasionally
- Broke down frequently
- Broken
- Other, please specify
- Don't know

If you have installed a solar thermal system please answer questions 14 to 16
If you have installed a heat pump or biomass system please go to question 17.

14) [Please answer if you have installed a solar thermal system] * What is your main heating system?

- Gas
- Oil central heating
- Electric heaters

- Solid fuel
- Bottled gas/ paraffin
- Storage radiators
- Gas fires
- Communal or district heating

---

15) [Please answer if you have installed a solar thermal system] * Overall, how satisfied are you with your main heating system?

- Very satisfied
- Fairly satisfied
- Neither satisfied or dissatisfied
- Fairly dissatisfied
- Very dissatisfied

---

16) * Overall, how satisfied are you with your renewable heating system?

- Very satisfied
- Fairly satisfied
- Neither satisfied or dissatisfied
- Fairly dissatisfied
- Very dissatisfied

---

17) * Compared with your previous heating system, how easy or difficult do you find it to operate your renewable heating system?

- Much easier
- Easier
- About the same
- Difficult
- Very difficult
- Don't know

---

18) * How easy did you find it to arrange installation of your renewable heating system? Please rate this on a scale of 0 to 10 with 0 being not at all easy and 10 being very easy.

- 0 (not at all easy)
- 1
- 2
- 3
- 4

- 5
- 6
- 7
- 8
- 9
- 10 (very easy)

---

19) * Do you think your new heating system will save you money in the long run?

Yes No Don't know

---

20) * How important a consideration was saving money when you decided to install your renewable heating system?

- Very important
- Important
- Not important
- Not at all important
- Don't know

---

21) * How much did it cost to install your renewable heating system in your home? Please include the cost of the technology and the cost of having it installed.

- Less than £2,000
- £2,000 - £3,999
- £4,000 - £5,999
- £6,000 - £7,999
- £8,000 - £9,999
- £10,000 - £11,999
- £12,000 - £13,999
- £14,000 - £15,999
- £16,000 - £19,999
- £20,000 or more
- Don't know

---

22) * Do you have friends or neighbours that are considering installing a renewable energy technology?

Yes No Don't know

---

23) * Have you recommended installing a renewable heating system to anyone else?

Yes No Don't know

If you answered 'yes' to question 23 please go to question 25.
If you answered 'no' or 'don't know' to question 23 please go to question 24.

24) [Please answer if you have not already recommended installing a renewable heating system to anyone else] * If no, would you recommend installing a renewable heating system to anyone else?

Yes No Don't know

---

25) * Did you receive written information, for example leaflets, handbooks, guidance, on how to use your renewable heating system?

Yes No Don't know

If you answered 'yes' to question 25 please go to question 26.
If you answered 'no' or 'don't know' to question 25 please go to question 28.

26) [Please answer if you received written information on how to use your renewable heating system] * If yes, what sort of information did you receive? (Please select all that apply)

- Handbook
- Leaflets
- Website information
- Other, please specify

---

27) [Please answer if you received written information on how to use your renewable heating system] * Do you feel the written information was sufficient?

Yes No Don't know

---

28) * Did the person or company that installed your renewable heat system explain to you or another person in your household how to use the system, at the time of installation?

Yes No Don't know

---

29) * Were you satisfied with the level of explanation that you received?

Yes No Don't know

---

30) * Why did you decide to install your renewable heating system? (Please select all that apply)

- As a more reliable energy supply
- Be more self sufficient
- Able to generate my own energy
- It helps the environment
- It's more efficient

- [ ] Could get funding/grant
- [ ] Local community project
- [ ] Saw technology in action elsewhere
- [ ] Free installation
- [ ] Building a new home
- [ ] Upgrading home
- [ ] Refurbishment
- [ ] Had funding available
- [ ] Reduce my carbon emissions
- [ ] Reduce my dependence on fossil fuels
- [ ] Save money
- [ ] Liked the look of it
- [ ] Recommended by friend
- [ ] Recommended by plumber or installer
- [ ] Diminishing global supply of fossil fuels (e.g. oil)
- [ ] Rising prices of fossil fuels (e.g. gas, oil)
- [ ] Needed to replace heating system
- [ ] Make my home warmer
- [ ] I like the technology
- [ ] Other, please specify
- [ ] Don't know

---

31) * Please state whether you agree or disagree with the following statements

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I am concerned about fuel prices	○	○	○	○	○
I am concerned about the impact of carbon emissions on the environment	○	○	○	○	○
I like to be green	○	○	○	○	○

---

32) * Which of the following energy efficiency measures did you have in your home before you installed your renewable heating system? (Please select all that apply)

- [ ] Double glazing
- [ ] Cavity wall insulation
- [ ] Solid wall insulation

- [ ] Draught proofing or draught exclusion
- [ ] Hot water tank insulation
- [ ] Loft insulation or top-up loft insulation
- [ ] Thermostat controls fitted on individual radiators
- [ ] Don't know

---

33) * Which of the following energy efficiency measures did you install in your home at the same time as your renewable heating technology? (Please select all that apply)

- [ ] Thermostat controls fitted on individual radiators
- [ ] Solid wall insulation
- [ ] Loft insulation or top-up loft insulation
- [ ] Draught proofing or draught exclusion
- [ ] Double glazing
- [ ] Cavity wall insulation
- [ ] Hot water tank insulation
- [ ] Don't know

---

34) * The installation of energy efficiency measures, (loft insulation and cavity wall insulation where possible) were eligibility requirements of the payment, were either of these measures installed in your home in order to meet this requirement?

○ Yes ○ No ○ Don't know

---

35) * If yes, how easy did you find it to have the energy efficiency measures installed in your home? Please rate on a scale of 0 to 10 with 0 being not at all easy and 10 being very easy.

- ○ 0 (not at all easy)
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10 (very easy)

36) * Do you actively monitor how you use energy in your home? By 'actively monitoring' we mean checking how much energy you are using on a regular basis.

Yes No Don't know

---

37) * How likely, or unlikely, is it that you would have installed your renewable heating system in your home if you had not received the Renewable Heat Premium Payment (RHPP)?

- Very likely
- Fairly likely
- Fairly unlikely
- Very unlikely
- Don't know

---

38) * Have you heard of the Renewable Heat Incentive (RHI) scheme?

Yes No Don't know

If you answered 'yes' to question 38 please go to question 40.
If you answered 'no' or 'don't know' to question 38 please go to question 39.

39) [Please answer if you have not heard of the RHI] * If no, are you aware of any other longer term financial support schemes for renewable heat technologies?

Yes No Don't know

---

40) * After the Premium Payment, how did you pay for the remaining cost of your renewable heating system? (Please select all that apply)

- Savings
- Loan
- Finance agreement (where payments are spread over a longer timeframe)
- Mortgage
- Local authority scheme
- Other, please specify

---

41) * Please rate your experience of applying for the Renewable Heat Premium Payment (RHPP) prior to installation.

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
The information provided by the Energy Saving Trust on the application process for the RHPP was useful					
The information provided by the Energy					

Saving Trust on the application process for the RHPP was easy to understand					
The grant application process was straightforward	○	○	○	○	○

42) * Please rate your experience of claiming the RHPP after installation.

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I was given clear guidance on how to claim my grant	○	○	○	○	○
I was kept adequately informed about the progress of my claim	○	○	○	○	○
My claim was process in a reasonable time	○	○	○	○	○

43) * Overall, please rate your level of satisfaction with the process of receiving the Renewable Heat Premium Payment grant

- ○ Very satisfied
- ○ Fairly satisfied
- ○ Neither satisfied or dissatisfied
- ○ Fairly dissatisfied
- ○ Very dissatisfied

44) Please provide any additional comments you have regarding the process of applying and receiving the Renewable Heat Premium payment.

45) * Are you...

○ Male ○ Female ○ Prefer not to say

46) * How old are you?

- ○ 16-24
- ○ 25-34
- ○ 35-44
- ○ 45-54
- ○ 55-64
- ○ 65-74
- ○ 75 or over

Prefer not to say

47) What is the house number/name of the property where your renewable heating system is installed?

48) What is the postcode of the property where your renewable heating system is installed?

49) * Which of the following categories best describes your current employment status?

- Employed full time
- Employed part time
- Self employed
- Unemployed
- Retired
- Student
- Housewife/househusband
- Prefer not to say
- Other, please specify

50) * Which of the following categories best describes your current tenancy status?

- Own property outright
- Own property with a mortgage
- Rent property
- Landlord of property
- Shared Ownership
- Prefer not to say
- Other, please specify

51) * How many people live in your household? Please enter as a number.

52) How many people of each age live in your home? Please tick 0 if there are no people in a particular age group living in your home.

	0	1	2	3	4	5	More than 5	Prefer not to say
0-4	☐	☐	☐	☐	☐	☐	☐	☐
5-10	☐	☐	☐	☐	☐	☐	☐	☐
11-15	☐	☐	☐	☐	☐	☐	☐	☐

16-24	☐	☐	☐	☐	☐	☐	☐	☐
25-34	☐	☐	☐	☐	☐	☐	☐	☐
35-44	☐	☐	☐	☐	☐	☐	☐	☐
45-54	☐	☐	☐	☐	☐	☐	☐	☐
55-64	☐	☐	☐	☐	☐	☐	☐	☐
65-74	☐	☐	☐	☐	☐	☐	☐	☐
75 or over	☐	☐	☐	☐	☐	☐	☐	☐

---

53) * Which of the categories below represents the total annual income of the whole household before deductions for income tax, National Insurance etc?

- ○ Up to £5,199
- ○ £5,200 to £10,399
- ○ £10,400 to £15,599
- ○ £15,600 to £20,799
- ○ £20,800 to £25,999
- ○ £26,000 to £31,199
- ○ £31,200 to £36,399
- ○ £36,400 to £41,599
- ○ £41,600 to £46,799
- ○ £46,800 to £51,999
- ○ £52,000 to £71,999
- ○ £72,000 or over
- ○ Prefer not to say

Appendix A2 – Follow-up Questionnaire

Renewable Heat Premium Payment Scheme (RHPP) – Questionnaire 2

Please complete this questionnaire – your thoughts and experience are vitally important to help Government better understand people's experiences of using renewable heating and better design policies like this in the future. This is the second of two surveys that RHPP applicants are asked to help with as a requirement for the Renewable Heat Premium Payment.

The information you provide is being collected for research purposes only. Data may be shared with the UK Government, or others acting on their behalf, for the purpose of research and to inform the development of Government policy. Data may be linked to other surveys or datasets and summary data may be published, but it will not be possible to identify any person, household or address from any published data or reports.

Where questions refer to your renewable heating technology, please answer referring to the technology installed as part of the RHPP scheme. If you have installed more than one technology through the scheme, you will be sent a questionnaire for each technology you installed. In this questionnaire, please answer questions on 'your renewable heat technology' for one technology only, and complete a second questionnaire relating to your other installation through the scheme.

Please note that some of the questions are mandatory, and therefore must be answered before you can move onto the nest question. Mandatory questions are marked as shown (*).

The questionnaire should take no more than 15 minutes to complete. Thank you for your time and cooperation with this important piece of research.

1. ***Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RHPP):**

- ⬭ Solar thermal system
- ⬭ Ground or water source heat pump
- ⬭ Air source heat pump
- ⬭ Biomass boiler

2. ***Please confirm which of the following services your renewable technology provides:**

- ⬭ Hot water only
- ⬭ Heating only
- ⬭ Heating and hot water

3. ***Overall how satisfied are you with your renewable heating system?**

- ⬭ Very satisfied
- ⬭ Fairly satisfied
- ⬭ Neither satisfied or dissatisfied
- ⬭ Fairly dissatisfied
- ⬭ Very dissatisfied

4. ***Have you needed advice, guidance or assistance at any time since the technology was installed?**

- ⬭ Yes
- ⬭ No
- ⬭ I don't know

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Have you needed advice, guidance or assistance at any time since the technology was installed? e*quals* Yes)

5. ***What were the reasons for this advice, guidance or assistance? (Please select all that apply).**

- ☐ Asked for more advice on getting the best out of the system
- ☐ The installer/manufacturer contacted me to check everything was OK

☐ Manufacturing fault

☐ Installation fault

☐ Other, please specify_____

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Have you needed advice, guidance or assistance at any time since the technology was installed? Equals Yes)

6. *How did you get this advice, guidance or assistance? (Please select all that apply):

☐ From the installer – technology under warranty

☐ From the installer – technology not under warranty

☐ From the manufacturer – technology under warranty

☐ From the manufacturer – technology not under warranty

☐ From the Energy Saving Trust

☐ From the Renewable Heating Trade Association

☐ From another source on the internet

☐ Other, please specify _____

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Have you needed advice, guidance or assistance at any time since the technology was installed? Equals Yes)

7. *Was the advice, guidance or assistance you receive sufficient?

☐ Yes

☐ No

☐ I don't know

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Was the advice, guidance or assistance you received sufficient? Equals No)

8. Please elaborate on why you felt the advice was not sufficient?

9. *Overall how satisfied are you with each of the following aspects of your new renewable heating system

	Very satisfied	Fairly satisfied	Fairly unsatisfied	Very unsatisfied	Don't know/not applicable
Noise level	⬭	⬭	⬭	⬭	⬭
How it looks	⬭	⬭	⬭	⬭	⬭
How reliable it is (ie whether breaks down)	⬭	⬭	⬭	⬭	⬭

Understanding the system controls	⬭	⬭	⬭	⬭	⬭
Ease of adjusting the controls	⬭	⬭	⬭	⬭	⬭

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm which of the following services your renewable technology provides: equals Heating only
  Or
  If Please confirm which of the following services your renewable technology provides: equals Heating and hot water)

10. *Which of the following best describes the temperature achieved by your renewable heating system during ...

	Much too hot	**Too hot**	**About right**	**Too cold**	**Much too cold**	**Have not experienced this yet**	**Don't know**
... the coldest days	⬭	⬭	⬭	⬭	⬭	⬭	⬭
... the coldest nights	⬭	⬭	⬭	⬭	⬭	⬭	⬭
... overall	⬭	⬭	⬭	⬭	⬭	⬭	⬭

This box is shown in preview only.
The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm which of the following services your renewable technology provides: equals heating and hot water only
  Or
  If Please confirm which of the following services your renewable technology provides: *equals* Heating only)

11. * **How satisfied are you with the time it takes to achieve your desired level of comfort from your renewable heating system in....**

	Very satisfied	Fairly satisfied	Fairly unsatisfied	Very unsatisfied	Have not experienced this yet	Don't know
... winter	⬭	⬭	⬭	⬭	⬭	⬭
... autumn/spring	⬭	⬭	⬭	⬭	⬭	⬭
...summer	⬭	⬭	⬭	⬭	⬭	⬭

This box is shown in preview only.
The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm which of the following services your renewable technology provides: equals heating and hot water
  Or
- If Please confirm which of the following services your renewable technology provides: equals heating and hot water)

12. *How satisfied are you with the amount of hot water available from your renewable heating system in...

	Very satisfied	Fairly satisfied	Fairly unsatisfied	Very unsatisfied	Have not experienced this yet	Don't know
... winter	⬭	⬭	⬭	⬭	⬭	⬭
... autumn/spring	⬭	⬭	⬭	⬭	⬭	⬭
...summer	⬭	⬭	⬭	⬭	⬭	⬭

This box is shown in preview only.
The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm which of the following services your renewable technology provides: equals heating and hot water
  Or
- If Please confirm which of the following services your renewable technology provides: equals hot water only)

13. ***How satisfied are you with the temperature of hot water available from your renewable heating system in ...**

	Very satisfied	Fairly satisfied	Fairly unsatisfied	Very unsatisfied	Have not experienced this yet	Don't know
... winter	⬭	⬭	⬭	⬭	⬭	⬭
... autumn/spring	⬭	⬭	⬭	⬭	⬭	⬭

...summer	⬭	⬭	⬭	⬭	⬭	⬭

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm which of the following services your renewable technology provides: equals heating and hot water
  Or
- If Please confirm which of the following services your renewable technology provides: equals heating only)

14. If you feel too cold, what are the main actions you take? (Please select up to three actions)

- ☐ Use additional heating sources
- ☐ Turn up the thermostat
- ☐ Adjust the timer to extend the time the heating is on
- ☐ Turn the heating to be on all the time
- ☐ Adjust the thermostatic radiator valves to increase the temperature
- ☐ Adjust the zone control system
- ☐ Wait for the heating system to provide a comfortable temperature
- ☐ Put on additional layers of clothing
- ☐ Do nothing
- ☐ Other, please specify _____

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm which of the following services your renewable technology provides: equals heating and hot water
  Or
- If Please confirm which of the following services your renewable technology provides: equals heating only)

15. *If you feel too hot, what are the main actions you take? (Please select up to three actions).

- ☐ Switch off the heating system
- ☐ Turn down the thermostat
- ☐ Adjust the timer to reduce the time the heating is on
- ☐ Adjust the thermostatic radiator valves to reduce the temperature
- ☐ Adjust the zone control system to reduce heating/temperature
- ☐ Wait for the heating system to provide a comfortable temperature
- ☐ Remove layers of clothing
- ☐ Open windows to ventilate rooms
- ☐ Open doors to ventilate rooms
- ☐ Do nothing
- ☐ Other please specify _____

This box is shown in preview only.
The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm which of the following services your renewable technology provides: equals heating and hot water
  Or
- If Please confirm which of the following services your renewable technology provides: equals heating only)

16 *During winter (Dec-Feb) have you used any supplementary heating system, in addition to your renewable heating system, to achieve the comfort you desire in your home?

☐ Yes

☐ No

☐ I don't know

This box is shown in preview only.
The following criteria must be fulfilled for this question to be shown:

- (If, During winter (Dec-Feb) have you used any supplementary heating system, in addition to your renewable heating system, to achieve the comfort you desire in your home? Equals Yes)

17. Approximately how many hours (on average) per month did you use these supplementary heating systems, during the winter (Dec-Feb)?

	More than a few hours a day	A few hours a day	A few hours once or twice a week	A few hours a month or less	Not at all/not applicable	Don't know
Plug in electric radiator	⬭	⬭	⬭	⬭	⬭	⬭
Electric fan heating	⬭	⬭	⬭	⬭	⬭	⬭
Electric fire	⬭	⬭	⬭	⬭	⬭	⬭
Gas/LPG fire	⬭	⬭	⬭	⬭	⬭	⬭
Open fire	⬭	⬭	⬭	⬭	⬭	⬭
Wood burning stove	⬭	⬭	⬭	⬭	⬭	⬭
Other	⬭	⬭	⬭	⬭	⬭	⬭

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, During winter (Dec-Feb) have you used any supplementary heating system, in addition to your renewable heating system, to achieve the comfort you desire in your home? Equals Yes)

18. If you selected 'other;, above, please specify which other supplementary heating system you have used:

19. *How much thought, if any, would you say you give to saving energy in your home?

⬭ A lot
⬭ A fair amount
⬭ Not very much
⬭ None at all
⬭ I don't know

20. *Since you have installed a renewable hating system, please state to what extent you agree/disagree with the following statements:

	Strongly Agree	Agree	Disagree	Strongly disagree	Don't know
I consider the way I use heating more now	⬭	⬭	⬭	⬭	⬭
I consider the way I use hot water more now	⬭	⬭	⬭	⬭	⬭
I am more careful to switch lights and electrical appliances off now	⬭	⬭	⬭	⬭	⬭
I open windows and doors to ventilate rooms more often now	⬭	⬭	⬭	⬭	⬭

21. *Do you know how much you pay for your fuel/energy bills (or all household energy use)?

⬭ Yes exactly

⬭ Yes approximately

⬭ I have not had a bill through yet

⬭ No

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Do you know how much you pay for your fuel/energy bills (for all household energy use)? Equals Yes approximately

Or

If Do you know how much you pay for your fuel/energy bills (for all household energy use)? Equals Yes exactly)

22. Have you noticed any change in your fuel/energy bills (for all household energy use) since your system has been installed?

	Decrease	No change	Increase	Not applicable	Don't know
Electricity	⬭	⬭	⬭	⬭	⬭
Gas mains (for solar thermal)	⬭	⬭	⬭	⬭	⬭
Oil	⬭	⬭	⬭	⬭	⬭
Coal	⬭	⬭	⬭	⬭	⬭
LPG	⬭	⬭	⬭	⬭	⬭
Biomass	⬭	⬭	⬭	⬭	⬭
Other	⬭	⬭	⬭	⬭	⬭

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

(If, Do you know how much you pay for your fuel/energy bills (for all household energy use)? Equals Yes approximately
Or
If Do you know how much you pay for your fuel/energy bills (for all household energy use)? Equals Yes exactly

23. If you selected 'other'. Please specify which other fuel/energy you are referring to:

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals Solar thermal system)

24. *Since installing solar thermal, have you change the times when you use hot water?

- ⬭ Yes
- ⬭ No
- ⬭ I don't know

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals Solar thermal system)

25. If you selected 'yes', in what way have you changed the times when you use hot water?

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals biomass boiler)

26. *Which fuels do you use for your biomass heating system? (Please select all that apply).

- ⬭ Logs
- ⬭ Pellets
- ⬭ Woodchips
- ⬭ Other, please specify _____

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals biomass boiler)

27. *How satisfied are you with the following aspects of your biomass heating system?

	Very satisfied	Fairly satisfied	Fairly unsatisfied	Very unsatisfied	Don't know
Space to keep the fuel	⬭	⬭	⬭	⬭	⬭
Time it takes to feed the boiler	⬭	⬭	⬭	⬭	⬭
Keeping the fuel clean	⬭	⬭	⬭	⬭	⬭

28. **How easy or difficult do you find it feeding the fuel into your biomass boiler?**

- ⬭ Very easy
- ⬭ Quite easy
- ⬭ Quite difficult
- ⬭ Very difficult
- ⬭ I don't know

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals biomass boiler)

29. *How easy or difficult has it been to find a source of appropriate fuel?

- ⬭ Very easy
- ⬭ Quite easy
- ⬭ Quite difficult
- ⬭ Very difficult
- ⬭ I don't know

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals biomass boiler)

30. *Where do you usually get your fuel from? (Please select all that apply).

- ⬭ I buy it on the internet
- ⬭ I pick it up from the local store
- ⬭ I collect it locally
- ⬭ It is delivered via a local supplier
- ⬭ It is delivered by a national supplier
- ⬭ Other please specify
- ⬭ I don't know

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals biomass boiler)

31. How much do you estimate you spend on fuel for your biomass boiler? Please provide amounts in £ below:

£

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- (If, Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RGHPP): equals biomass boiler)

32. Is this estimate you have provided for your fuel cost for your biomass boiler based on...

- ⬭ A weekly cost
- ⬭ A monthly cost
- ⬭ A quarterly cost
- ⬭ I don't know

33. *Which, if any, of the following energy efficiency measures have you installed in your home since installing your renewable heating technology? (Please select all that apply).

- ⬭ Thermostatic controls fitted on individual radiators
- ⬭ Thermostatic controls upgraded on individual radiators
- ⬭ Solid wall insulation
- ⬭ Loft insulation or top-up loft insulation
- ⬭ Draught proofing or draught exclusion
- ⬭ Double glazing
- ⬭ Cavity wall insulation
- ⬭ Hot water tank insulation
- ⬭ Other insulation
- ⬭ None
- ⬭ Don't know
- ⬭ Other, please specify
- ⬭ I don't know

34. * Do you think that your renewable heating installation has affected the current value of your property?

- ⬭ Yes, I think it will be worth more now
- ⬭ Yes, I think it will be worth less now
- ⬭ No, I think it will be worth about the same now
- ⬭ I don't know

35. * Have you recommended installing a renewable heating system to anyone else?

Yes

No

I don't know

36. * Would you recommend installing a renewable heating system to anyone else?

Yes

No

I don't know

37. Please elaborate on why you would/wouldn't recommend a renewable heating system to anyone else?

38. * Please tell us your employment status

Full time employment

Part time employment

Retired

Unemployed

Student

I'd prefer not to say

Other

39. * Which of the categories represents the total annual income of your WHOLE household before deductions for income tax, National Insurance etc.

Up to £5,199

£5,200 to £10,399

£10,400 to £15,599

£15,600 to £20,799

£20,800 to £25,999

£26,000 to £31,199

£31,200 to £36,399

£36,400 to £41,599

£41,600 to £46,799

£46,800 to £51,999

£52,000 to £71,999

£72,000 to £103,999

£104,000 to £129,999

£130,000 or over

Prefer not to say

I don't know

40. How many people of each of the following age brackets live in your home? (Please include yourself).

0-4

5-11

11-15

16-24

25-34

35-44

45-54

55-64

65-74

75 or over

41. * Which of the following categories best describes your current tenancy status?

Own property outright

Own property with a mortgage

Rent property

Landlord of property

Shared Ownership

I'd prefer not to say

Other, please specify

I don't know

42. * To help us understand heating patterns, please tell us how often there is someone at home during the following times?

	Never	Rarely	Sometimes	Usually	Prefer not to say	I don't know
During weekdays						
During weeknights						
During weekends						

43. Please can you confirm when your home was built?

Before 1919

1919-1944

1945-1964

1965-1980

1981-2000

2001 or after

I don't know

44. What do you think are the main advantages or your renewable heating system?

45. What do you think are the main disadvantages of your renewable heating system?

Information on the amount of energy used by different types of households is of great value to the government in learning from policies. Would it be OK for the Department of Energy and Climate Change (DECC) to use data from your energy supplier on the amount of electricity (and gas – for solar thermal users) used at this address to help with this analysis? All information will be anonymised and used at a summary level for research and statistical purposes only.

46. * Are you happy for DECC to obtain this information?

Yes
No

To obtain data for electricity, it is helpful to have your MPAN number. Your MPAN is the unique identifying number for the electricity meter at your property, often referred to as a 'Supply Number' or 'S' number. It is a 21 digit number, which should appear on your electricity bill (this is different from your customer account number). Your supply number will normally be shown on your bill using a large 'S' and a grid of numbers.

47. Please write this 21 digit number in the box below:

This box is shown in preview only.
The following criteria must be fulfilled for this question to be shown:

- (

  If Please confirm the type of renewable heating technology you have installed with help from the Renewable Heat Premium Payment Scheme (RHPP): equals Biomass boiler

49. *As part of ongoing research into RHPP and other schemes to encourage renewable heat, we may wish to contact people in the future to take part in further research. Would you be willing to be contacted?

Yes

No

Appendix B – Methodology

Excel tables on the number of applications, questionnaires issued, and the number of responses have been published alongside this report.

Introduction

The objectives of the analysis is focussed on the RHPP1 experience, described as follows:

- **Who are RHPP1 respondents?**
  - *What are their socio-demographic characteristics, attitudes and aspirations?*
  - *What resources do they have available?*
  - *How are they different to the target population of each renewable heat technology?*
- **Why have RHPP1 respondents decided to install renewable heat technology?**
  - *What factors have driven their decision to install renewable heat technology?*
  - *What are the perceived benefits of renewable heat technology?*
  - *How are they paying for their renewable heat technology installation?*
  - *How has RHPP1 influenced their decision?*
  - *Where did RHPP1 enter the decision?*
- **What are RHPP1 respondents' experiences of installation?**
  - *What advice/guidance (if any) was given? Was it sufficient?*
  - *Installation of other energy efficiency measures?*
  - *Ease of installation?*
- **What are RHPP1 respondents' initial views on their recently installed renewable heat technology?**
  - *Ease of use, overall satisfaction?*
  - *Propensity to recommend renewable heat technology to others?*
- **What are RHPP1 respondents' views on their renewable heat technology several months following installation?**
  - *Ease of use, satisfaction with aspects of renewable heat technology, overall satisfaction?*
  - *Propensity to recommend renewable heat technology to others?*
  - *Are perceived benefits being realised?*
  - *Are RHPP1 respondents experiencing a reduction in their energy bills?*
  - *Have their views changed, if so how and why?*
- **How are RHPP1 respondents using their renewable heat technology?**
  - *Actions taken when too hot/cold?*
  - *Use of additional heating sources?*
  - *How are they sourcing fuel (biomass)?*
  - *Has renewable heat technology influenced how energy is being used or considered?*
- **What lessons can be learnt to influence take up of renewable heat technology to the wider population?**

Two questionnaires were designed, by DECC, for homeowners applying through the householder voucher scheme. The scheme started in August 2011. Homeowners would apply for a voucher under the RHPP scheme in advance of their technology being installed.

Installation dates ranged from July 2011 to March 2012. The vouchers could be redeemed once an MCS Certificate had been obtained from the installer.

Questionnaires were administered electronically by Energy Saving Trust, with invitations being sent by email and the data submitted on-line. All homeowners who redeemed a voucher were invited by email to complete a **post-installation** questionnaire for each type of technology installed. These were completed between October 2011 and July 2012.

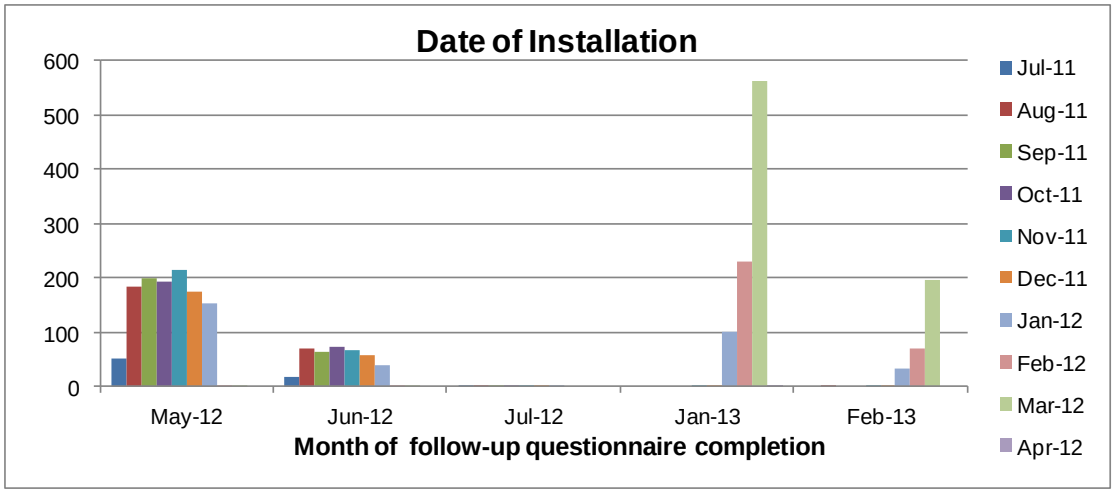
At least three months after redemption of the RHPP1 voucher, recipients were sent a link via email to the **follow-up** on-line questionnaire. As it was important to collect information on the use of renewable heating technologies over a winter period, any RHPP1 voucher recipient who had installed their renewable heating technology up to 31 January 2012 were issued the follow-up questionnaire in May/June 2012 (Wave 1), with the remainder being issued in January/February 2013 (Wave 2).

EST sent out reminders. There was a closing date of late August for the post-installation questionnaire. Data collected up to 19th February 2013 was included for the follow-up questionnaire.

48 of the 53 questions in the post-installation questionnaire were compulsory so either an individual would have completed and submitted the questionnaire or they would not have responded. 33 of the 49 questions were compulsory in the follow-up questionnaire.

Figure B1 shows the timing of the date of installation by the timing of the distribution of the follow-up questionnaires.

Figure B1 Installation and timing of follow-up questionnaires



Glossary

RHPP	Renewable Heat Premium Payment Scheme A government scheme that provides a one-off grant to help householders with the cost of installing renewable heat technologies
ASHP	Air Source/Air-to-water heat pump Air source heat pumps absorb heat from the outside air. This heat can then be used to heat radiators, underfloor heating systems, or warm air convectors and hot water.
BB	Biomass boiler Wood-fuelled heating systems, also called biomass systems, A boiler burns logs, pellets or chips, and is connected to a central heating and hot water system.
G/WSHP.	Ground-source or water-source heat pump Ground source heat pumps use pipes which are buried in the garden to extract heat from the ground. This heat can then be used to heat radiators, underfloor or warm air heating systems and hot water. The length of the ground loop depends on the size of the home and the amount of heat needed. Longer loops can draw more heat from the ground, but need more space to be buried in. If space is limited, a vertical borehole can be drilled instead.
ST	Solar thermal Solar water heating systems use free heat from the sun to warm domestic hot water. A conventional boiler or immersion heater can be used to make the water hotter, or to provide hot water when solar energy is unavailable.
RHI	The Renewable Heat Incentive (RHI) is a UK Government scheme set up to encourage uptake of renewable heat technologies among householders, communities and businesses through the provision of financial incentives. The UK Government expects the RHI to make a significant contribution towards their 2020 ambition of having 12 per cent of heating coming from renewable sources. The Renewable Heat Incentive is the first of its kind in the world. There are two phases to the introduction of the RHI: • Phase 1: the introduction of the RHI for non-domestic installations in the industrial, business and public sectors. • Phase 2: the domestic element of the RHI, is expected to be introduced in spring 2014 following the consultation published in September 2012 and more recently the UK Government Heat Strategy.

Data Processing

Following receipt of the post-installation questionnaire, the following tasks were undertaken prior to analysis:

– **Data validation and cleaning:** Route, range and logic checks were applied to the data. As the data were collected on-line, checks were also applied at the time of data entry. The data

were therefore relatively clean in terms of internal consistency. Basic cross-tabulations were produced on variables to check the data were consistent with other related responses to questions in the questionnaire. Further checks were undertaken for missing values, duplicate RHPP1 voucher numbers.

- **GIS coding:** Using GIS software MAPINFO, postcode data were mapped and allocated to Super Output Area, Local Authority Area and Region.
- **Open-ended coding:** The open ended coding included 3 tasks. The first task was to review the 'other' responses to specific questions. The second task focused on the responses to Q44 of the post-installation questionnaire. Only responses relating to the RHPP1 scheme in general were included, with those responses relating to the application processes excluded. The third and final task focussed on the responses to Q8, Q25, Q37, Q44 and Q55 of the post-installation questionnaire.
- **Scheme data:** Scheme administration data were appended to the post-installation questionnaire data.
- **Identify records at household level:** Some households had multiple technologies and multiple applications. The number of individual households was identified and a data file containing data at household level created.
- **Secondary data:** Relevant socio-demographic (British Labour Force Survey) and property data (English Housing Survey, National Survey for Wales and the Scottish Housing Survey) were analysed to provide comparisons with the questionnaire population.

Where results are applicable at the household or respondent level (for example, in analysis of demographic information), weights have been applied to the data for those households with multiple technologies, for example, where there are two technologies, a weight of 0.5 was applied, while those with one technology have a weight of 1. Weighting has been used where results are given at a household level (for example analysis of income).

Given the relatively large sample size in this analysis, more complex analysis, using multi-variate analysis techniques such as regression modelling have been undertaken. An analysis specification was drafted and agreed with the client.

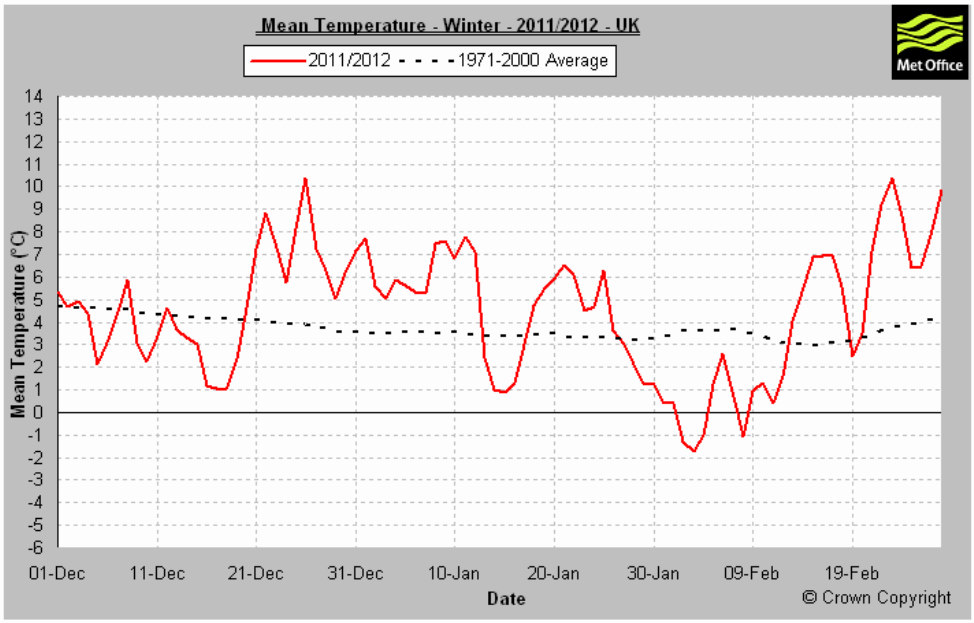
Table B1 shows the average winter temperatures for December to January over both waves of the post-installation questionnaire, and the daily variation shown in Figure B2.

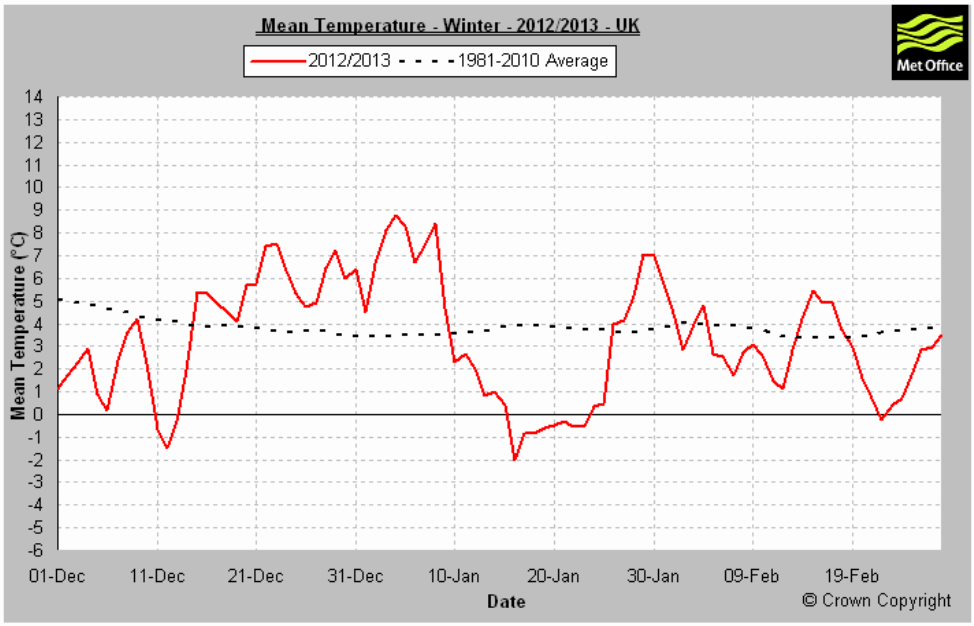
Table B1: Average winter temperatures Dec/Jan/Feb Mean Temperature UK/degrees centigrade

Wave 1 2011/2012	4.5
Wave 2 2012/2013	3.3

Source: metoffice.gov.uk/climate

Figure B2: Average winter temperatures

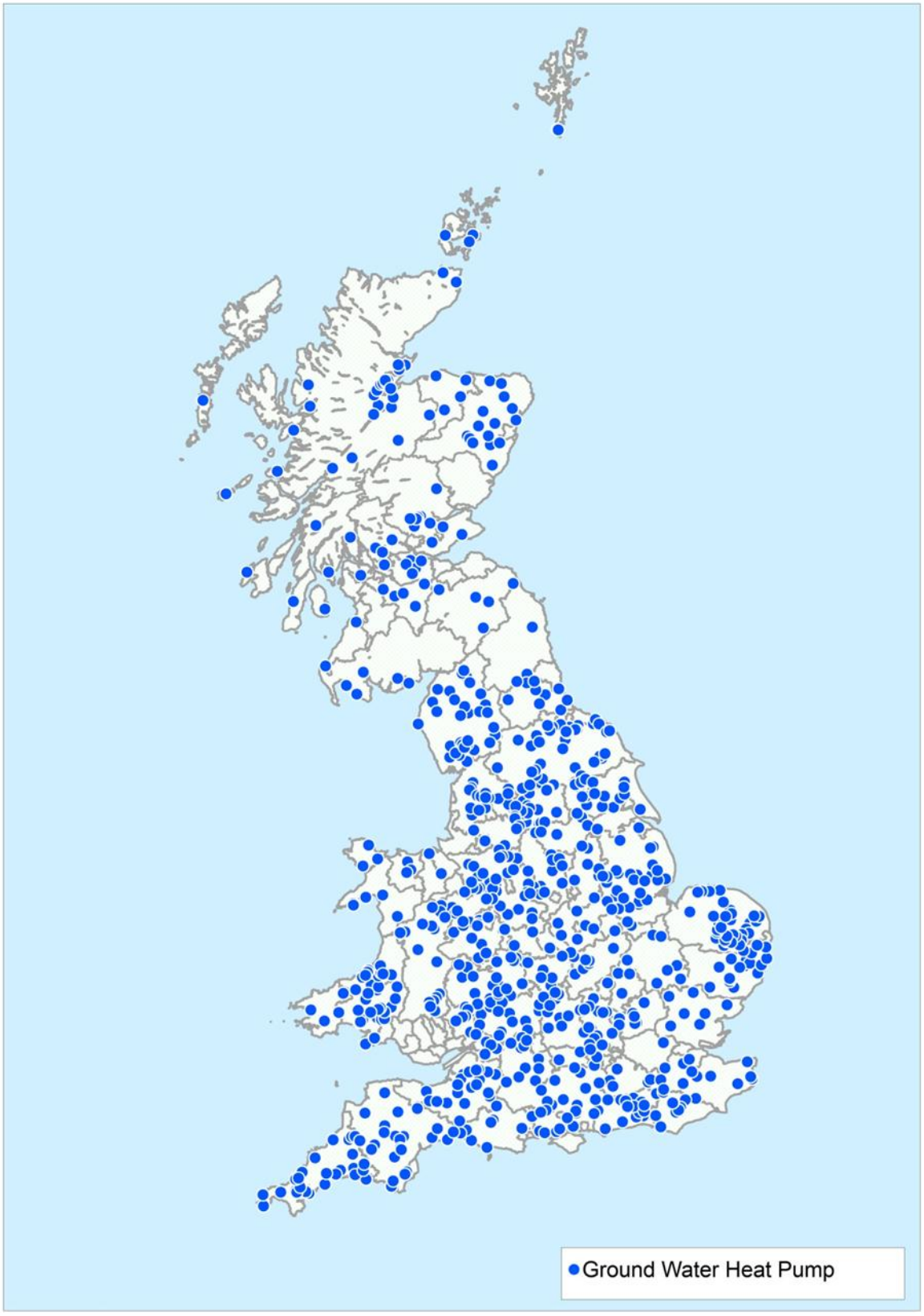


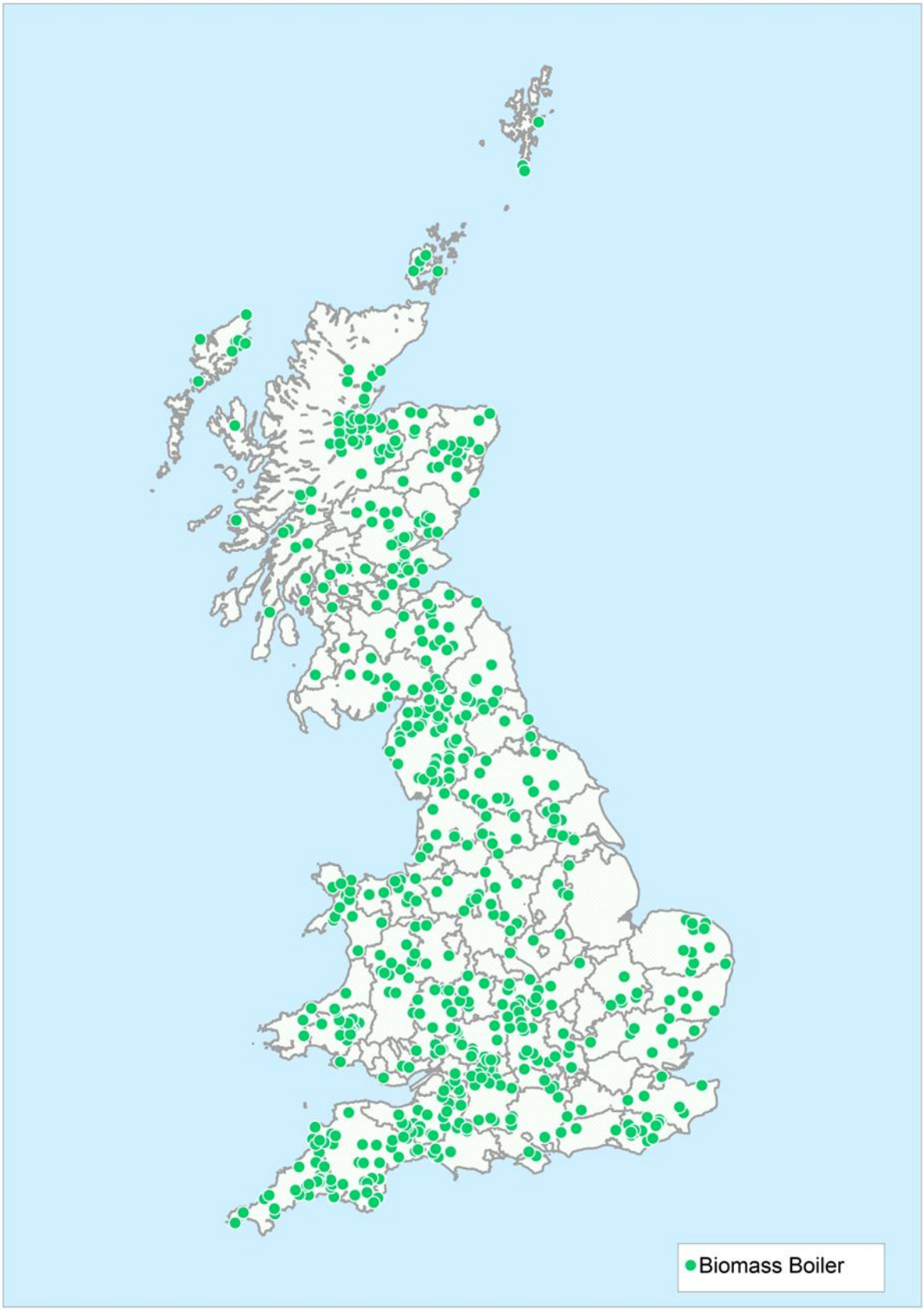


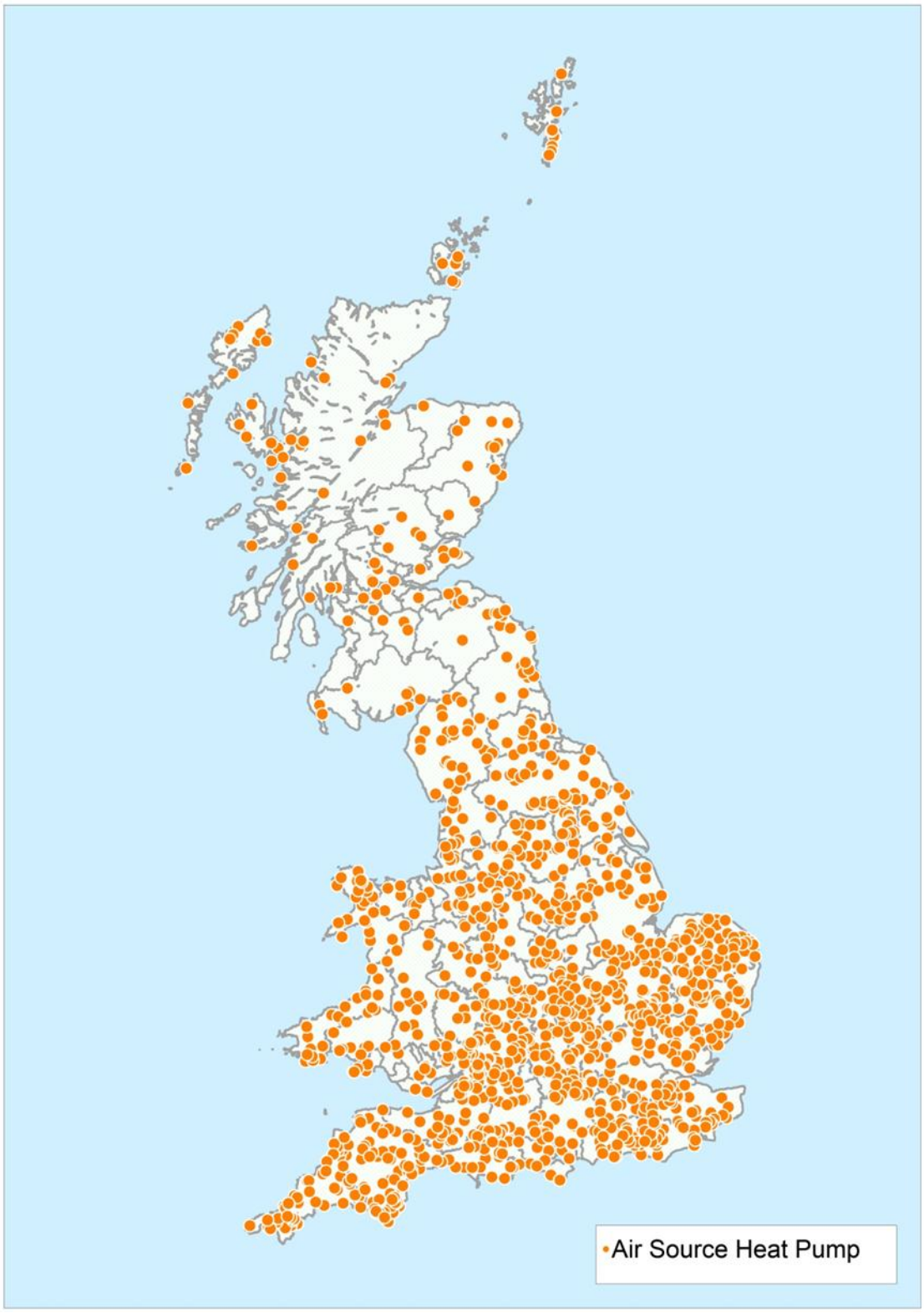
Appendix C – Analysis of Non-Response

Appendix C has been published separately as Excel tables and provides an analysis of the characteristics of those who have responded and those who have not to identify whether there is any non-response bias in the questionnaire data.

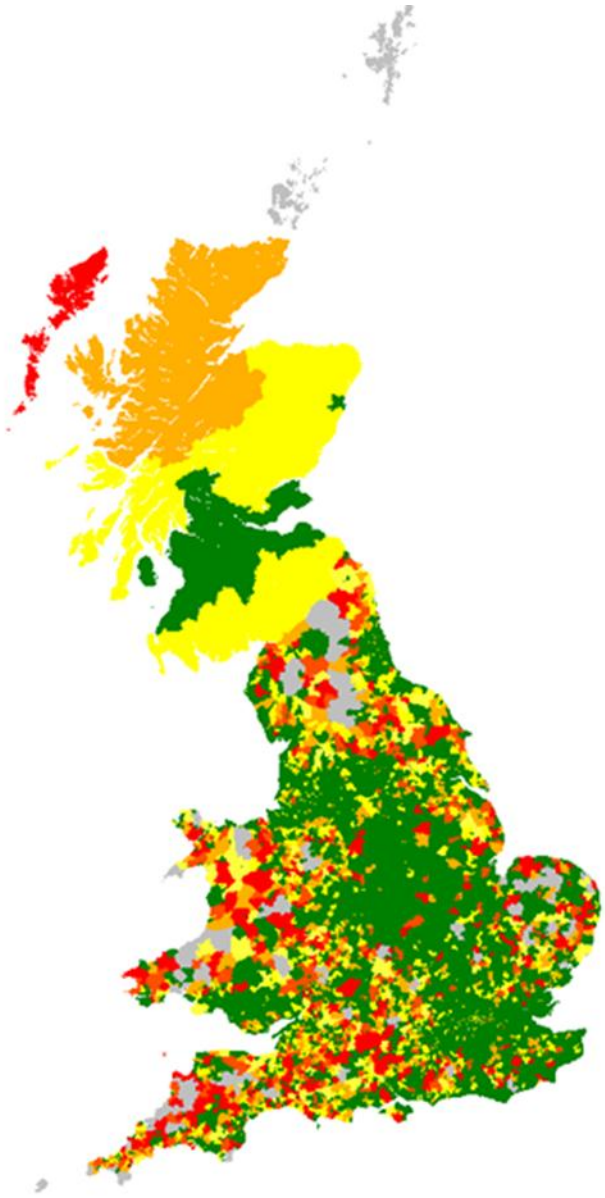
Appendix D – RHPP1 Plots of Respondent Postcodes


Ground Water Heat Pump


Biomass Boiler


Air Source Heat Pump

Appendix E – Off Grid Locations



Boundary Areas:

England/Wales: Lower/Middle Super Output Areas

Scotland: Local Authority Area

Key:

- On-Grid (Ratio above 0.8)
- Off-Grid Ratio Low (0.6 - 0.8)
- Off-Grid Ratio Medium (0.4 – 0.6)
- Off-Grid Ratio High (0.0 – 0.4)
- No Data Available

Appendix F – Regression Modelling

Introduction

This section presents the methodology and findings from logistic regression modelling carried out on the sample of 3958 owner-occupier questionnaires in the post implementation data set.

Regression models involve specifying a dependent variable (which is the behaviour we are trying to explain) and a number of independent variables (those variables we are using to explain the dependent variable). The use of logistic regression is dictated by the nature of the dependent variable which in this case is categorical rather than continuous.

Logistic regression analysis has been conducted with the post implementation data set to investigate how variables representing individual and household characteristics (independent or predictor variables) are associated with the type of Renewable Heat Technology people have chosen. Dependent variables have been defined for each of the following Renewable Heat Technologies that have been chosen:

– Solar thermal panels
– Ground or water source heat pump
– Air source heat pump
– Biomass Boiler

Table F1 below shows how the sample of 3,958 observations is split between the different Renewable Heat technologies.

Table F1 - Take up of each Technology

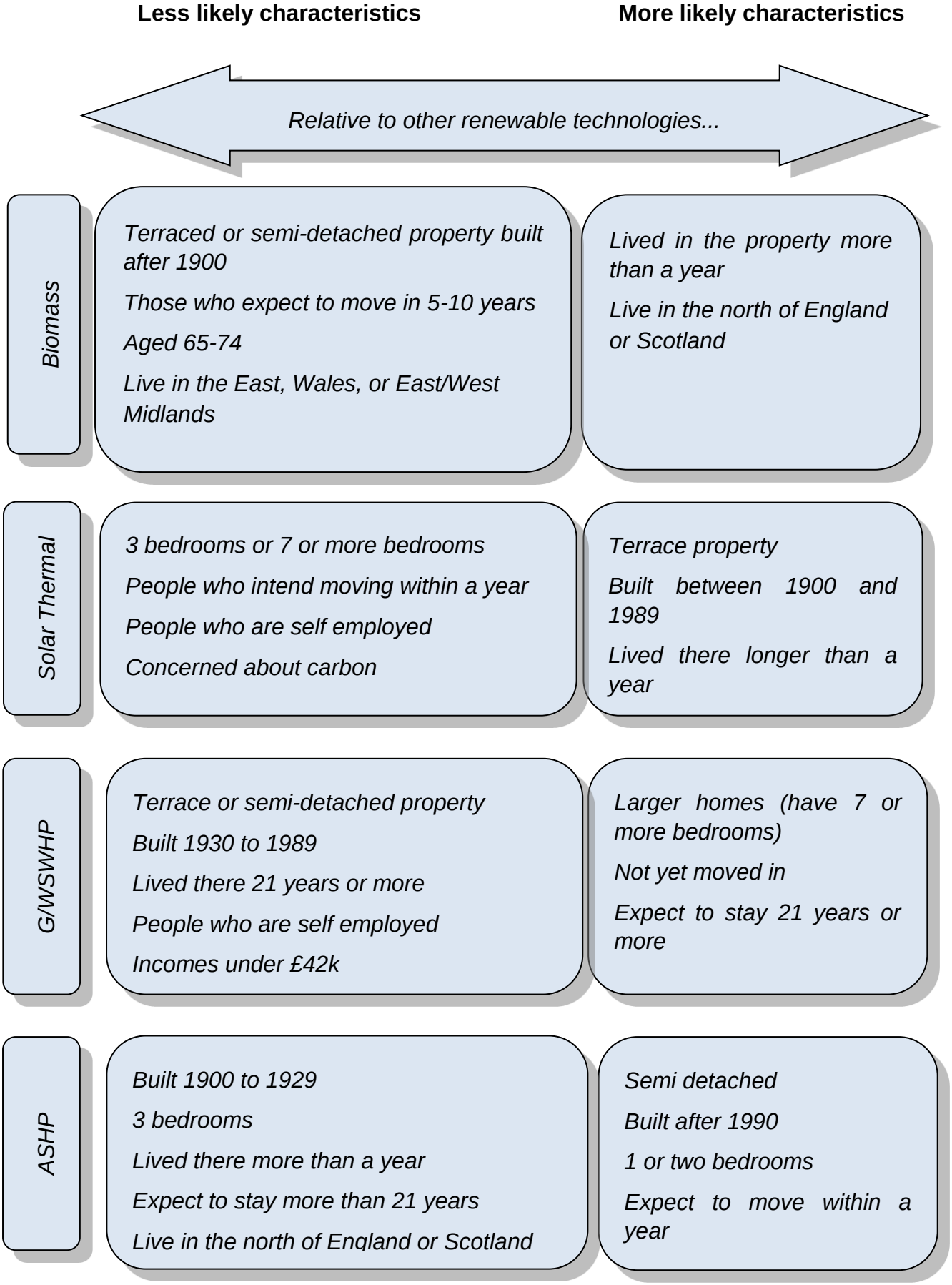
	N	%
Solar Thermal Panels	1,215	31%
Ground or Water Heat Pump	771	19%
Air Heat Pump	1,370	35%
Biomass Boiler	602	15%
Total	**3,958**	**100%**

We have concentrated on binary logistic regression modelling here because the results are easier to interpret in terms of characteristics of choosers of different Renewable Heat Technologies. By modelling each Renewable Heat Technology separately we are exploring how those who have chosen a particular Renewable Heat Technology are different from the others and this modelling seeks to identify the characteristics of choosers of each RHPP1 technology and explores commonalities and differences between them.

Alternative forms of logistic modelling were explored, for example multinomial logistic modelling. This compares the characteristics of those who have chosen each technology relative to a base. For example if Solar Thermal panels were taken as the base, then a multinomial logistic model would highlight the differences in characteristics of those choosing Ground or Water Heat Pump versus Solar Thermal Panels, Air Heat Pump versus Solar Thermal Panels and Biomass Boiler versus Solar Thermal Panels. This makes interpretation very complex so it was decided to adopt a simpler Binary Model approach where the characteristics of each technology were compared against all the other technologies combined.

Regression modelling provides coefficients for each independent variable which reveal how a one-unit change in the value of the independent variable is expected to influence the outcome of the dependent variable when the other independent variables are held constant. In short these coefficients indicate how important each independent variable is in explaining variations in the dependent variable. Hence, the regression coefficients provide information on the impact of each independent variable on the dependent variable while simultaneously controlling for the effects of the other independent variables in the model.

A summary of the findings is presented on the next page.


Less likely characteristics
More likely characteristics
Relative to other renewable technologies...
Biomass
Terraced or semi-detached property built after 1900
Those who expect to move in 5-10 years
Aged 65-74
Live in the East, Wales, or East/West Midlands
Lived in the property more than a year
Live in the north of England or Scotland
Solar Thermal
3 bedrooms or 7 or more bedrooms
People who intend moving within a year
People who are self employed
Concerned about carbon
Terrace property
Built between 1900 and 1989
Lived there longer than a year
G/WSWHP
Terrace or semi-detached property
Built 1930 to 1989
Lived there 21 years or more
People who are self employed
Incomes under £42k
Larger homes (have 7 or more bedrooms)
Not yet moved in
Expect to stay 21 years or more
ASHP
Built 1900 to 1929
3 bedrooms
Lived there more than a year
Expect to stay more than 21 years
Live in the north of England or Scotland
Semi detached
Built after 1990
1 or two bedrooms
Expect to move within a year

Analysis of respondent characteristics by technology

After this introduction this Appendix consists of five further sections:
– Modelling Approach
– Model Summaries
– Conclusions
– Outline of Variables
– Detailed Model Outputs

Modelling Approach
We outline our approach to modelling under the following sub headings
- Variables;
- Analysis and Interpretation;
- Goodness of Fit; and
- Outline of Model Results.

Variables

The variables contained in the regression analysis data set were collected from the full post-installation survey questionnaire. This section outlines the variables used in the regression modelling. These can be divided into dependent variables and independent variables.

Dependent Variables

There was a dependent variable for each Renewable Heat technology:

– Solar Thermal Panels
– Ground or Water Heat Pump
– Air Heat Pump
– Biomass Boiler

These were defined as dummy variables where 1 indicated it was chosen and 0 indicated it was not chosen. These are shown in Outline of Variables section (Table F7.1).

Independent Variables

The independent variables tested in the modelling are listed in the Outline of Variables section (Table F7.2) at the end of this Chapter. This table shows the different categories used for each variable and which category was taken as the base, this was usually that category with the largest number of observations. This is important for this type of modelling as will be explained later. The variables used in the modelling were:

<u>Information about Property</u>
– Property Type
– Year Home Built?
– Size of Property (Number of Bedrooms)
– How long in home?
– Expected time in home

<u>Socio-demographic Information</u>
– Age
– Employment Status
– Income
– Region

<u>Attitudinal Information</u>
– Whether Concerned about fuel prices
– Whether concerned about carbon emissions
– Whether they like to be considered *green*

The variables listed above and contained in Tables F7.1 are nominal or ordinal in nature and, in order to model these, separate dummy (0/1)variables have been estimated for each level of the variable. In order to estimate the

parameters for these variables it is necessary to drop one of the levels, with this omitted level becoming the base against which the other levels are compared. When interpreting the model output it must be borne in mind that the B parameter (see explanation in following section) measures the unit change from the base (the omitted level or levels). The base level is clearly identified in Table F7.2 for each variable.

Analysis and Interpretation

Tables showing the detailed model (one for each Renewable Heat Technology) are contained in the detailed model outputs section at the end of this Chapter. These tables show:

– Variable Name
– B parameter,
– Significance level (denoted sig or sometimes P) – probability that the true parameter value is zero. Usually a significance level of 0.05 is used. So if sig < 0.05 the parameter can said to be 'statistically significant'.
– Exp(B),
– 1/Exp(B) – this is useful for showing the importance of those variables which have a negative value of B, see example later, and
– Odds (which is the Absolute odds ratio). The absolute odds enable variables which have positive and negative values of B to be compared on an equal basis. The odds ratio for each parameter has been shaded to indicate whether the parameter is an enabler – is more likely to be associated with the technology in question (green) or a barrier – is less likely to be associated with the technology in question (orange).

The detailed model outputs show the full model estimated even if the parameters are not statistically significant (as measured by the significance level). We have adopted this approach because dropping variables which are not statistically significant effectively creates a different base category from which the other variables are compared. This can make interpretation more difficult especially if different models have different variables.

However the summary models shown in Tables F8.1 to F8.4 only show those variables that are statistically significant. Again these are colour coded to indicate whether they are enablers or barriers to the technology in question.

The results for each logistic model include a parameter (B) for each of the predictor (independent) variables in the model. In an ordinary regression model the B coefficient measures the change in dependent variable arising from a unit change in the independent variable. However, in a logistic regression model the B coefficient measures the change in the log odds of the dependent variable. The odds ratio is a more useful indicator. It is calculated as exp(B) and shows the multiplicative increase (or decrease) in the odds of choosing a particular type of technology for a one-unit change in an independent variable. For categorical independent variables the odds ratio shows the multiplicative increase (or decrease) in the odds of choosing a particular technology for each category compared to the baseline category.

For example if B=1.5, then exp(B) would be 4.48. This means when the independent variable changes by one unit the odds that likelihood that the technology in question is chosen increases by a factor of around 4.5, controlling for the other variables in the model. Alternatively if B=-1.5 then exp(B) would be 0.22. This means when the independent variable changes by one unit the odds that the technology in question is chosen decreases by a factor of around 4.5 (1/0.22).

The key summary results tables (F8.1 to F8.4) contain the following information:
– Variable name; and
– Odds – this is the Absolute odds ratio.

The tables show the importance of the different variables in terms of impact on odds of choosing a particular technology. The tables show the key 'enablers' which are those variables that make choosing a particular technology more likely (shaded green) and 'barriers' which are those that make choosing a particular technology less likely (shaded orange). In our commentary we have focused on those variables which have a significance level of 0.5 or less.

Odds Ratio Interpretation – Example

In Table F3 the variable 'Terraced' has an odds ratio of 2.04, which is shaded green. This means that those who live in terraced houses are 2 times MORE likely than those in detached properties (the base) to have a Solar Thermal Panel.

Similarly the variable '3 bedrooms' has an odds ratio of 1.34, which is shaded orange. This means that those who live in the 3 bed houses are 1.3 times LESS likely than those in 4 bed houses (the base) to have a Solar Thermal Panel.

Goodness of Fit

The goodness of fit of the logistic regression models was assessed using the McFadden Rho Squared Statistic which is comparable with the coefficient of determination statistic R^2 in a linear regression model. This is calculated from the initial and final log likelihood statistic produced by the model. Like R^2 it can takes values from 0 to 1 where 1 would indicate that independent variables are fully able to predict the dependent variable, although what can be taken as an acceptable goodness of fit is less straightforward for the Rho Squared statistic.

Table F2 below shows the goodness of fit as measured by the McFadden Rho Squared statistic for each model. A Rho Squared statistic of 0.10 is regarded as acceptable and a value of over 0.20 is regarded as a good fit. On this basis all models have a good goodness of fit to the data. Also shown in this table are the number of observations in each modelled category (Obs=0 and Obs=1, where 1 is chosen and 0 is not chosen).

Table F2 - Goodness of fit of models

Model	Initial -2 Log Likelihood	-2 Log likelihood	Obs=0	Obs=1	Total Obs	Rho Squared
1 Solar Thermal Panels	5486.95	4487.41	2743	1215	3958	0.18
2 Ground or Water Heat Pump	5486.95	3386.78	3187	771	3958	0.43
3 Air Heat Pump	5486.95	4875.35	2588	1370	3958	0.29
4 Biomass Boiler	5486.95	3000.33	3356	602	3958	0.64

Model Summaries

On the pages that follow a model summary has been produced for each of the detailed models and these are shown in Tables F8.1 to F8.2. Only those variables that are statistically significant (sig value <=0.05) have been reported and these have been colour coded to highlight whether they are an enabler or barrier to the particular technology being chosen. These tables also show the base category which is being compared with. It should be assumed that those levels not highlighted are not significantly different from the base level. Variables that are not included do not contribute to explanation of the dependent variable in question.

MODEL 1 - Solar Thermal Panels

Table F3 below shows the enablers and barriers to choosing a solar thermal system compared with the other technologies.

This shows that compared with:

- being a detached property
  - a terraced property is two times MORE likely to have solar thermal panels
- a home being built pre 1900,
  - homes built between 1900 and 1989 are more than two times MORE likely to have solar thermal panels
- a property with 4 bedrooms,
  - properties that have 3 bedrooms or 7 or more bedrooms are 1.3 and 1.7 times respectively LESS likely to have solar thermal panels.
- those who have lived less than a year in the property
  - people who have lived there longer are MORE likely to have solar thermal panels. This is 1.4 times MORE likely for those who have lived there 3-4 years but rises to 2.3 times MORE likely for those who have lived there 21 years or longer.
- those who have do not intend moving
  - people who intend to move within a year are 5 times LESS likely to have solar thermal panels.
- those who work full time
  - those who are self-employed are 1.3 times LESS likely to have solar thermal panels.
- those who neither agree or disagree that they are concerned about fuel prices,

- those who agree that they are concerned about fuel prices are 2.4 times LESS likely to have solar thermal panels

– those who neither agree or disagree that they are concerned about carbon,
  - those who agree that they are concerned about carbon are 1.3 times LESS likely to have solar thermal panels

– those in the south,
  - people in north are nearly 1.7 times LESS likely to have solar thermal panels, and
  - people in the midlands are 1.4 times LESS likely to have solar thermal panels.

Table F3 – Solar Thermal Panels Model Summary

Type	
Variable	**Odds**
Property Type	
Base (Detached)	
Terraced	2.04
Home Built?	
Base(Pre 1900)	
1900_1929	2.20
1930_1949	2.28
1950_1989	2.29
Number of Bedrooms	
Base (4 Bedrooms)	
3 bedrooms	1.34
7 or more bedrooms	1.74
How long in home?	
Base (Less than 1 year)	
3-4 years	1.36
5-10 years	1.77
11-15 years	1.93
16-20 years	2.13
21 years or over	2.28
Employment Status	
Base (Employed FT)	
Self Employed	1.37
Staying in property	
Base (Not moving)	
Less than 1 year	5.33
Concerned about fuel prices	
Base (neither agree or disagree)	
Agree	2.44
Concerned about carbon	
Base (neither agree or disagree)	
Agree	1.31
Region	
Base (South)	
North	1.70
Midlands	1.44

MODEL 2 - Ground or Water Heat Pump

Table F4 below shows the enablers and barriers to choosing a Ground or Water Heat Pump

This shows that compared with:

- being a detached property
    - a terraced property is 2.8 times LESS likely, and
    - a semidetached property is 1.7 times LESS likely to have a Ground or Water Heat Pump
- a home built pre 1900,
    - homes built between 1930 and 1989 are around three times LESS likely to have a Ground or Water Heat Pump
- a property with 4 bedrooms,
    - properties with 7 or more bedrooms are 2 times MORE likely to have a Ground or Water Heat Pump.
- those who have lived less than a year in the home,
    - those who have not yet moved in are 1.7 times MORE likely to have a Ground or Water Heat Pump.
    - those who have lived in the home for between 1 and 21 years are over 2 times LESS likely to have a Ground or Water Heat Pump. This rises to 3.3 times LESS likely for people who have lived in their home 21 years or over;
- those not planning to move,
    - people who expect to stay in their home between 5 and 15 years are between 1.4 and 2.1 times LESS likely to have a Ground or Water Heat Pump, but
    - those who expect to stay 21 years are more than 1.6 times MORE likely to have a Ground or Water Heat Pump;
- those who work full time
    - those who are self-employed are 1.3 times LESS likely to have solar thermal panels.
- those not stating their income,
    - people whose income is £10,400-£31,199 are 1.6 times LESS likely to have a Ground or Water Heat Pump
    - people whose income is £31,200-£41,599 are 1.4 times LESS likely to have a Ground or Water Heat Pump
- those in the South,
    - people in the North are around 1.5 times MORE likely and those in the Midlands are around 1.3 times MORE likely to have a Ground or Water Heat Pump.

Table F4 - Ground or Water Heat Pump Model Summary

Type	
Variable	**Odds**
Property Type	
Base (Detached)	
Semi Detached	1.66
Terraced	2.75
Home Built?	
Base(Pre 1900)	
1930_1949	3.11
1950_1989	2.59
Number of Bedrooms	
Base (4 Bedrooms)	
7 or more bedrooms	2.03
How long in home?	
Base (Less than 1 year)	
Not moved in yet	1.70
1-2 years	2.07
3-4 years	2.48
5-10 years	2.60
11-15 years	3.35
16-20 years	2.63
21 years or over	3.31
Expected time in home	
Base (Not Planning to move)	
5-10 years	2.06
11-15 years	1.39
21 years or more	1.62
Employment Status	
Base (Employed Full Time)	
Self Employed	1.31
Income	
Base (Prefer not to say)	
£10,400 - £20,799	1.61
£20,800 - £31,199	1.61
£31,200 - £41,599	1.43
Region	
Base (South)	
North	1.46
Midlands	1.33

MODEL 3 - Air Source Heat Pump
Table F5 below shows the enablers and barriers to choosing a Air Heat Pump

This shows that compared with:

- being a detached property,
  - a semi detached property is 1.3 times MORE likely to have a Air Heat Pump
- a home being built pre 1900,
  - homes built later than1990 are around 1.4 times MORE likely to have a Air Heat Pump, but
  - homes built between 1900 and 1929 are 1.4 times LESS likely.
- a property with 4 bedrooms,
  - properties that have less than 1 or 2 bedrooms are around 1.5 times MORE likely to have a Air Heat Pump and
  - properties that have 3 bedrooms are 1.4 times LESS likely to have a Air Heat Pump.
- those who have lived less than a year in the home,
  - people who have lived there more than a year are around 1.5 times LESS likely to have a Air Heat Pump.
- those who are not planning to move,
  - people who expect to move within a year are 4 times MORE likely to have a Air Heat Pump,
  - those who expect to move in 5-10 years are 1.4 times MORE likely to have a Air Heat Pump, and
  - people who are expecting to stay in their home for 21 years or more are 1.4 times LESS likely to have an Air Heat Pump.
- those who neither agree or disagree that they are concerned about fuel prices,
  - those who agree that they are concerned about fuel prices are 1.4 times LESS likely to have Air Heat Pump
- those in the South,
  - people in the north are 1.5 time LESS likely to have a Air Heat Pump, but
  - those in the midlands are 1.2 times more likely

Table F5 - Air Heat Pump Model Summary

Variable	Odds
Property Type	
Base (Detached)	
Semi detached	1.30
Home Built?	
Base(Pre 1900)	
1900 to 1929	1.39
Later than1990	1.35
Number of Bedrooms	
Base (4 Bedrooms)	
1 or 2 bedrooms	1.48
3 bedrooms	1.40
How long in home?	
Base (Less than 1 year)	
Not moved in yet	1.58
5-10 years	1.38
11-15 years	1.50
16-20 years	1.54
21 years or over	1.67
Expected time in home	
Base (Not Planning to move)	
Up to one year	4.14
5-10 years	1.44
21 years or more	1.44
Concerned about fuel prices	
Base (neither agree or disagree)	
Agree	1.44

Region	
Base (South)	
North	1.49
Midlands	1.19
Age of Respondent	
Base (55-64)	
Aged 35-44	1.27

MODEL 4 - Biomass Boiler

Table F6 below shows the enablers and barriers to choosing a Biomass Boiler

This shows that compared with:

- being a detached property
  - a terraced property is 2.6 times LESS likely to have a Biomass Boiler
  - a semi-detached property is 1.5 times LESS likely to have a Biomass Boiler
- a home being built pre 1900,
  - a home built after 1900 is LESS likely to have a Biomass Boiler – this increases to 3.1 times LESS likely if the property was later than 1990
- those who have lived less than a year in the home
  - people who have lived there for more than a year are around twice MORE likely to have a Biomass Boiler.
  - People who have not yet moved are 1.7 times LESs likely to have a Biomass Boiler.
- those who are not planning to move,
  - people who expect to move in 16-20 years are 1.5 times MORE likely to have a Biomass Boiler
  - people who expect to move in 5-10 years are 1.5 times LESS likely to have a Biomass Boiler
- those who are 55-64 years of age,
  - Those who are 65-74 are 1.8 times LESS likely to have a Biomass Boiler
- those not stating their income,
  - people whose income is £20,800-£31,199 are 1.7 times MORE likely, and
  - people whose income is £31,200-£41,599 are 1.6 times MORE likely, to have a Biomass Boiler
- those who neither agree or disagree that they are concerned about fuel prices,
  - those who agree that they are concerned about fuel prices are around 5 times LESS likely to have a Biomass Boiler
- those in the South,
  - people in the north are 2 times MORE likely, to have a Biomass Boiler.
  - those in the midlands are 1.3 times LESS likely to have a Biomass Boiler.

Table F6 - Biomass Boiler Model Summary

Variable	Odds
Property Type	
Base (Detached)	
Semi-detached	1.50
Terraced	2.57
Home Built?	
Base(Pre 1900)	
1900_1929	1.92
1930_1949	1.75
1950_1989	2.84
Later than 1990	3.10
How long in home?	
Base (Less than 1 year)	
Not moved in yet	1.68
1-2 years	1.71
3-4 years	1.89
5-10 years	1.63
11-15 years	2.04
21 years or over	1.49
Expected time in home	
Base (Not Planning to move)	
5-10 years	1.49
16-20 years	1.50
Age	
Base (55-64)	
65-74	1.77
Income	
Base (Prefer not to say)	
£20,800 - £31,199	1.74
£31,200-£41,599	1.64
Concerned about fuel prices	
Base (neither agree or disagree)	
Agree	5.15
Region	
Base (South)	
North	2.21
Midlands	1.31

Conclusions

The logistic regression models have identified characteristics associated with the choice of different Renewable Heat Technologies.

Outline of Variables Used

Table F7.1 outlines the different dependent variables used in the regression analysis.

Table F7.1 - Dependent Variables

Dependent Variables	Description
Depsol	Chosen Solar Thermal Panels (=1) or not (=0)
Depgwheat	Chosen Ground or Water Heat Pump (=1) or not (=0)
Depaheat	Chosen Air Heat Pump (=1) or not (=0)
Depbio	Chosen Biomass Boiler (=1) or not (=0)

Table F7.2 outlines the independent variables included in the regression analysis and the different levels used for each variable indicating which level is taken as the base.

Table F7.2 Independent Variables

Property Type
Base (Detached)
Semi Detached
Terraced
Flat/ Maisonette /Other/Missing
Home Built?
Base(Pre 1900)
1900_1929
1930_1949
1950_1989
Later than 1990
Other/Missing
Number of Bedrooms
Base (4 Bedrooms)
1 or 2 bedrooms
3 bedrooms
5-6 bedrooms
7 or more bedrooms

Table F7.2 Independent Variables (continued)

How long in home?
Base (Less than 1 year)
Not moved in yet
1-2 years
3-4 years
5-10 years
11-15 years
16-20 years
21 years or over
Don’t Know
Expected time in home
Base (Not Planning to move)
Currently Moving
Up to one year
1-2 years
3-4 years
5-10 years
11-15 years
16-20 years
21 years or more
Age
Base (55-64)
16-24
25-34
35-44
45-54
65-74
75 or over
Other/Missing
Employment Status
Base (Employed FT)
Self Employed
Other/Missing

Table F7.2 Independent Variables (continued)

Income
Base (Prefer not to say)
up to £10399
£10399-£20799
£20800 - £31,199
£31,200-£41,599
£41,600-£51,999
£52,000- £71,999
£72,000 or over
Concerned about fuel prices
Base (neither agree or disagree)
Agree
Disagree
Concerned about carbon emissions
Base (neither agree or disagree)
Agree
Disagree
Like to be Green
Base (neither agree or disagree)
Agree
Disagree
Region
Base (South)
Midlands
North

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