



User behaviour in energy efficient homes

Phase 2 report

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EXECUTIVE SUMMARY

“*User behaviour in energy efficient homes*” or “User Behaviour” for short, is a research project that aims to improve understanding of how people actually use the energy efficient systems installed in their homes. Do they use them efficiently? Do they gain the benefits assumed by those who install them and the policy benefits such as contribution to CO₂ emission reductions assumed by the government programmes that supported the installations? In 2003, ACE carried out a feasibility study (phase 1 of the project) to identify the potential for a survey of user behaviour in energy efficient homes to answer these questions. Phase 2 – the survey itself and the report on its findings – commenced in October 2003.

The survey

The sample for the survey was taken from estates of participating housing associations, identified in the initial feasibility study as having been the subject of energy efficiency improvements at least 15 months ago. In most cases the interviews with householders were conducted by personnel from local EEACs acting as ACE’s agents. Seven case studies, comprising 118 interviews, form the basis of this report.

Survey findings

The survey’s findings on respondents’ demographics, previous and current heating system experience, heating controls and heating pattern, use of their current system and energy advice received, their level of energy awareness and the impact of their homes on their lives have been summarised in order to describe the sample. Generally, interviewees were pleased with the energy efficiency improvements to their homes

Testing the hypothesis

The hypothesis has been set up, describing the relationship between the results someone gets from their system (“Desired Results” – *Yes* or *No*), their behaviour in managing their heating (“Behaviour Style” – *Efficient*, *Reasonable* or *Inefficient*) and four key influences on that behaviour. These four influences or factors are:

- demographics such as age and employment situation
- previous experience such as heating systems and whether they lived in the house before it was improved
- their general energy awareness as shown through heating system use, use of energy saving strategies elsewhere in the home and attitudes to energy supplier switching
- the instructions and advice they were given, by whom and when

The analysis found that the most likely influences on Behaviour Style are whether or not a household has children, is full time employed, has had previous experience of gas central heating, has switched energy supplier and is aware of energy labels. The most likely influence on whether or not Desired Results are achieved appears to be the position of the thermostat.

Conclusions and recommendations

The following findings are made in relation to the hypothesis of user behaviour in energy efficient homes:

- Most respondents (86%) get the Desired Results from their heating systems
- 23% use their heating systems in a way that corresponds to policy expectations, i.e. are Efficient;
 - 89% of these get the Desired Results
- 50% do it in a way that is efficient from their own perspective; i.e. they get results in a way that suits them and their lifestyle, i.e. is Reasonable;
 - 96% of these get the Desired Results
- The remaining 23% are Inefficient; they do not use the systems effectively and they do not get the best value for their lifestyle;
 - only 55% of these get the Desired Results

Further research is suggested to develop the relationships between Behaviour Style in using the system, obtaining Desired Results, and the likely influences on these identified in the analysis. In addition it is recommended that further analysis of energy advice provision is carried out to determine with greater certainty the 'best practice' case study examples, that best practice in setting heating controls and TRVs in relation to thermostat positions is identified and that energy advice providers review heating system documentation provided by installers.

In phase 3 the key messages from this research will be developed and disseminated through a variety of channels. It is hoped that improvements will arise for both the comfort and the expenditure, both in monetary and CO₂ terms, of the occupants.

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List of abbreviations

ACE	Association for the Conservation of Energy
B&B	bed & breakfast
BRE	Building Research Establishment
CFL	compact fluorescent light
CH	central heating
CPSU	combined primary storage unit
CWI	cavity wall insulation
Defra	Department for Environment, Food and Rural Affairs
EAS	Energy Action Scotland
EB	Efficient behaviour
EEAC	Energy Efficiency Advice Centre
EEPH	Energy Efficiency Partnership for Homes
FT	full time
HA	housing association
HW	hot water
IB	Inefficient behaviour
NCHA	Nottingham Community Housing Association
NAO	National Audit Office
PT	part time
RB	Reasonable behaviour
TRV	thermostatic radiator valve

INTRODUCTION

“User behaviour in energy efficient homes” or “User Behaviour” for short, is a research project that aims to improve understanding of how people actually use the energy efficient systems installed in their homes. Do they use them efficiently? Do they gain the benefits assumed by those who install them and the policy benefits such as contribution to CO₂ emission reductions assumed by the government programmes that supported the installations?

These questions lead to others, such as how can we manage such efficiency installations in order to achieve the results expected of them. Effectively we want to know how we can optimise approaches that are already using scarce resources in terms of money and personnel especially in local government and housing associations, where many energy officers have this as only part of their roles. In addition, programmes delivering energy improvements to owner-occupiers have no framework for on-going support, so that getting the message of how to get the best out of new systems has only one direct opportunity for success apart from general media messages.

Why do we assume that people do not use their systems efficiently? Surely it is in everyone’s best interests to do so? There is plenty of anecdotal evidence for lack of understanding of the role of thermostats and programmers, and combinations of heating, insulation and ventilation can provide the non-technical person with a confusing array of buttons and switches. With incomplete understanding of how to get the internal environment they would like, it is hardly surprising that they resort to simply turning things on and off as required, or opening the window if it gets too hot. The only direct evidence of these behaviours we found is the Easthall project “Easthall Revisited” (EAS 2002), where a review of the way people used the systems in a block in Glasgow that had been refurbished to high specification found these types of behaviours were common.

In developing the concept of this project we found little other evidence and, once we brought the project to the Feasibility Study stage, our literature research found many interesting approaches to identifying how people used energy advice but nothing about how people used their heating systems. The Feasibility Study literature review is included as Appendix 1 to this report.

We developed this second phase of the project – the survey – through liaison with a number of housing associations that agreed to take part as case study groups. The reason for choosing housing associations was twofold; firstly we had previously worked on projects to benefit housing associations (e.g. Directory of Energy Services NCHA 2001) which suggested that there were some associations who had done more than others to support understanding of heating systems and provided support and advice. Secondly, working with housing associations gave us more control of the survey stages; the existing relationships with the housing provider meant we had more ‘standing’ with the residents to carry out such a survey than we would had we approached owner-occupiers ‘cold’. Despite a more limited spread of socio-economic groupings amongst social housing tenants than owner-occupiers, we have no reason to believe that the way they use their heating systems is any different, indeed they may have more of an incentive to use them economically.

The aims and development of the survey are explained more fully in the next chapter and we recommend that a full evaluation is carried out in the next phase, not only to temper the findings from this stage, but also so that we, and any other organisations who plan a similar exercise, can learn and improve both the methodology and the results.

The results of the survey are shown in the following two chapters; we use descriptive statistics to give the overall picture of what we found, then we introduce our hypothesis exploring the

relationship between the results someone gets from their system, their behaviour in managing their heating, and four key influences on that behaviour. These four influences are:

- demographics such as age and employment situation
- previous experience such as heating systems and whether they lived in the house before it was improved
- their general energy awareness as shown through heating system use, use of energy saving strategies elsewhere in the home and attitudes to energy supplier switching
- the instructions and advice they were given, by whom and when

It is clear that we have not achieved as many surveys as we would like in order to develop some of these ideas further. We achieved only half the number of interviews originally planned. This has made the validity of the statistics less strong, and a note on statistical issues is included in Appendix 3. Nevertheless, this is a solid piece of research that provides useful clues, some of which will stand on their own and allow us to say we have achieved certain objectives. Some will be left for others to investigate more fully and others that might have been promising theories may now look as if they are not worthy of further investigation. In this we will have contributed to saving others from researching less promising lines of enquiry and helped to focus on the more salient issues. We believe we have found some candidates for best practice, but they have not been proven as such. This means we can indicate opportunities to housing associations, whilst not saying, "this is the best way to do it".

We feel this is a valuable piece of work, and hope that others find it useful. The dissemination of this work will form phase 3 of the project, which will, we hope, follow immediately from this.

First, we look at how the survey was developed and then at its results.

SURVEY OF USER BEHAVIOUR IN ENERGY EFFICIENT HOMES

This section provides an overview of the survey methodology; the actual survey questionnaire is included for reference in Appendix 4.

Aim and objectives

The aim of the survey was:

- to identify how householders who have energy efficient homes react to and use their systems

The objectives:

- assess householders' behaviour in using their systems in 10-12 projects or case studies
- identify differences in the projects that can provide best practice solutions
- identify where technologies are difficult to use and link to other 'usability' studies
- support other research in information needs for householders receiving energy efficiency measures
- provide information on energy refurbishment projects for the Green Street project (Sustainable Homes, 2003)
- spread best practice to housing managers so that their energy strategies have a greater effect on their tenants and residents

Size of the sample

We aimed to achieve a sample (total number of interviews) of the order of 300. This would give us ample scope for reliable and valid sub-groups and detailed analysis. In our estimate, a minimum of 250 would still meet this criterion. To this end we wanted to achieve 30 interviews in each of 10 case study groups, allowing for the possibility of 2 groups falling by the wayside for unforeseen reasons. Based on the information available on the Easthall survey, which achieved 26 interviews from 42 letters to residents, we suggested that candidate case studies needed at least 50 homes within the sample group to achieve the target 30 interviews. We were relying on the strength of the relationship of the housing association with their tenants to achieve this relatively high response rate.

Case studies

We identified a number of housing associations or trusts that were thought to have carried out energy efficiency improvements to a sizeable group of homes. This identification was through discussion, hearsay, case studies in the public domain and recommendations. Once we made contact, the housing association was provided with the criteria and we discussed whether it seemed feasible for them to become a case study. If so, they were asked to complete a form allowing us to capture basic information on the case study such as number of properties, types of work done, and also checking the extent of input from the association in terms of setting up and carrying out the interviews.

A number of the housing associations appeared to be able to offer more than one case study group, which differed in some way such as measure introduced or type of housing (e.g. sheltered housing versus general needs). In this way we developed a list of twelve possible case studies with characteristics and base size as indicated in Table 1.

One condition of participation is that information on the housing associations taking part is confidential, unless specifically agreed if “best practice” examples are to be developed. A benefit to each housing association is that individual evaluation reports are being written to give the results of their survey, with comparisons where appropriate with the whole survey.

Table 1: Outline of proposed case study groups

General location	Case study characteristics	Overall group size
Scotland	Sheltered housing programme with communal gas heating and insulation improvements (rolling programme)	60
Scotland	General needs insulation programme (2002)	120
Northern Ireland	Off-gas network, efficient oil central heating system replacing costly electric system (2002)	52
Northern Ireland	Gas central heating installation; gas is a relatively novel heating technology for tenants (2000)	68
North West England	Central heating replacement programme, cavity wall and loft insulation, low-e double glazing (?)	485
East Midlands	Central heating replacement programme, cavity wall and loft insulation, low-e double glazing, hot water tank insulation (?)	67
Wales	Central heating programme, condensing boilers, loft plus cavity wall insulation or internal insulation of solid wall homes (?)	30
London	Central heating modernisation programme & hot water tank insulation (2002/2003)	47
London	Sheltered housing, community heating programme (communal gas boiler, 1997)	43
Southern England	Central heating replacement programme plus insulation upgrade as appropriate (?)	74
Southern England	Off-gas network group of rural houses; wood-fired central heating system (?)	16
South West England	Solid wall houses with external cladding plus window replacement and loft insulation; central heating installation (?)	76

From now on the case study groups will be referred to by a letter, i.e. Case Study A, B, C etc.

Survey teams

Most of the housing associations were unable to supply personnel to carry out all the interviews, and in many cases were only able to commit to setting up the appointments with the tenants. The local Energy Efficiency Advice Centre, Energy Agency or Sustainable Energy Centre (EEACs) were contacted to discuss whether they would be able to act as ACE's agent in delivering the interviews. To this end the EEACs were invited to participate in the development of the project with the case study concerned, including the relevant training on the survey questionnaire. Some consideration was given to the question of introducing bias depending on whether the interviewer was from the association or an independent person, from the tenants' point of view. After discussion, it was decided that any such bias was unlikely to have an effect on the overall results.

Survey questionnaire

The questionnaire was developed from three main sources; the form used for the Easthall survey which was known to have gone through a number of iterations to meet the standards required by Glasgow City Council for dialogue with its tenants; the Tenants Green Survey, developed by BRE and Sustainable Homes (ref.) and the standard 'DIY Home Energy Check' form as supplied by one of the EEACs. The resulting questionnaire, although a simple two pages in the question format, provided a comprehensive data collection sheet in order to allow for all eventualities, and looked quite daunting to most of the case study personnel. The questionnaire was intended to be somewhat time consuming in order to allow the tenant to relax into the conversation and say what they actually did rather than a quick response to what they might think they should do. However the aim to allow an hour for the survey was possibly a drawback and some of the housing associations had reservations over its length. This aspect of the survey will be evaluated further in phase 3. The majority of survey interviews lasted around forty minutes.

Setting up interviews

The ACE team, the housing association personnel and the EEAC representative agreed the arrangements at a meeting that took place between October and December for all but two of the housing associations. The last two were delayed; one for logistical reasons and the other due to other priorities including a phase of stock transfer. These were arranged in January, one ultimately being the first to complete its surveys and their input to the database, the other being further compounded by bereavement amongst key personnel.

Pilot case study

One case study was tackled before all the others in order to treat it as a pilot and to disseminate lessons to the other survey teams. It suffered great problems in obtaining volunteers to take part despite the efforts of the estate officer. It was taken that the interest was reduced due to a survey six months earlier about other aspects of the estate, but perhaps more notice should have been taken of the difficulty in engendering interest. However, the pilot allowed the questionnaire and the data transfer mechanism to be fully tested and no major adjustments were made.

The interviews

The interviews took place from early January to late February, with one housing association continuing into early March to make the most of the opportunity for evaluation of its programme. A number of different approaches were made for setting up the interviews, with some being promoted by the housing association directly by telephone, for others the association sent a letter asking for response. Others sent letters asking them to respond if they did *not* want to take part, and then following everyone else up by phone. Most associations agreed a form of incentive, either supplying this from their own resources or jointly with the EEAC. Energy efficient light bulbs for everyone taking part was a common incentive: others included entry in a draw for gifts

such as a solar powered radio or Argos vouchers. One association took the approach that the tenants had received improvements and this was the evaluation so the tenant *should* take part, rather than it being voluntary. This was a most successful approach, if hard to replicate in many areas!

There were a small number of “failed” interviews where the appointments were not kept, whether through other events such as family illness, or just forgetting. The number was consistent with expectations.

One problem from a budgetary point of view was that the interview budget had been arranged on the basis that a number of interviews would be carried out in one visit. Increasingly as interviews became harder to fix, the interviewers took the opportunity of “door-knocking” (with the associations’ permission) to see if people were willing to take part without a prior appointment, rather than personnel returning home after just one interview. Most case study personnel made an additional effort to set up interviews by phone but despite this, the final numbers were disappointing, reaching just half the original target.

Results

The results were input to a database using an online form, so that the interview questionnaires remained with the EEAC/association and only the raw data, without names and addresses, was received by ACE. In this way the survey complied with data protection considerations, the identifiable data remaining in the hands of the association.

The total number of interviews finally achieved was 118 with a further 32 expected¹. This was very disappointing, but still represents a sample 3 or 4 times larger than any comparable study. The analysis of the results will take care to treat only those groups of a size sufficient to make a reliable study. This means that for some of our objectives, the figures are only of anecdotal value, although others will be adequately well founded to make sound arguments and recommendations.

The results are analysed in the next two sections, and these are followed by comparison with objectives and recommendations.

¹ At time of writing data from these interviews have been received and will be incorporated into a later version as an appendix
Association for the Conservation of Energy

GENERAL SURVEY FINDINGS

In this section we describe the survey on a statistical basis, identifying key factors and reporting on the percentage of responses for each section of the interview. The following chapter will develop our hypothesis that there is a relationship between the behaviour of those surveyed in using their systems and various factors which could lead to improving the way we achieve energy efficiency through installation of measures. First, what does our survey tell us about the people involved?

Section 1: Demographics

At the time of this report, 118 survey interviews were recorded. The length of time at the address, the type of house, age and number of bedrooms are recorded in Table 2 and Table 3.

Table 2: Length of time in current home

<i>Length of time</i>	<i>No.</i>
Less than one year	10
1-2 years	21
2-3 years	14
3-5 years	14
5-7 years	16
7-10 years	12
more than 10 years	31

Table 3: Type and age of house, with number of bedrooms

<i>Type of house</i>	<i>No.</i>	<i>Age of house</i>	<i>No.</i>	<i>Number of bedrooms</i>	<i>No.</i>
Detached	5	Pre 1919	20	None - studio/bedsit	4
Semi-detached	9	1919-1945	19	One	45
End of terrace	21	1946-1965	2	Two	26
Mid-terrace	37	1966-1990	62	Three	33
Maisonette	3	1990-2000	3	Four	9
Converted flat	6	post 2000	6	Five	1
Purpose built flat	37				

There were a total of 275 people covered by the survey of whom:

- Fifteen were adults over 75.
- Forty were adults over 60 (but under 75): 20 of whom lived alone, 1 lived with a person over 75, 3 with a person under 60 and 8 with another 60-75 year old.
- Of the 137 adults under 60, there were two groups of five at the same address; 13 single adults had children living with them; 1 adult under 60 lived with 2 adults (60-75), and all adult couples had at least one child.
- There were a total of 55 children over 11, 21 children under 11 and 7 infants. There were 34 households with children of any age.

Employment status is shown in Table 4. Twenty-two households had at least one person in full-time employment, 49 had at least one person retired. Twenty-one households had at least one person suffering from long-term ill health or disability; three had carers living with them, the other carers looked after children.

Table 4: Employment status of adults in households

<i>Employment Activity</i>	<i>No.</i>
Full-time employment	31
Part-time employment	15
Self-employed	4
Unemployed	32
Ill-health	27
Retired	57
Full time carer	6
Student	14

In response to questions about where they lived before, 80% had lived in the same area, with most (42%) coming from a larger property. Thirty-three percent had come from a smaller property, and the balance (25%) from one of similar size. There was no discernible pattern between moving from the same or a different area to a larger, smaller or same size house; most of the reasons were health/mobility, proximity to family and friends, and the need for a larger or smaller house. A smaller number moved from temporary accommodation including B&Bs and hostels, or for security reasons, although not necessarily into sheltered accommodation.

Thirty-six moved in after the work was done, 86 living in the accommodation whilst the energy efficiency work was carried out. A few moved between one stage of alterations and another, e.g. after insulation work but before heating installation or vice versa. They have been classified according to when the heating was done.

Section 2: Previous experience

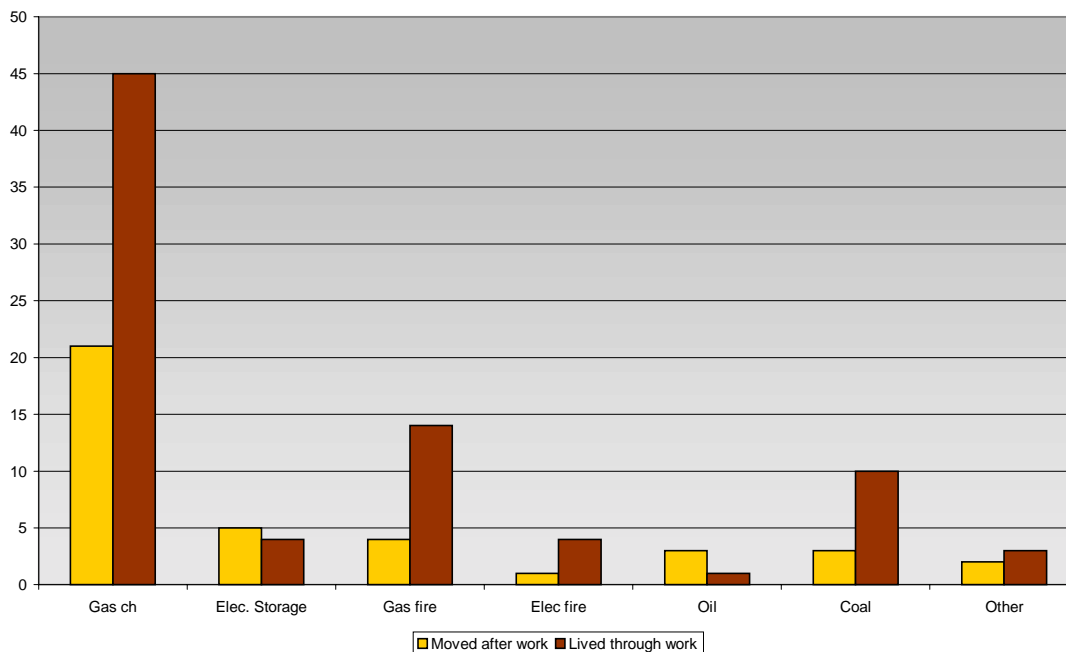


Figure 1: Prior heating systems before moving in or before improvements done

Of the 36 who moved after the work was done, 20 previously had gas central heating in their homes. Five used electric storage, three a stand-alone gas fire in the living room, one relied solely on an electric living room fire, three used oil-fired heating, and four used other forms of heating including coal fires in the living room, Calor gas fires in all rooms and electric fan heaters and bars in all parts of the house “because it was so damp”. Those with gas central heating mostly heated

most of the rooms most of the time or when at home; the other approaches varied considerably from just one room when in the house to most of the rooms most of the time.

The 86 who “lived through” the works show a similar distribution of previous heating systems: 45 had gas central heating, 4 electric storage, 14 gas fires, 4 electric fires, 1 oil fires system and 13 “other”, mainly coal, with two having had under floor central heating. The distribution of these systems for each group is shown in Figure 1.

Section 3: Current systems

The new systems installed comprised 101 gas central heating systems, 7 oil-fired central heating systems, and 11 off-peak efficient electric systems. The latter 18 properties are not on the gas network.

The type of systems reported in the interviews show considerable variation with the information provided by the housing associations when setting up the case studies. There are various possibilities, for example the one person who used peak electric as the primary heating fuel did so despite having gas central heating; in fact that person said the main heating used was the electric fire. Where possible, the responses from the interviews have been adjusted to reflect the known installations, and to complete the data where the interviewee has responded “don’t know”. These responses – both unadjusted and adjusted – are shown in Table 5.

Table 5: Primary heating fuel and gas boiler type; responses and adjusted for HA information

<i>Primary heating fuel</i>	<i>Initial response</i>	<i>Modified response</i>
Natural gas	96	101
Off peak	10	10
Oil	11	7
Peak electric	1	0
<i>Primary heating type (Gas)</i>	<i>Initial response</i>	<i>Modified response</i>
CPSU	3	6
Non-condensing combi	20	20
Condensing combi	22	30
Non-condensing ord.	14	14
Condensing ord.	18	27
Other	8	2
Don't know	15	4

The properties with oil central heating represent most of the remaining “don’t knows” as there was insufficient information recorded about these systems. The electric systems used slim-line and conventional storage systems. The properties using Combined Primary Storage Units (CPSUs) are all in sheltered units.

The control units for the gas systems were as shown in Table 6. The interesting thing for the non-technical observer is the range of positions for the thermostat. Taking this in conjunction with the setting for the thermostat, it seems reasonable to suppose that there would need to be a considerable range of settings in order to achieve a “standard heating pattern” in the home. The majority of the homes with central heating now have thermostatic radiator valves (TRVs) on all or most of the radiators. The variability in the thermostat position and TRV use is an area which could do with further analysis, in conjunction with how easy the occupant finds it to set the system to work the way they want it.

Table 6: Control systems for gas/oil fired central heating systems

<i>Type</i>	<i>Time set</i>	<i>Temperature set</i>	<i>Location</i>	<i>No.</i>
Mechanical 24 hr	19	3	Kitchen	11
			Airing cupboard	5
			On boiler!	3
Mechanical 7 day	6	4	Kitchen	4
			Hall	1
Digital 7 day	49	3	Kitchen	28
			Hall/foot of stairs	2
			Living room	1
			Top of stairs	1
			Bedroom	5
			Cupboard (inc. airing)	2
			On boiler	1
Integral time/temperature controller	2	3	Hall	1
			Kitchen	1
			On boiler	1
Wall mounted room thermostats	14	74	Kitchen	4
			Hall/foot of stairs	39
			Living room	26
			Top of stairs	2
Thermostatic radiator valves (TRVs)	54		All radiators	
Bypass systems	5	1		

Electric systems also have a range of controllers, although these are confined within one case study and will not be further analysed here.

The heating pattern for the house was a question that many found difficult to answer or the interviewer did not record sufficient answer for analysis. The responses have been classified according to whether set hours were specified and whether a comment was made on overriding the system, and according to other descriptions of how the heating system was set – as shown in Table 7.

Table 7: Heating pattern description classified by type of response

<i>Heating pattern described</i>	<i>No.</i>
Set hours with or without manual intervention	37
All day (assumed efficiently)	14
Switch on/off at boiler or thermostat	21
Reliance on secondary heating e.g. gas fire/cooker	2
Other (storage radiators, community heating)	13

Other energy efficiency measures were also investigated, although very few occupants were aware of insulation measures that had been carried out. There was high awareness amongst the two case studies with solid wall homes that there was external cladding or dry lining (100% for external cladding and 50% for the case study with dry lining, although this was a mixed house type and 30% of those had cavity wall insulation with 20% no response). Two case studies showed reasonable levels of awareness (around 50%) of cavity wall insulation. Only one of the case studies had not included wall insulation in the improvement programme.

Table 8: Awareness of wall insulation installed by case study

Case study ref.	CWI	Ext/int insulation	Awareness %
A	Yes		50
B	Yes		0
C		Yes	30 CWI; 50 Ext
D	No*		2
E		Yes	100
F	Yes		51
G	Yes		5

* not as part of the programme

Just under half were aware that they had loft insulation, but this also reflects a percentage of those living in flats who did not respond. Very few had an accurate idea of how thick this was, assuming that the programmes installed insulation to current specifications. Seventy-five percent had double glazed windows; most who did not were in case studies where this was not part of the programme. There were no instances recorded of low-emissivity (low-e) double or triple glazing, even though two case studies reported low-e was specified for their programmes.

With regard to hot water systems, 48 were provided through a combi system (combined water and heating) and 4 through a back boiler. The hot water tank insulation standard was reported as 17 none, 3 poor jacket, 8 good jacket, and 38 solid foam. A number of associations had included cylinder insulation in their programmes and it is to be assumed out of those who said “none” at least some proportion actually had spray foam insulation, otherwise the figures do not make sense.

Table 9: Change of heating system from old to new

Old heating system	New heating system		
	<i>Gas central heating</i>	<i>Electric storage</i>	<i>Oil central heating</i>
<i>Gas central heating</i>	60	3	
<i>Electric storage</i>	5	2	1
<i>Gas fire</i>	17		
<i>Electric fire</i>	4	1	
<i>Oil</i>	2		2
<i>Other</i>	12	4	4

Table 9 describes the change from the old system to the new regardless of whether the occupier was an existing tenant when the work was done. It shows that 60 tenants had previously used gas central heating and had a new gas central heating system as part of the improvements. This is an important statistic, as it will form the basis of one test of our hypothesis in the next chapter. It is interesting that three moved from gas central heating to electric storage, and also of interest are those 25 who moved from non-gas to gas central heating.

The setting of the thermostats was one of the items noted during the survey. Although the data is patchy, i.e. not all interviewers recorded this information, we do have 89 responses, which are charted in Figure 2. The large number at the top end i.e. over 25 would be reasonable if this was heavily weighted towards the more elderly households, so in the second column, the responses for those households with members over 75 have been removed. Whilst this affects the top end of the readings, it does not affect the overall pattern. It may be that the use of TRVs to control the room temperature means that the thermostat is deliberately set high, but this, coupled with the findings on the position of the thermostats in Table 6, suggests that the more technical researchers might wish to determine guidance on thermostat settings in these sets of circumstances if we are to achieve “efficient” use of the systems.

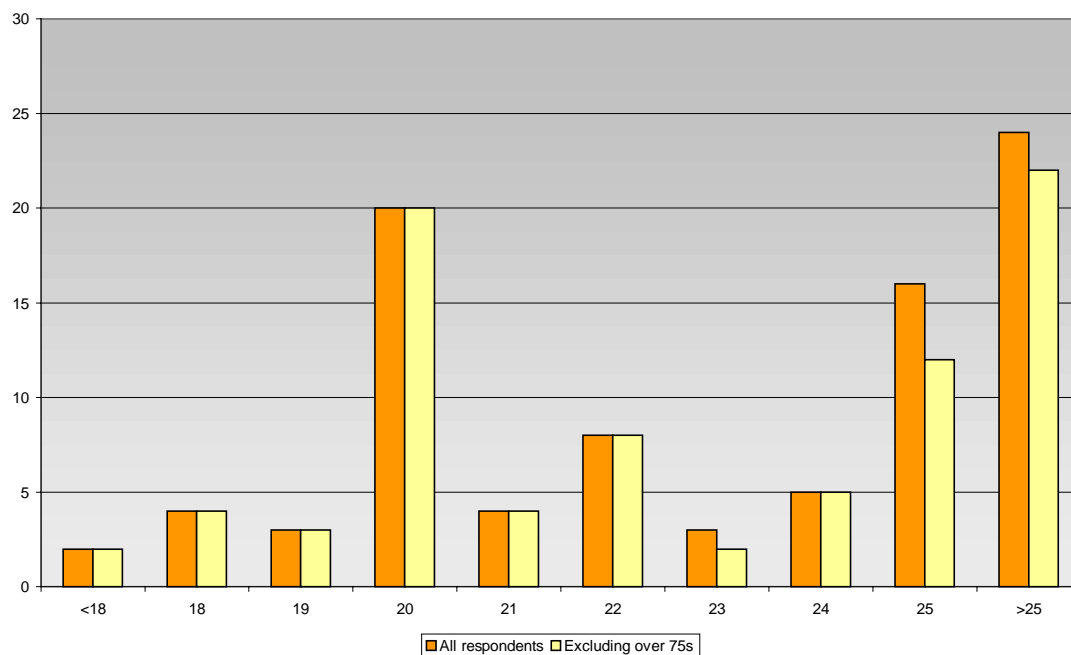


Figure 2: Thermostat settings in degrees Celsius; all responses and excluding over 75s

The final part of section 4 of the questionnaire was to count the numbers of appliances in the household and whether there was any awareness of energy labelling. We took the opportunity to ask about entertainment appliances – TVs, DVDs, computers etc. Generally, over the 118 households there were:

- 55 electric cookers, 49 gas, 19 gas hob/electric oven, plus 102 microwave ovens
- 111 electric kettles, 94 toasters and 24 coffee makers
- 92 washing machines, 59 tumble dryers and 11 dishwashers
- 45 fridges, 43 freezers and 76 fridge freezers
- 113 electric irons and 25 electric blankets
- 54 fluorescent lights, 32 halogens and 163 energy efficient light bulbs (CFLs)
- 167 TVs plus 59 satellite or cable TVs (together nearly 2 per household)
- 120 video cassette recorders, 65 DVD players, 122 mains radios/stereos etc, 53 games consoles and 48 computers

Only 15 known A label appliances were found, 5 each on washing machines and on fridge freezers, the others distributed amongst the other appliances. There were a large number of responses that indicated they thought they had a labelled appliance but didn't know what the label was.

Section 4: Use of current systems and advice received

The section of the questionnaire asking “What sort of information have you had about using the following. . .?” aimed to establish how much advice or assistance the tenant had had to use the central heating systems, thermostatic radiator valves, heating controls, ventilation systems if any, as well as other household appliances. The results were difficult to separate as many people, if they had received any advice or instruction, did not distinguish between the different parts of the system. Consequently the answers have been aggregated into one set of responses on the heating system generally from each tenant.

It is not clear whether those who did not respond at all to this set of questions had not received any instruction at all. It is also likely that some people have responded “we were given leaflets” as

constituting instruction whereas some people responded “none” without mentioning any leaflets. It is also clear from the comments written that some people have information in their homes that they were not aware of before the interview took place. However, with a warning that these figures should only be taken as indicative, the aggregated responses are shown in the following tables.

Table 10: Responses to who provided the information

<i>Who did you get instruction from?</i>	<i>No. of responses</i>
Installer/contractor/electrician/fitter	61
Housing association personnel	22
Booklets left/given by installer	15
Installer (oral) and booklet	8
Member of the family	2
None given	8

Where instruction was given it was either on installation or when the person moved in. On a small number of occasions additional advice was indicated from association staff at a later date, weeks or months after the installation. This was also thought to be the best time to do it – the majority when the work was done or when they moved in, and a few isolated responses preferred a few days later or a follow-up visit. A few suggested they could always contact the estate office/housing office for help, but some realised the information they needed was in the tenant’s handbook.

Table 11: Responses to the amount of information given

<i>Response to the amount of information given</i>	<i>No.</i>
Satisfied:	
Happy with leaflets left/everything needed to know	12
Fine – had same system before	1
Installer gave practical demonstration	2
People who hadn’t had C/H before would probably need more	1
Pretty straightforward	1
Dissatisfied:	
Received none	50
Too technical	1
Would have liked more	4
Needed more explanation	4
Same but slower – didn’t take it in	1
Just want straightforward instruction, not technical leaflets	1
Don’t change it because don’t understand book	2
Specifics:	
More on TRVs	3
Would have liked information on setting C/H timer, boiler and thermostats	4
Would have liked training and books	4
Should have had practice using controls	2
Want to know how to control storage heaters	1

There was no distinction between information on how something works or how to use it, although people did distinguish between how it works and how to use it when responding on what they would have liked by way of instruction.

Despite this confidence, only 68% feel they know how to use the heating controls. The rest admit they don't really understand them, "sort of" understand them, leave them to someone else or just leave them as they are set. Two admit they need help and 6 don't use them, just turn on and off (or not use the system at all).

There were few difficulties in using the controls physically, 4 were in a difficult place to reach, 4 found the dials and/or TRVs difficult to turn, all citing arthritis making it difficult, and 1 admitted to "struggling" with them. However most get the results they want – as shown in Table 12.

Table 12: Responses to "Do you get the results you want?"

<i>Do you get the results you want from your heating system?</i>	<i>No.</i>
Yes	61
Sort of	12
Specific problems	10
No	6

Most of the specific problems are to do with radiators "cutting out" or not managing to achieve a reasonably constant temperature. Some are specific technical problems requiring repair. There are some isolated problems that could do with investigation from the association such as "the radiators don't give enough heat so I use the gas fire" and "I use the gas fire and gas oven for heating the kitchen". These sorts of issues are explored in more depth in the next section, when examining the links between prior knowledge and other factors with regard to success with the heating system.

Section 5: Energy awareness

This section was designed to capture how the respondents behaved in relation to standard energy-saving advice. It allows our analysis to cross-check 'energy-saving behaviour' with common sense approaches to saving money generally. The first group of questions were asked using a rating system to see how often the respondent took these actions around the home: the scale ran from 1=never to 5=always. The results are shown in Figure 3.

Each bar represents one energy-saving action, labelled on the left. The dark bar on the left-hand side represents the number who said "never" and the bar on the right-hand side represents those who said "always" – with the ranges in between. It can be seen that most people always let food cool before putting it in the fridge. Surprisingly, most people seem to be energy aware and do not leave appliances on stand by. This does not necessarily fit with the observations of some of the interviewers, who commented that many appliances were on standby when the interview took place. The results therefore, should be treated with caution.

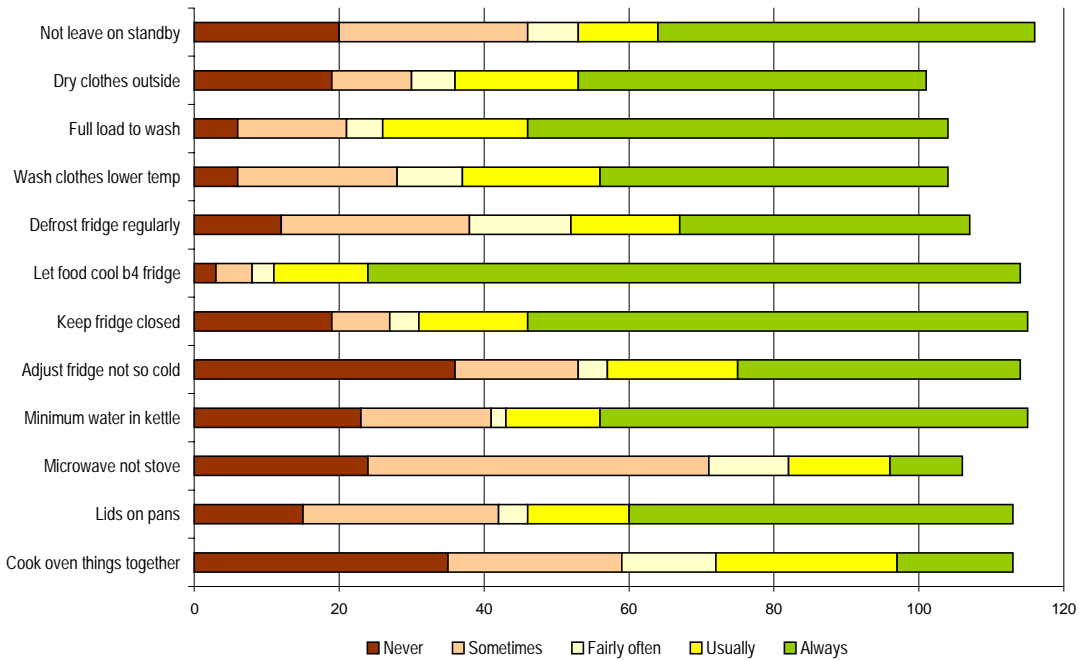


Figure 3: Responses to energy-saving actions

Section 6: Overall impact of the home on their lives

In this section, the consequences of the energy efficiency improvements were examined, covering general response ratings, specifics on energy and gas supply issues and the (perceived) impact on health and well-being.

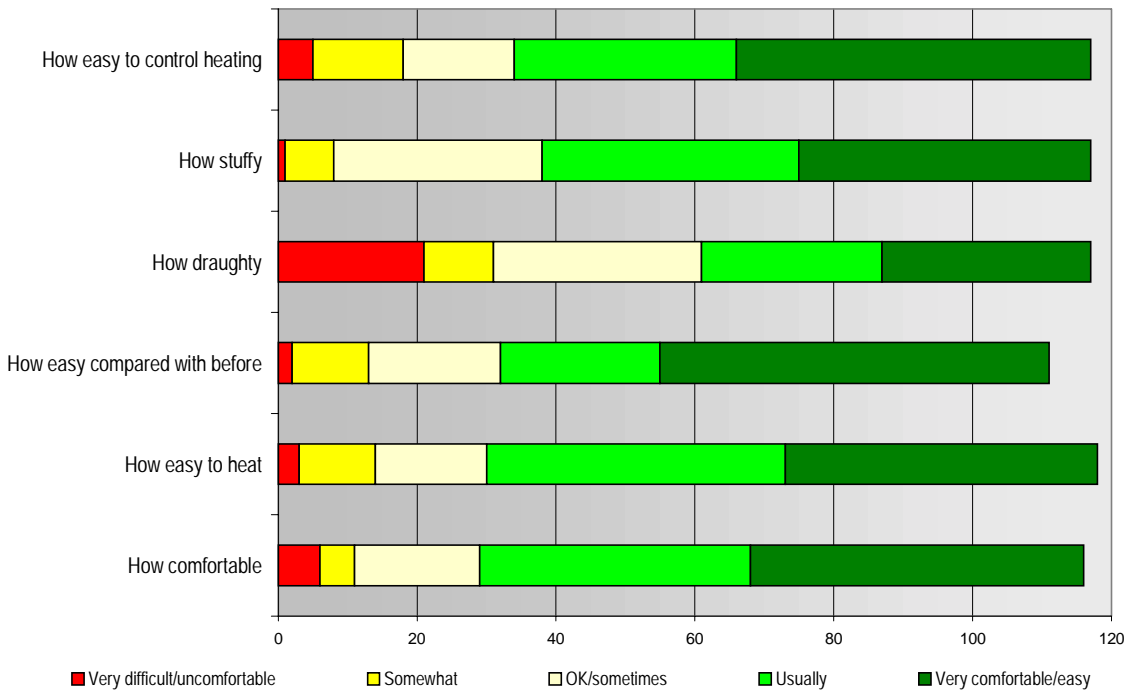


Figure 4: Responses on assessment of comfort and ease of heating home

In a way similar to the previous section, interviewees were asked a range of questions about their perception of their home overall, including its comfort, ease of heating, draughtiness- or stuffiness, and how easy it is to control the heating. Response was generally very positive, with the lowest level of satisfaction in the area of draughtiness. One case study in particular had a problem with

draughty doors, which had not been replaced when the windows were done. It is particularly interesting to compare “How easy it is it to heat” with “How easy is it to control your heating”. There is only a small difference, but whilst more people rated the former “4 or 5”, fewer people rated it 5 than they did control of heating. How either of these compare with the response to “Do you get the required results form your heating” will be examined in the next section.

Gas and electricity suppliers

People were asked what they paid for their gas/oil and for their electricity. Most could estimate a number, and the range was between £5 and £10 per week for each fuel. However, this was generally not taken from bills so the figures have not been included in the report as they are not reliable. Across the sample, 13 respondents said they had fuel debts before moving in/works were carried out and 8 chose not to answer. After moving in/the energy efficiency works, the situation improved for 8 and stayed the same for 4; one respondent did not answer this question. In addition, two respondents said they have fuel debts now because they inherited the previous tenant’s outstanding balance.

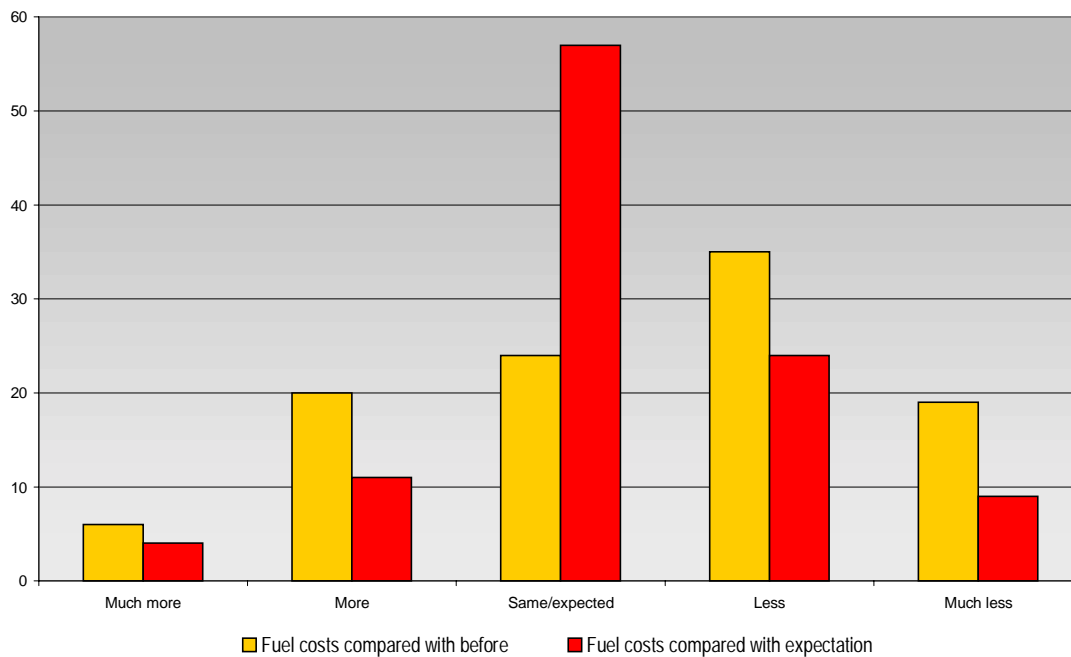


Figure 5: Are you paying more or less than before/expected?

In response to the questions on whether the fuel bill was more than before and more than expected, the results are shown in Figure 5. There is a tendency to be paying less than before, and less than or about as much as expected. However a comparatively large number are paying more than before and this is worthy of further analysis when time permits, especially as some comments in this section indicate problems of inherited debts from previous tenants. Moreover, the difference in perception of the bills between those that have had the work done and those that have moved in since may be significant.

The analysis of supplier switching was included, as there was an opportunity to do so, but also because the attitude to supplier switching may be an indicator of energy awareness. The results of the switching in each case study read a little like the football results, but the overall losses and gains are shown in Table 13. Some detective work was necessary to determine whether the respondent meant gas from Scottish Power when they said Scottish Gas, and some older regional names for suppliers have been left as they are or converted when this makes the trading name picture clearer.

Table 13: Table of losses and gains through switching suppliers

<i>Company</i>	<i>Gas losses</i>	<i>Gas gains</i>	<i>Elec. losses</i>	<i>Elec. gains</i>	<i>Net</i>
British/Scottish Gas	13	5	8	15	-1
London Elec.	1				-1
Manweb			4		-4
npower	5	1	1	4	-1
Powergen	3	3	9	8	-1
Scottish Power	2	9	3		+4
Southern		2		2	+4
SWALEC		4		3	+7
SWEB	1	1	9	1	-8
Telecom Plus		1		1	+2
Yorkshire		1			+1

The reasons for changing suppliers or not changing suppliers are interesting: incentives cited included dual fuel plus phone deals and no standing charges. Some respondents commented on difficulties with supplier switching, two tried to change but couldn't due to previous tenant debts; two were moved without their permission and one changed because they thought they had to but has since moved back. The table below gives the full set of reasons given. Note that the total number who changed represents those who changed one or more supplier, not the total number of changes of supplier, which can be determined from the table above.

Table 14: Reasons for changing or not changing fuel supplier

<i>Total who changed</i>	<i>42</i>	<i>Total who didn't change</i>	<i>61</i>
Price/incentives	26	No need/happy with supplier	22
Trouble with supplier	6	Not considered it	14
Better quality supplier	4	Don't want hassle	4
Other	3	Bill low/no point	4
		Other	3

Health

We took into account the concerns about the health impacts of cold and damp housing, and asked interviewees whether the work was done while they were there or before they moved into the house and whether they had noticed any improvement in the health of any member of the household. These were rated on a scale from 1 to 5 (much worse to much better), and the results are shown in Figure 6.

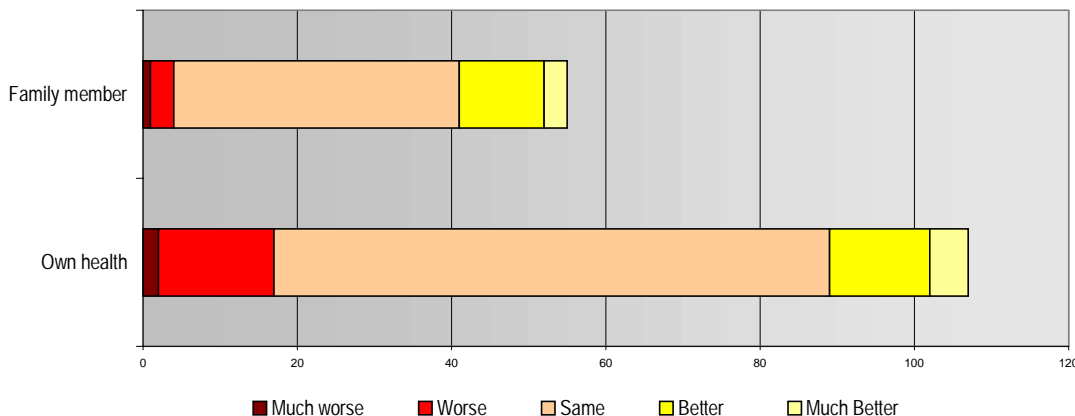


Figure 6: Have you noticed an improvement in health?

The results for 'own health' are not remarkable – the response shows answers distributed evenly around the middle answer 'the same'. However for family members there is a slight shift towards 'better'.

Fourteen examples were cited in health that had improved:

- Asthma
- Heart problems
- Chest infection
- Move better around house
- Fewer trips to hospital
- General well-being

Seventeen examples were cited where health had not improved. Of these, five were not related to the house (such as a broken leg) and five others were “simply my age”. The rest were:

- Arthritis
- Asthma
- Chest infection
- Depression
- More colds

This is encouraging, even though the same conditions are cited as both better and worse in different case studies. However the numbers are too small to draw any real conclusions.

Summary

Generally, interviewees were pleased with the energy efficiency improvements to their homes, as shown in Figure 7. They were also asked what they liked and disliked about their home, responses to which are listed in Appendix 5 together with the incidence of belonging to a tenant participation scheme, which was generally low.

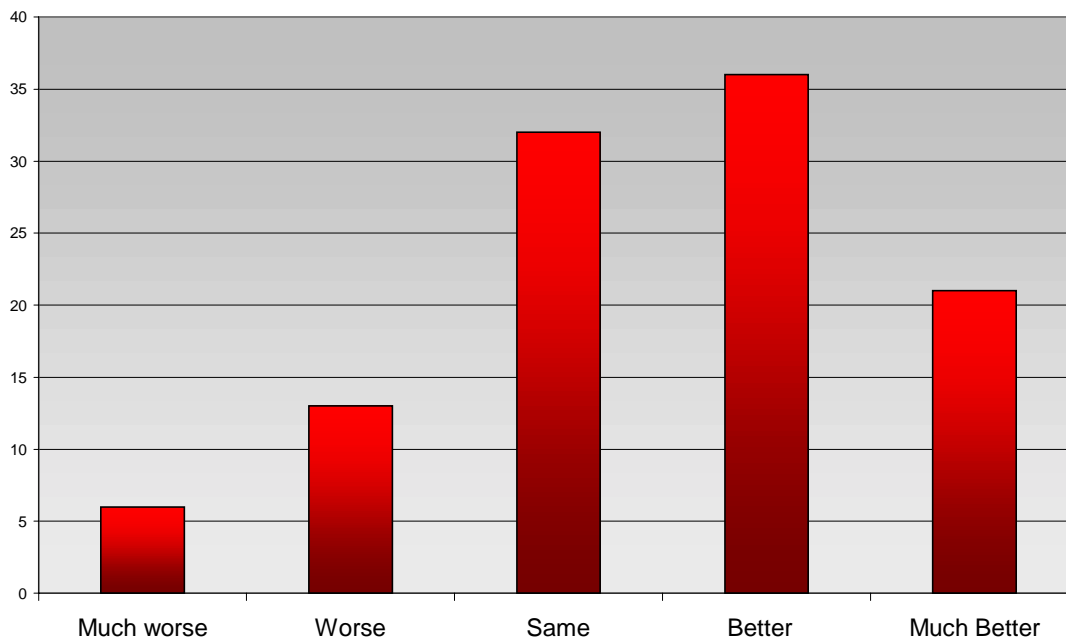


Figure 7: How does your home compare with what you expected?

Although this section has identified the responses from the interviewees to the questions they ask, the most value comes from determining where groups of responses differ between different

groups. This report will not generally deal with differences between case studies as the numbers are small. There will be an assessment from the reports to each case study whether there are differences that warrant a 'best practice' approach, and publication of this will be agreed with the case study associations concerned. This will form part of phase 3 of the project. However we do wish to learn more about the different conditions that lead to more efficient use of the measures in the case studies' homes. In the next section we introduce our hypothesis for user behaviour in energy efficient homes and analyse a number of factors from the survey that could lead to useful conclusions.

TESTING OUR HYPOTHESIS

The overall aim of the project is to identify how householders who have energy efficient homes react to and use their systems. What leads to that reaction? Why do some people find the systems easy to use and get the required results, and others not? How can we encourage more people to use their systems in an energy efficient way? These questions will be examined in this section. First we will outline our hypothesis, namely that there are factors which affect the way people use the systems and whether they get the results they want from them.

We will then describe the key indicators we are using to test this hypothesis and check whether they are valid, i.e. they do describe the behaviour we are using them for. We then develop the hypothesis by analysing various categories of response, described already in the previous section, in terms of the key indicators of behaviour. Finally we offer some conclusions.

Description of the hypothesis

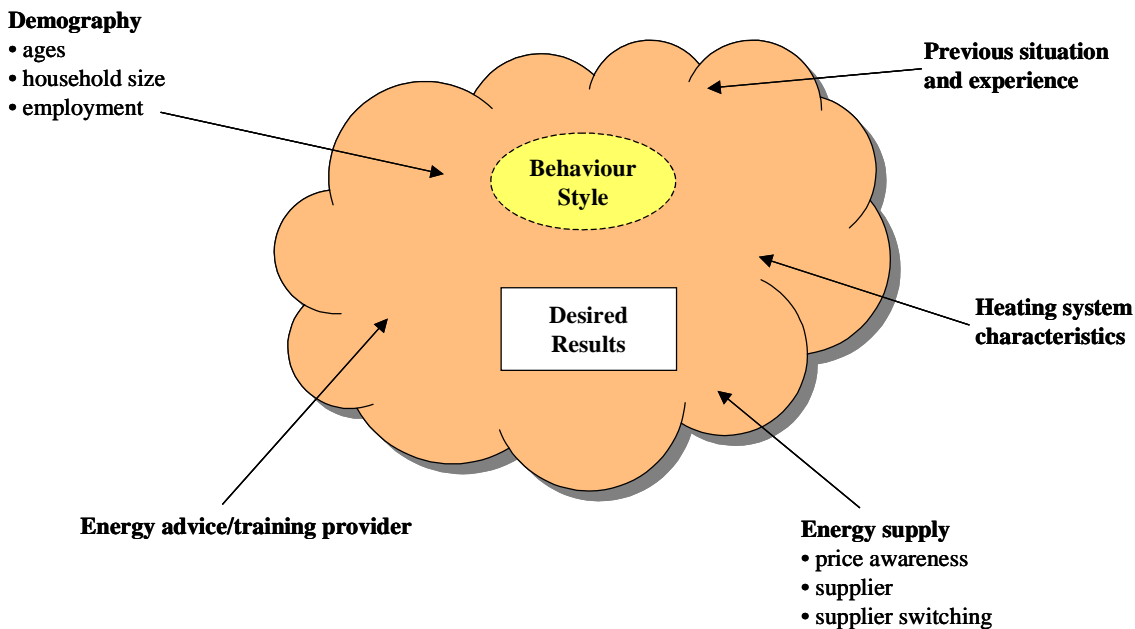


Figure 8: Hypothesis for analysing User Behaviour in Energy Efficient Homes

Figure 8 above represents our hypothesis in diagrammatic form. The cloud represents the relationship between the way people use the system and whether they get the required results from those systems. We describe these two factors as “Behaviour Style” and “Desired Results”.

Behaviour Style can be divided into three categories: is it the ‘right’ behaviour expected from the design of the system (Efficient), or is it behaviour – judged to be cost-effective (Reasonable) or not (Inefficient) – distinct from that expected from the design of the system, i.e. adapted to personal circumstances.

We have called the first Efficient or recommended behaviour in that, according to energy efficiency policy, this behaviour should produce the results that are expected or assumed in all the theoretical work on carbon savings, energy efficiency and domestic energy use. From this point of view Efficient (with a capital ‘E’) or recommended behaviour is by definition energy efficient behaviour.

The second and third Behaviour Styles we classify as Reasonable and Inefficient respectively. Like Efficient behaviour, Reasonable behaviour is cost-effective but is suited to personal circumstances and does not use the recommended practice. It is thus distinct from policy-prescribed/policy-assumed Efficient behaviour. Finally, behaviour classified as Inefficient is distinguished by it being not cost-effective.

Our judgement in classifying behaviour as either Efficient, Reasonable or Inefficient is based on information from respondents about their heating patterns and what they said about the way they use their system. For a full explanation of the rationale applied to the classification of respondents' behaviour into the three styles please see Appendix 2.

The three styles form the basis of our analysis of user behaviour:

- Efficient behaviour (EB)
- Reasonable behaviour (RB)
- Inefficient behaviour (IB)

Does this behaviour give the required results? This can be assessed from the answer the question 5.84 in the interview: "Do you get the required results?" The answers to this were classified in Table 12. For the purposes of the hypothesis these are brought down to a Yes/No response as described under the next heading. There are two other questions within the survey that support our assessment of "Desired Results", 6.02 and 6.05, and these were included in the responses shown in Figure 4. These provide supporting information on the classification of behaviour, and the relationship will be demonstrated in Figure 9.

The big question is: "What influences behaviour and achievement of desired results?" Our candidates for the main influences are:

- Demographics such as age, household make-up and employment status
- Previous experience of the heating systems
- Whether they "lived through" the improvement or moved in afterwards
- Who gave them information about the system and when
- General energy awareness and tendency to live in an energy efficient manner
- The characteristics of the heating system itself

Analysis of these factors will form the main part of this chapter, but first we examine the relationship between Desired Results and Behaviour Style.

Desired Results and Behaviour Style

Reduction of the responses to the question "Do you get the required results?", using supporting comments in the interview where necessary², provides:

- Yes – 101 (86%)
- No – 17 (14%)

This assessment can be validated against direct questions asked in the interviews. We have used "How easy is it to heat the home?", which required a response rating from 1=very difficult to 5=very easy. We consider that testing validity against "ease of heating" is a good method as it implicitly takes account of more than just the heating system itself, which was the question "How easy is it to control the heating?". The relationship between "Desired Results" and the responses to the ease of heating question is shown in Figure 9.

² See Appendix 2 for the rationale.
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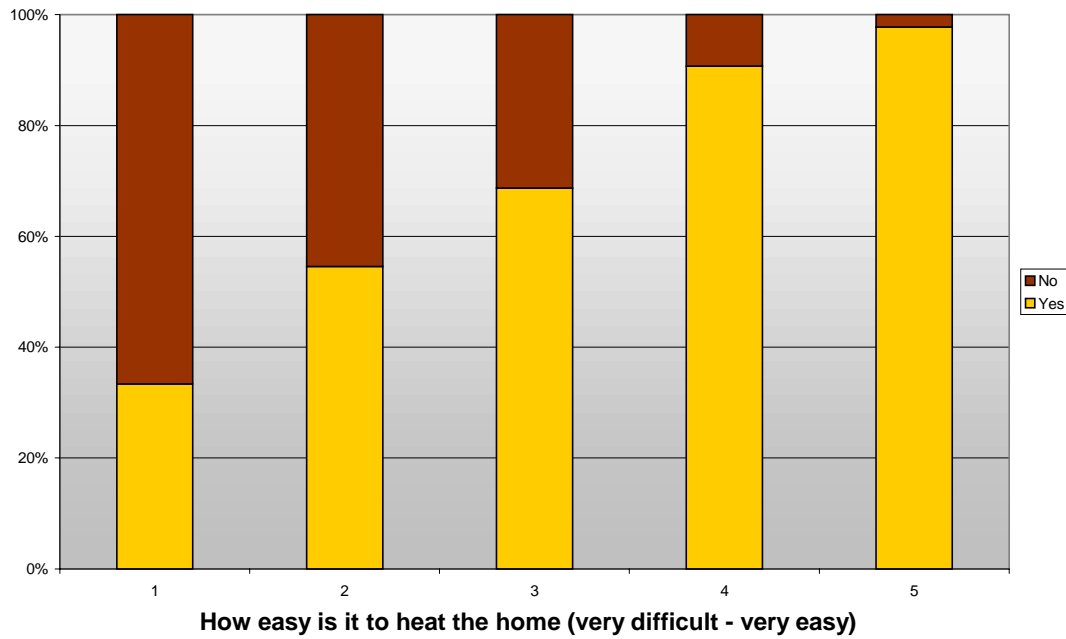


Figure 9: Relationship of Desired Results indicator to ease of heating the home

This is a satisfactory result as it shows that there is a direct relationship between satisfaction in heating and obtaining desired results. It is not surprising that some people who find it difficult to heat the home nevertheless get the required results, but it is pleasing that most of those who find it very easy to heat the home also get the desired results.

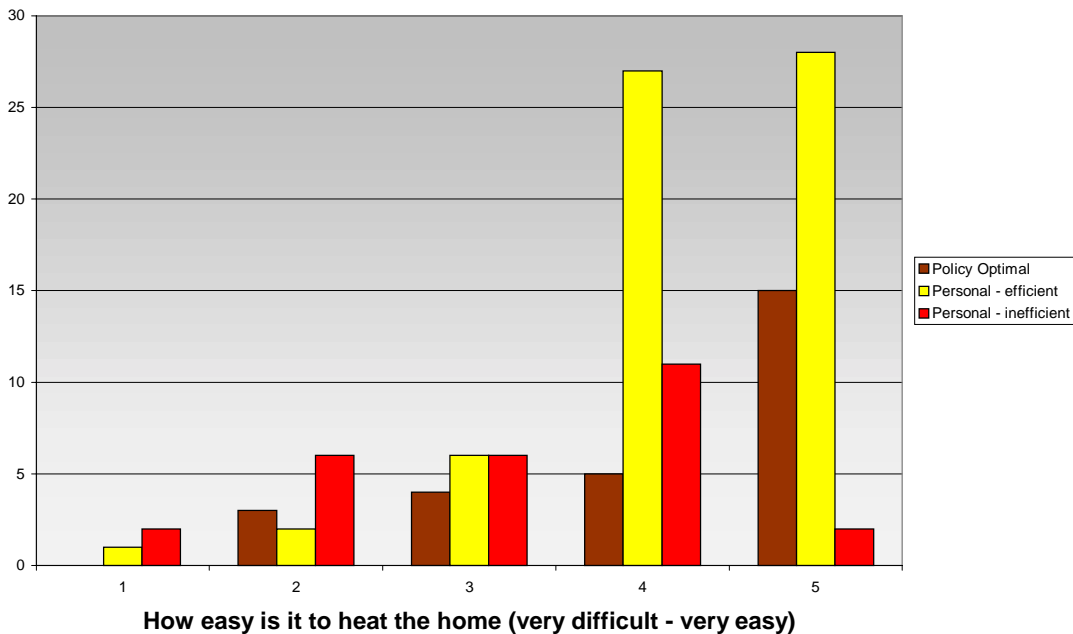


Figure 10: Relationship between Behaviour Style and ease of heating home

Classifying overall responses into the Behaviour Styles Efficient (EB), Reasonable (RB) and Inefficient (IB) gives:

- EB – 27 (22.8%)
- RB – 64 (54.6%)
- IB – 27 (22.8%)

In Figure 10 each of the three behaviour styles, EB, RB & IB are shown compared with the ease which the respondents find in heating their homes. A similar result is obtained in a comparison

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with the question “ease of controlling the heating”. RB shows a direct relationship, very strong in the ‘easy’ ranking, IB shows no relationship with the grading, and EB tends towards a direct relationship with ease of control, again, markedly positive at the ‘very easy’ rating.

Having established our baseline of key indicators for Desired Results and Behaviour Style, and checked that they have face validity, we can now turn to how other factors influence these behaviours and results.

Relationships with other factors

In this section we compare the Desired Results and Behaviour Styles with other contributing factors.

This analysis compares sub-groups of the sample – divided according to the factors analysed (e.g. households with/without children) – against the key indicators of Desired Results and Behaviour Style. The objective is to identify differences and trends between and across groups with regard to each factor. Where differences are described as “significant” or “likely to be significant” then this is meant in a statistical and not a rhetorical sense. Please see Appendix 3 for a note on the statistics behind the survey’s results, their description and their analysis.

Demography

Children and age

Households have been grouped into two sets of two categories in this respect:

- households with or without children
- households exclusively with adults over 60 and the remainder (households with adults under 60)

The under 60 group includes four ‘borderline’ cases where there are also adults over 60, although these none of these four have adults over 75 years old.

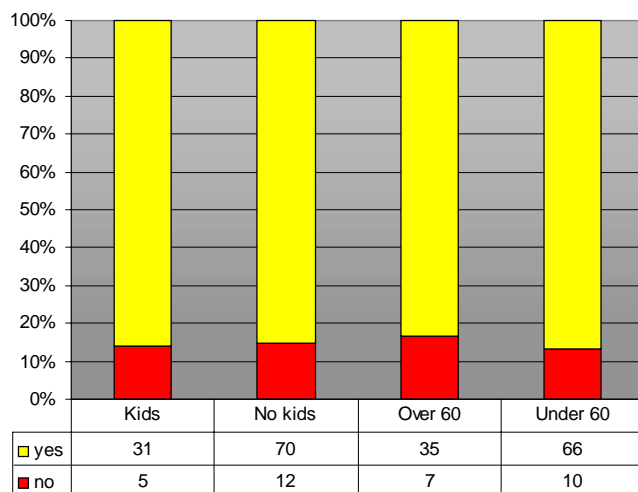


Figure 11: Desired Results from different household types

In Figure 11 there are no discernible differences between the groups in terms of Desired Results achieved. However, looking at the behaviour style (Figure 12) shows noteworthy differences.

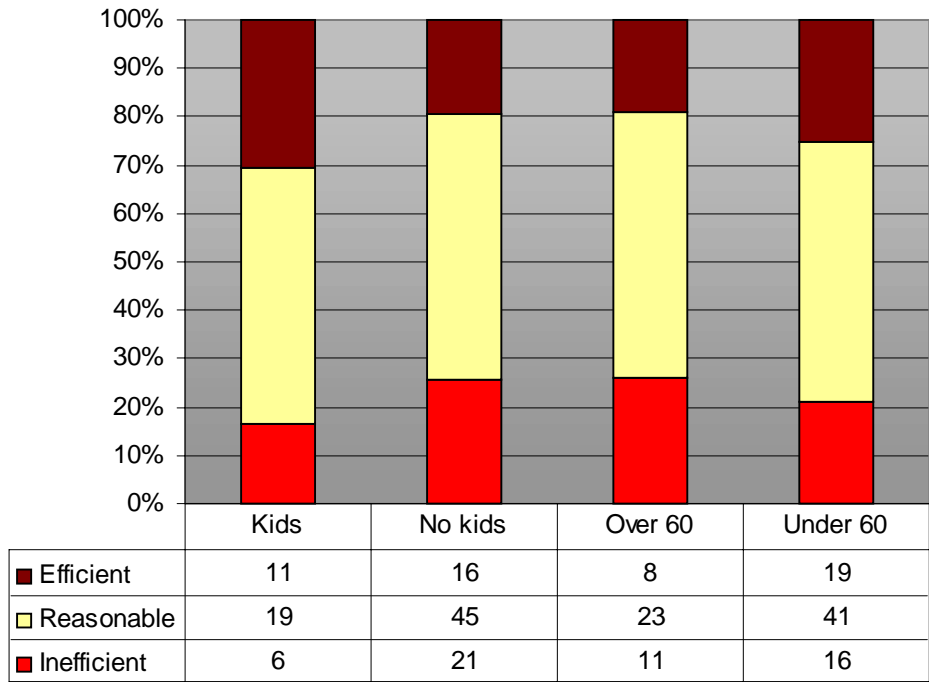


Figure 12: Behaviour Style compared against household type

Within the group of households with children, there is a greater percentage displaying Efficient behaviour than in the group without children. In addition, the Efficient subset outnumbers the proportion of households with children that are Inefficient, in marked contrast to the sample as a whole. The same appears to be the case for the Under 60 group compared to the Over 60 group, but taking out the 25 households with children (which are a complete subset of the Under 60 group), the group’s numbers swing towards Inefficient behaviour. Given our requirements the differences between the groups cannot be considered significant, but further research into the relationship between children/young(er) households and Behaviour Style may be desirable.

Dwelling type

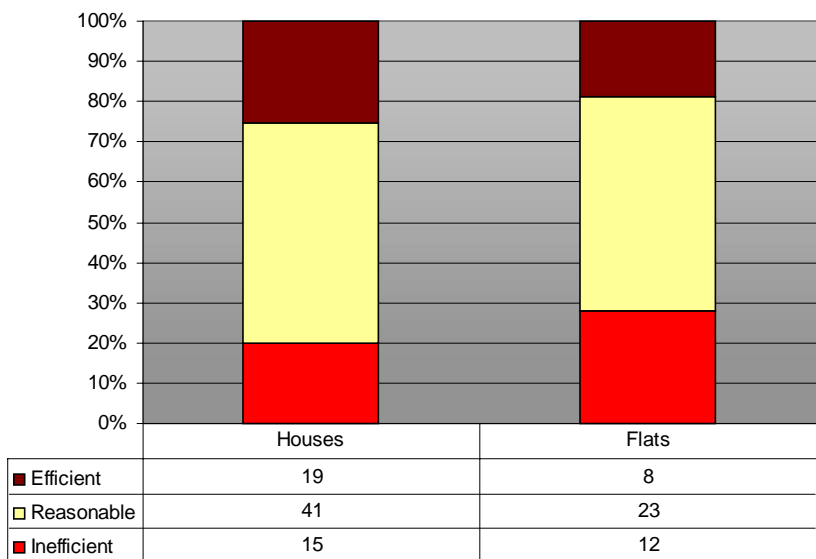


Figure 13: Behaviour Style compared against dwelling type

The survey used eight categories of dwelling, all of which can be grouped into either 'house' or 'flat'³. Comparing Desired Results against the each dwelling type yields Yes/No percentages very similar to those for the whole sample. Behaviour Style between houses and flats varies more clearly albeit not significantly.

It is worth pointing out here that 34 of 36 households with children reside in houses, and that again the balance between Efficient and Inefficient is in favour of the former.

Household size

The households in the survey range from one to six persons in size. They have been classified as small (1 to 2 persons), medium (3 to 4) and large (5 to 6 persons).

As with all the factors examined so far, the percentage of households achieving Desired Results is between 80 and 90 for each of the groups. In Figure 14 we can see that in a similar manner to above, the medium and large household groups (41 altogether), where Efficient is more common than Inefficient behaviour, largely coincide with the households with children (32 out of 36 in all). The difference between medium and large compared to small households is not significant.

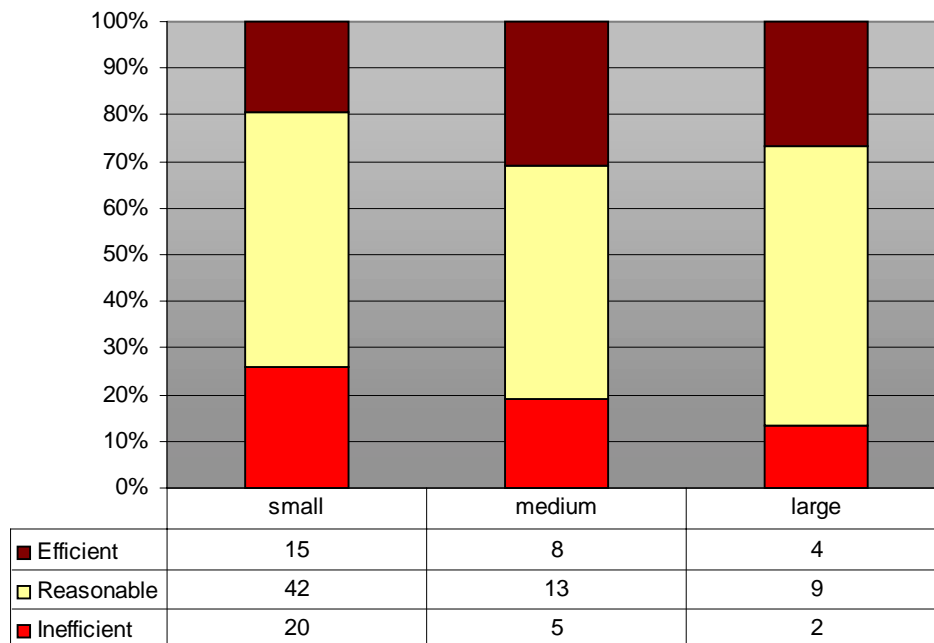


Figure 14: Behaviour Style compared against household size

Employment

Many households contain individuals with different employment status. In order to create a useful categorisation that reflects the circumstances and the amount of time spent in the home, a precedence order has been used. The order of precedence is (including number of households in category):

- full-time employed (22)
- self-employed / part-time employed (15)
- unemployed / ill-health (37)
- retired (44)
- full-time carer (0)
- student (0)

³ Maisonettes have been considered to have more characteristics in common with houses than with flats.
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There is just one household where the principal individual is a full-time carer which is included in the unemployed / ill-health group because of the potentially comparable time spent in the dwelling. Similarly there are just four households where the principal individuals are students and these have been included in the part-time employed group for the same reason.

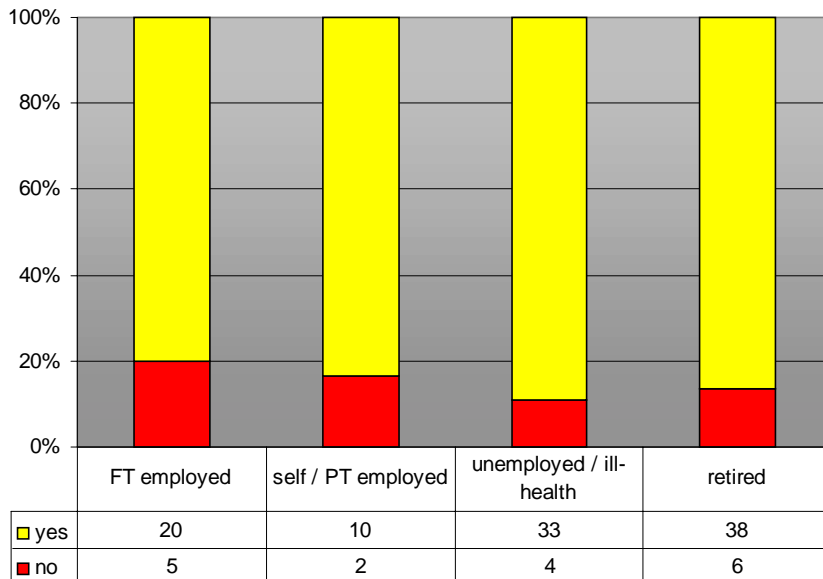


Figure 15: Desired Results compared against employment status

As Figure 15 shows once again, the ratio of desired results achieved to not achieved is fairly consistent. Larger differences are observable between the groups in the behaviour patterns displayed as shown in Figure 16.



Figure 16: Behaviour Style compared against employment status

The numbers are small, but the FT-employed group displays notably more Efficient behaviour than all the other groups do. In fact, the difference is likely to be significant, whether comparing

each group to the FT-employed or comparing to all non FT-employed groups taken together. This result indicates that FT-employed households are indeed more likely to set heating patterns that conform to standard energy efficiency assumptions.

The suggestion above that households with kids may be more likely to display Efficient behaviour does not correspond with employment status as it does with dwelling type and household size. Households with children do not coincide much with the FT-employed group, and are spread fairly evenly across all the groups (apart from the retired).

Summary

Households with children and households in full-time employment appear to be the demographical factors most worthy of further analysis with respect to user behaviour in a larger survey. The result in terms of Efficient behaviour for the latter group of households is already likely to be significant.

Previous experience of heating systems

“Previous experience” under this heading covers two aspects:

- Householders’ previous experience of the type of heating system
- Whether they ‘lived through’ the improvement or moved in afterwards

It would be expected that people who have had gas central heating before would fare better than those who are new to the system *unless* those new to the system received better training or advice as they had no previous knowledge to ‘unlearn’ or bad habits to change. It might also be expected that those who ‘lived through’ the system changes would have had more opportunity to ask the installer about how to work the systems – many were consulted about the changes by their associations. First we explore the relationship for these indicators.

Table 15: Percentages of key indicators who moved in after the work or lived through it

<i>%ages</i>	<i>Moved in</i>	<i>Lived through</i>
<i>Yes</i>	27.7	72.3
<i>No</i>	47.1	52.9
<i>%ages</i>	<i>Moved in</i>	<i>Lived through</i>
<i>EB</i>	33.3	66.7
<i>RB</i>	25.0	75.0
<i>IB</i>	40.7	59.3

In Table 15 we see that nearly three-quarters of those who get the Desired Results have lived through the installation, compared with a fairly even split of those who do not get the Desired Results. However the numbers are small for those that do not get the Desired Results. The behaviour indicators show similar approaches for Efficient and Reasonable, with two-thirds of Efficient behaviour coming from those who ‘lived through’ and three-quarters of Reasonable behaviour from ‘lived through’. Again, there is no strong tendency for Inefficient behaviour. However it has to be noted that there are nearly twice as many respondents who ‘lived through’ the work than moved in afterwards, so any result more extreme than two-thirds swing to ‘lived through’ may indicate a difference. In this instance, “no” for Desired Results might be worth further investigation, but the numbers are too small to be reliable, so we will drop this line of enquiry.

If we take the view of the figures in the other direction, we calculate percentages of those who moved in and their Desired Results and Behaviour Style indicators as shown in Table 16.

In this direction, we see that only 77.8% of those who moved in find they get the Desired Results which is bordering the lower end of our range for noteworthy results. The way they do it is well spread through the options; Reasonable being the most common, but at less than 45%, which is noteworthy in itself. The trouble is that this sub-group is very small, so although there may be something further to investigate, it is not at a level that we could make any direct statements simply about having moved in after the work being significant. It would be worth considering in conjunction with other factors. For those that lived through the work, nearly 90% get the Desired Results, and most of them display Reasonable behaviour, and this would be expected from the overall range of figures.

Table 16: Percentages of ‘Moved In’ or ‘Lived Through’ showing key indicators

<i>%</i>	<i>Moved in</i>	<i>Lived through</i>
<i>Yes</i>	77.8	89.0
<i>no</i>	22.2	11.0
<i>%</i>	<i>Moved in</i>	<i>Lived through</i>
<i>EB</i>	25.0	22.0
<i>RB</i>	44.4	58.5
<i>IB</i>	30.6	19.5

The conclusion from this is that, although if you live through the works you are likely to be able to achieve the Desired Results with your heating, it is not significantly different from the group that moved in after the works. If you moved in after the work was done, it is possible that combined with other factors, a link might be found (using multi-variate statistics) affecting desired results, but we would not recommend returning to the issue otherwise.

The other aspect of previous experience is whether the interviewees have had previous experience of the type of heating system installed. In Table 9 we charted the change from old systems to new, either gas central heating, oil central heating or more efficient electric storage. In order to get sub-groups of sufficient size to make some reasonable assumptions, we have divided these into three “experience” groups:

- A – gas central heating to gas central heating, group size 60
- B – other system to gas central heating, group size 41
- C – any system to other systems, group size 17, which is too small for any reliable findings.

Firstly, as with the previous table, how do these three groups split into Yes/No on Desired Results and Efficient, Reasonable and Inefficient on behaviour? The percentages for each group are shown in Table 17. The most striking thing is that despite the differences in group size, the split between getting the desired results or not is virtually the same between the three groups. The central heating to central heating is slightly higher, but not significantly so. This rules out previous experience of the heating system as a factor in achieving Desired Results.

Table 17: Desired Results and Behaviour Style for three previous experience groups

<i>Group %</i>	<i>A</i>	<i>B</i>	<i>C</i>
<i>Yes</i>	88.3	82.9	82.4
<i>No</i>	11.7	17.1	17.6
<i>Group %</i>	<i>A</i>	<i>B</i>	<i>C</i>
<i>EB</i>	25.0	26.8	5.9
<i>RB</i>	58.3	43.9	64.7
<i>IB</i>	16.7	29.3	29.4

In considering the Behaviour Style for these three different groups, A, the largest group, is well within the expected range of answers, B has a slight swing towards Inefficient at the expense of Reasonable, which is noteworthy (albeit not significant), given the numbers, and C has a very low

number of Efficient. The difference in Efficient displayed by group C (i.e. those not on gas central heating systems) compared to groups A and B is in fact very likely to be significant. This is not actually surprising but just confirms the fact that the definition of Efficient is geared towards gas central heating and may simultaneously explain why the lower incidence of Efficient is balanced by a higher incidence of Reasonable rather than Inefficient. In this light, the sizeable but not quite significant difference between groups A and B in terms of the incidence of Inefficient behaviour is of real interest. It may be possible to propose a link between less or lack of gas central heating experience and Inefficient.

What should we take from this? There is no indication of a real link between previous experience and Desired Results, although in examining multiple factors and their interrelations, we should include 'Moved in after the work' as a candidate for affecting their achievement. There is a possible link between experience and Behaviour Style with respect to gas central heating and, in addition, changing to anything other than gas central heating is worth examining together with other factors for influences on Behaviour Style.

Information and advice

The question of who gave advice and when is rather difficult to analyse because of the variations in descriptions and patchy responses. The questionnaire also asked about information given on other systems⁴ that may have been given at the same time. Consequently the selection of data for this section has been based on the delivery of any information over all the questions in the section, and slotting the description into categories – e.g. installer for all electricians, plumbers etc. who were not otherwise identifiable as association staff, HA to indicate any association staff including wardens, estate officers, community assistants, gardeners, maintenance staff and surveyors/inspectors taken to be housing association staff in charge of the installation programme. Booklets and leaflets have been classed as books. Some people specified “booklets and installer” and these have been counted both separately and together. Where there were less than 8 in a sub-group these have been ignored, so influence of family members has been excluded. It has been suggested that the phrasing of the question may have discouraged answers such as “family” or “neighbours”. This will be addressed in the evaluation of the project.

Most of the information was given either when the systems were installed or when the person moved in. For the purposes of this analysis, separating these two would add a third dimension to the analysis, so they have been aggregated to form one “first opportunity” situation. Four incidents of “a few days after” were noted but have not been analysed. A number who received advice between a few months and a year later have been grouped under “1 year”. The ‘who and when’ of advice compared against Desired Results is shown in Table 18.

Table 18: Information received and achieving Desired Results

	<i>Book</i>	<i>Installer</i>	<i>HA</i>	<i>Book + installer</i>	<i>none</i>	<i>First Opp</i>	<i>1 year</i>
<i>Yes</i>	14	58	17	8	4	55	16
<i>No</i>	1	3	5	0	4	6	0

The problem with this analysis is that it doesn't really give any information. Only half of the “Nos”, already a small number, have responded. In contrast, 80% of those that achieve desired results have responded, and only 5% had received no instruction or information. In terms of achieving desired results, we can probably assume that receiving advice and information is a factor, but we are not in a position to assess which gives better results.

⁴ I.e. not part of energy efficiency works carried out.
 Association for the Conservation of Energy

Table 19: Information received and Behaviour Style

	<i>Book</i>	<i>Installer</i>	<i>HA</i>	<i>Book + installer</i>	<i>none</i>	<i>First Opp</i>	<i>1 year</i>
EB	7	17	6	5		17	9
RB	6	37	10	3	2	34	6
IB	2	7	6		6	10	1

In considering Behaviour Style, we are still unable to make much headway given the small numbers. However, the ratio EB:RB:IB should be around 1:2:1 for “no influence” on the result. This would indicate that if further research was to be done, or multi-variate analysis considered, then having books to refer to has an effect on Efficient behaviour, with the ‘book plus installer’ combination also being of interest, and that those who receive no information are more likely to display Inefficient behaviour. Although information at the first opportunity is common, some follow up information months to a year afterwards seem to influence Efficient behaviour. These comments should however be treated with extreme caution and merely as pointers for further investigation.

Energy awareness

In order to examine links between Desired Results and Behaviour Style against the factor of energy awareness, three sets of data that are a reflection of respondents’ level of energy awareness are used. Switching suppliers of gas and/or electricity, knowing what energy labels are on appliances and doing everyday household work in an energy conscious manner are all indications that a respondent is aware of energy consumption in their household.

Supplier switching

For the purpose of assessing any link between supplier switching and desired results/behaviour displayed, households have been divided into the following six groups (number in each group in brackets):

- no change (67)
- changed either (26)
- changed both (15)
- changed gas only (9)
- changed electricity only (17)
- no answer (10)

Those that only changed their supplier of gas or electricity constitute the ‘changed either’ group. It may be of interest to examine whether there are any differences between the two.

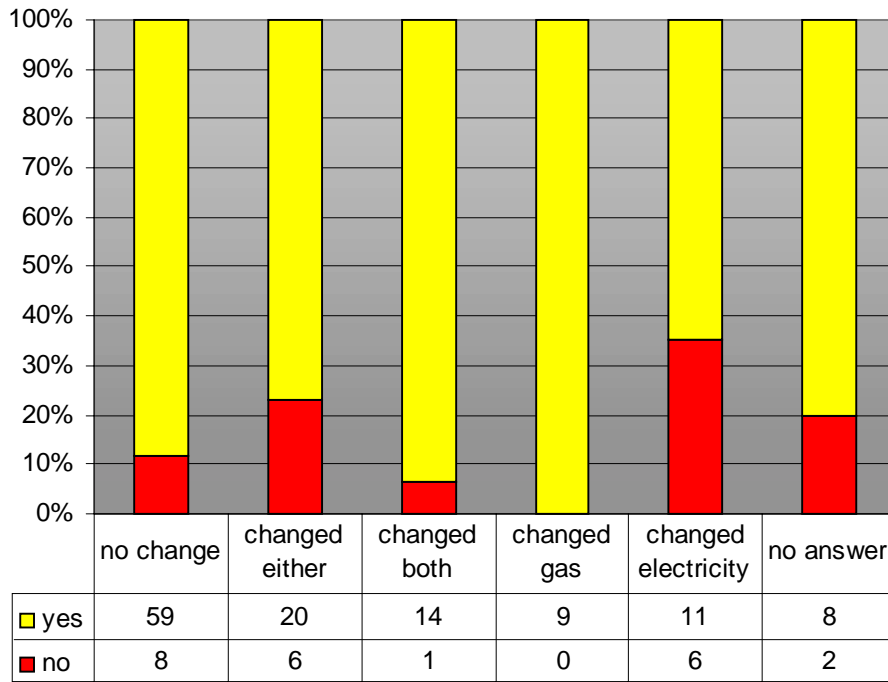


Figure 17: Relationship between supplier switching and Desired Results

The percentages achieving Desired Results or not are markedly different between the three groups that did not change supplier, did not provide a response or changed either supplier from the sample as a whole. Although the numbers of households in each of the remaining three groups are quite small and to be treated with caution, the percentage of those who changed both suppliers and are not achieving Desired Results is notably small. The difference between those who changed only their gas supplier and those who switched their electricity supplier is the largest between any two groups. Again, however, the numbers in these groups are too low for real conclusions, but further examination of differences between these two groups in a larger study may yield worthwhile results.

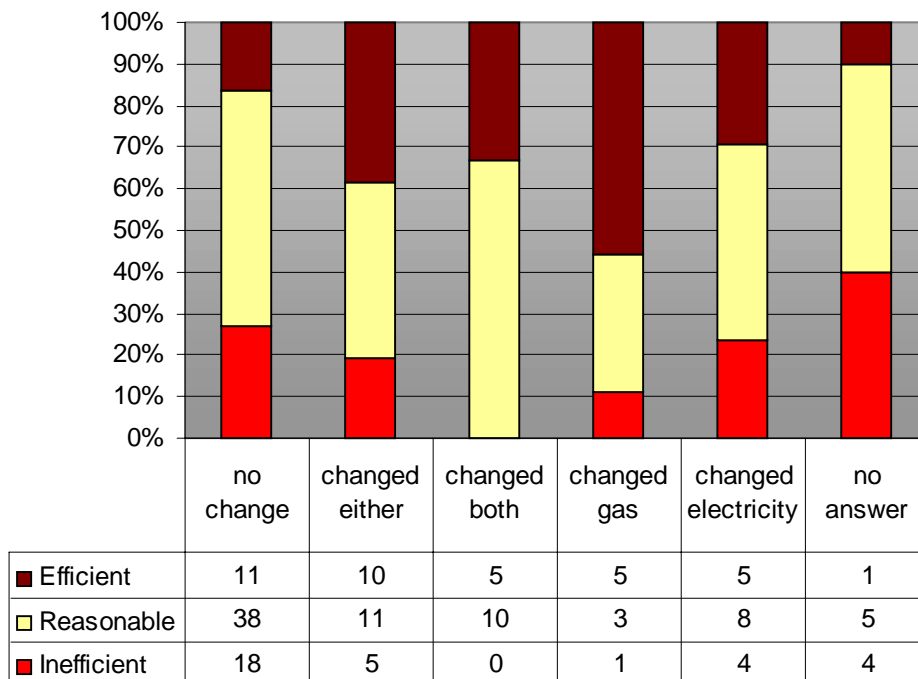


Figure 18: Relationship between supplier switching and behaviour style
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When assessing the groups against Behaviour Style, it is important to note that people who changed at least one supplier display Efficient behaviour significantly more often than the 'no change' group. If they have received packs sent out by suppliers to welcome new customers they are likely to have received energy efficiency information. Have they switched because it is a symptom of their Behaviour Style or are they more efficient because they have acted on the additional information received? This cannot be ascertained by using the survey's results but is worth examining in further research.

Energy labels

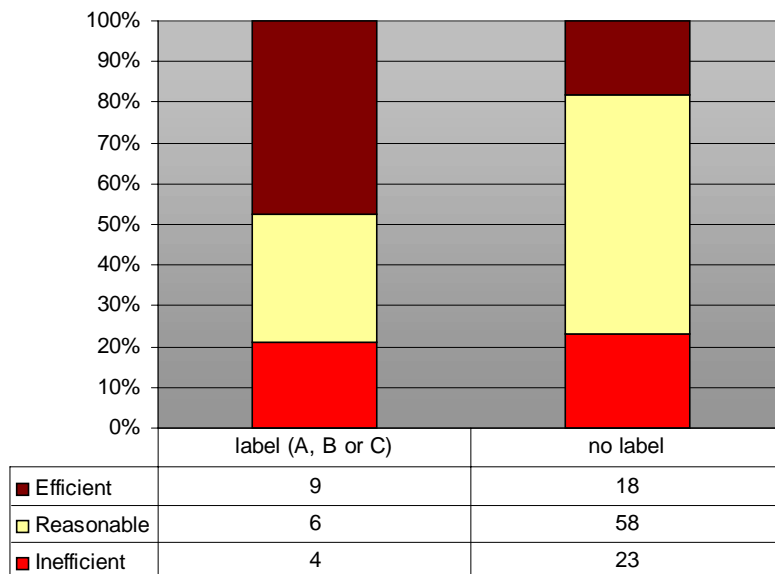


Figure 19: Relationship between energy label awareness and behaviour style

Households have been divided into two main groups to assess this component of the energy awareness factor. Households which could *specify* at least one label on one household appliance (i.e. A, B or C) constitute the 'energy aware' group (19 households), while households that specified either 'other' or knew of no label on their appliances constitute the group for comparison (99 households). The difference between the two groups in terms of achieving Desired Results are not very different from the whole sample, but the difference between the two groups in terms of Behaviour Style, illustrated by Figure 19, is likely to be significant.

Should a larger survey provide similar results, then this would indicate a strong link between energy awareness and more efficient Behaviour Styles. The size of the 'label (A, B or C)' group is small but the difference in Efficient behaviour compared to the 'no label' group is large enough to investigate further.

Energy saving actions

Responses with respect to this element of energy awareness – specific actions to save energy such as “Not leave appliances on standby” – are summarised in Section 5. Respondents were given the option to answer on a scale from 1=Never to 5=Always. In order to assess links between energy saving actions and Desired Results and Behaviour Style, respondents have been divided into three groups (number in each group in brackets):

- those scoring an average of less than three (34)
- average of between 3 and 4 (60)
- average of more than or equal to 4 (24)

Again, as illustrated by Figure 20, the differences between the three groups in terms of whether or not Desired Results are achieved are not large or consistent enough to draw any conclusions.

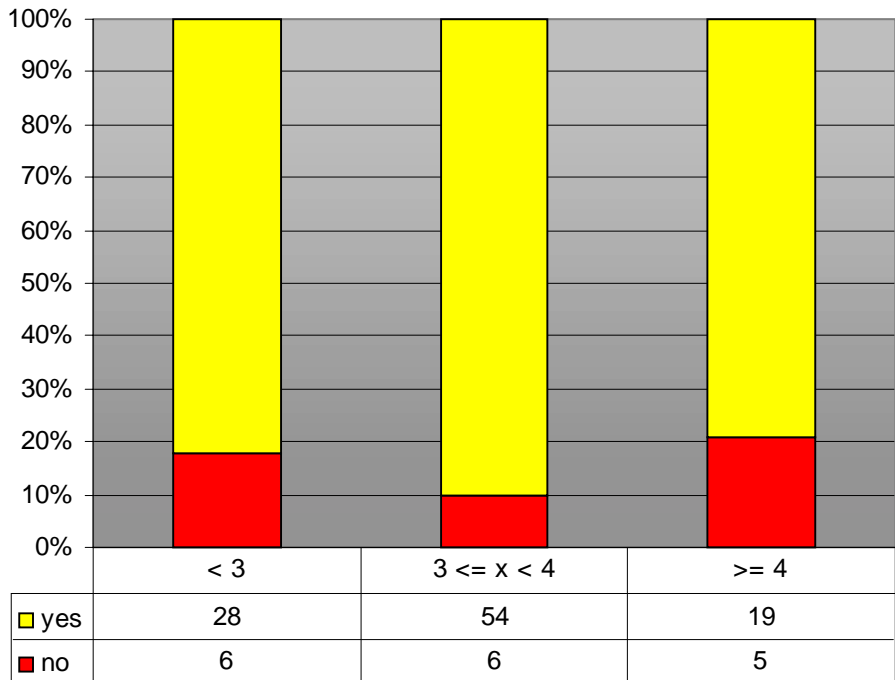


Figure 20: Relationship between energy saving actions and Desired Results

Nevertheless, a partial explanation for the results may be offered by the fact that some of the energy saving actions respondents were asked about are also common sense – such as “Let food cool before putting in fridge” – and are not necessarily an indication of energy awareness, rather a more general indication of good housekeeping. The relationship between energy saving actions and Behaviour Style as shown by Figure 21 is more interesting.

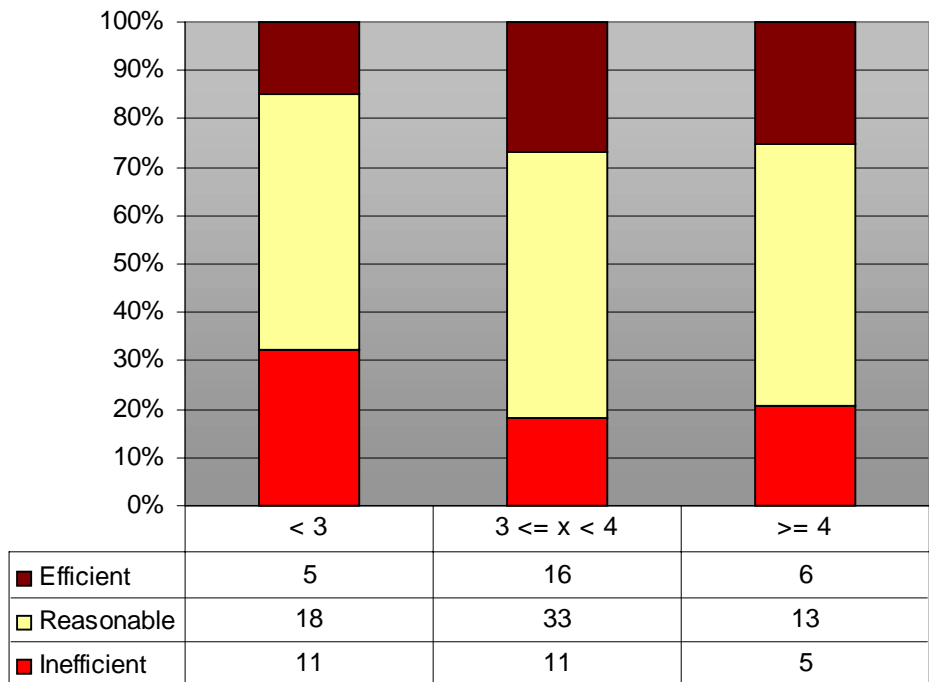


Figure 21: Relationship between energy saving actions and behaviour style

The lowest-scoring of the three groups is the only one that displays more Inefficient than Efficient behaviour. The other two groups are very similar in terms of their Behaviour Style. The difference is noteworthy but not significant. It is important to note that the division of respondents into these three groups is arbitrary, and that given a much larger sample size, it would be desirable to divide the sample into more than three groups to try and identify whether or not the shift from Inefficient to Efficient is continuous as average scores increase.

Summary

Each of three elements of energy awareness examined here show at least a noteworthy relationship with respondents' Behaviour Style. As with the demography data, this relationship proves more interesting than the relationship with whether or not Desired Results are achieved.

Consideration should be given to assessing the links between Desired Results, Behaviour Style and the energy awareness factor as a whole by amalgamating the three elements examined above. If results point to similar links between energy awareness and Behaviour Style in particular, the conclusions which so far could only be hinted at because of the small sample size may be strengthened.

Characteristics of the heating system

What might the key characteristics of the heating system be that influence achievement of Desired Results and Behaviour Style? Table 17 assessed the groups that had gas central heating systems and those that did not (group C), and found no clues to Desired Results, but found some possible indications on areas for investigation for Behaviour Style. In terms of the heating system, this section analyses thermostat position and setting, and insulation awareness. We have not included heating patterns as these were a key determinant of Behaviour Style.

Table 20 indicates the number of thermostats and average temperature setting for each of their main positions and includes a category where the position was not specified but the temperature was given. Where the setting was less than 18, 16 has been assumed, and for greater than 25, 28 has been assumed. It then gives the average setting for each of our key indicators.

Table 20: Number, position and settings of thermostats for key indicators

	<i>All</i>	<i>Hall</i>		<i>Kitchen</i>		<i>Living room</i>		<i>n/s</i>	
	<i>deg C</i>	<i>No</i>	<i>deg C</i>	<i>No</i>	<i>deg C</i>	<i>No</i>	<i>deg C</i>	<i>No</i>	<i>deg C</i>
<i>All</i>		39	22.8	4	21.25	26	23.3	21	24.8
<i>Yes</i>	23.3	33	22.7	3	20.7	26	23.3	20	24.7
<i>No</i>	23.9	6	23.2	1	23			1	28
<i>EB</i>	22.1	10	22.1	2	21	9	21.4	1	25
<i>RB</i>	23.6	24	23	1	20	14	24.5	13	24.3
<i>IB</i>	24.7	5	23.6	1	23	3	24	7	25.9

There are some remarkable issues in this table:

- All those with thermostats in the living room achieve the Desired Results. The number is only 26 but is large enough to be significant as it is 29% of all those reporting thermostat positions. There is a tendency for the Behaviour Style of those with thermostats in living rooms to be Reasonable or Efficient.
- Those with thermostats in the hall tend to display Efficient or Reasonable behaviour.
- Those who have not specified where their thermostats are tend to have them set higher.
- Note that there is bias in that the tendency for higher average thermostat settings in Inefficient compared to Efficient and Reasonable is due in part to the classification methodology which included thermostat setting (but *not* position!) as one decision criterion. Hence no valid conclusions can be drawn in this respect.

It is, again, easy to read too much into this table, and the two who had thermostats at the top of the stairs have been extracted, even though they were interesting examples as both were Inefficient, had high thermostat settings and did not achieve the Desired Results.

The range of thermostat positions tends to indicate that assistance is needed not only to determine where the best place for the thermostat is, but how best to set it depending on the rest of the configuration.

It was necessary to combine all who knew about their wall insulation into one group to get a usable number in the sub-group. Even so, as the percentages in Table 21 show, there is no discernable difference between this group and the whole sample.

Table 21: Insulation awareness and key factors

<i>Insulation</i>	<i>No</i>
<i>Yes</i>	79.2
<i>No</i>	20.8
<i>EB</i>	27.1
<i>RB</i>	52.1
<i>IB</i>	20.8

What conclusions can be drawn from the characteristics of heating systems selected? Unfortunately, very little, except that those with thermostats in the living room may have more success in achieving the Desired Results.

Additional factors

That last statement prompted a new question: what are the differences between case studies in terms of Desired Results and Behaviour Style? The problem with this in the overall analysis is the low numbers that form many of the case studies, so it is generally not possible to draw reliable conclusions. However, the issue raised earlier on “Books + Installer advice” and the issue of thermostats in living rooms are known to belong to the same case study. Table 22 gives the analysis in percentage terms (treated with caution due to low numbers) of the Desired Results and Behaviour Style by case study.

Table 22: Desired results and Behaviour by case study group

<i>%age</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>
Proportion surveyed	8.3	12.5	19.7	14.5	33.3	38.8	3.9
<i>%age</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>
Yes	80.0	100.0	<i>66.7</i>	<i>77.8</i>	<i>60.0</i>	96.2	100.0
No	20.0	0.0	<i>33.3</i>	<i>22.2</i>	<i>40.0</i>	3.8	0.0
<i>%age</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>
EB	<i>6.7</i>	<i>0.0</i>	33.3	<i>16.7</i>	<i>20.0</i>	<i>30.8</i>	42.1
RB	<i>66.7</i>	<i>60.0</i>	<i>46.7</i>	<i>50.0</i>	<i>20.0</i>	69.2	<i>47.4</i>
IB	<i>26.7</i>	<i>40.0</i>	<i>20.0</i>	<i>33.3</i>	<i>60.0</i>	0.0	10.5

In this table, the figures in *italics* are those worse than the expected or average range (i.e. more undesirable results from the heating or behaviour) and the figures in **bold** are those that are better than the expected range. These must be treated with caution because of the numbers, but greater reliability can be expected where the sample from each case study group is relatively large compared to the population of the group.

Groups B, F, and G all had a noteworthy percentage of people who get the Desired Results from their systems. However whereas F and G tend to have higher levels of Efficient and Reasonable behaviour, and G in particular has a high level of Efficient, B tends to have more Inefficient behaviour. There is the potential for more data from B which may help clarify this.

That groups C and E have the lowest level of success in achieving Desired Results is interesting because they are immediately distinguished from the rest by being the two groups of non-cavity wall properties. They are very different though in the Behaviour Style columns – C appears noteworthy for having a high number of Efficient and E for having a high number of Inefficient.

These issues will be analysed in more detail in the individual reports to the housing associations, and will include analysis of the statistics based on their sample size compared with their local population, i.e. if case study X had 12 case studies out of 60 properties. Any significant findings, including the activity of case studies F&G in influencing their tenant behaviour, will be introduced into the final dissemination messages.

CONCLUSIONS AND RECOMMENDATIONS

Key findings from results

- Most respondents (86%) get the Desired Results from their heating systems
- 23% use their heating systems in a way that corresponds to policy expectations, i.e. are Efficient;
 - 89% of these get the Desired Results
- 50% do it in a way that is efficient from their own perspective; i.e. they get results in a way that suits them and their lifestyle, i.e. is Reasonable;
 - 96% of these get the Desired Results
- The remaining 23% are Inefficient; they do not use the systems effectively and they do not get the best value for their lifestyle;
 - only 55% of these get the Desired Results

There is potential for further research to develop certain relationships between Behaviour Style in using the system, obtaining Desired Results and:

- Age under/over 40 and/or having children in the household
- Being full-time employed or not
- Having previous experience of gas central heating or not
- Receiving instruction from the installer when the work is being carried out
- Having support for use of the systems (from housing association or other) within a year of the installation
- Having booklets or instructions provided for reference
- General awareness of energy issues – as evidenced by those switching energy supplier(s) and those showing awareness of energy labels
- The location of the thermostat for the central heating system

Comparison with objectives

The aim of the survey was to identify how householders who have energy efficient homes react to and use their systems. Development of the Desired Results and Behaviour Style indicators has enabled us to illustrate this relationship.

To recap, the objectives were to (*achievements in brackets*):

- assess householders' behaviour in using their systems in 10-12 projects or case studies (*7 case studies have been included in the report*)
- identify differences in the projects that can provide best practice solutions (*two potential candidates have been identified*)
- identify where technologies are difficult to use and link to other 'usability' studies (*some individual difficulties have been identified, but these are not sufficient in number to draw valid conclusions without further study*)
- support other research in information needs for householders receiving energy efficiency measures (*dissemination in phase 3*)
- provide information on energy refurbishment projects for the Green Street project (Sustainable Homes, 2003) (*dissemination in phase 3*)
- spread best practice to housing managers so that their energy strategies have a greater effect on their tenants and residents (*individual case study reports for participating housing associations are being prepared; wider dissemination phase 3*)

Dissemination will be carried out under phase 3 of the project, the objectives of which overlap with those above. In addition, phase 3 will evaluate the survey against its objectives and identify areas for improvement, in particular with respect to the methodology used.

Recommendations

- Further analysis of the data on ‘information received’ to determine whether one or more of the case studies may provide ‘best practice’ examples:
 - There are two candidates, but further work would be advisable
- Identification of best practice in setting heating controls and TRVs for thermostats in different locations:
 - There seems to be good agreement over thermostats in living rooms, but wide variation in opinion on and results from other thermostat positions
- Documentation from installers should be reviewed by advice providers:
 - The difference between how to set the controls (technical guide) and how to use the controls to achieve the Desired Results (user guide) could be included in one simple document

Conclusion

This phase of the research project has surveyed over 118 people who have received energy efficiency improvements to their homes to find out what use they are making of them. It is the largest study of its kind and has produced valuable information. It is clear that more work could be done, especially comparing these people with those who have not had improvements to their homes, which would give an even greater picture of the extent to which domestic energy use could be reduced simply by recommended use of existing systems, rather than some of the more wasteful ways that individuals can devise. It is of even more concern to realise that some of the most wasteful ways do not even result in comfort levels desired by the occupant, so that the waste achieves nothing.

The key messages from this research will be developed and disseminated through a variety of channels and hopefully improvements will arise for both the comfort and the expenditure, both in monetary and CO₂ terms, of the occupants.

We would like to thank everyone who took part in this project including the interviewees, housing association and energy agency staff and all those who contribute their thoughts and ideas through the steering group process.

And in the words of one contributor: “Just because you’re old, they think you’re stupid and can’t understand.” With luck, we will all be there some day!

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APPENDIX 1 – FEASIBILITY STUDY LITERATURE REVIEW

All of the work reviewed here relates to energy saving behaviour in a domestic setting. Table 23 below is a list of topic areas, identified in a brief scoping exercise, which are pertinent to *User Behaviour*, both by themselves and in conjunction with one another. *User Behaviour* is to place its emphasis on the topics ‘Active user education’, ‘User behaviour assessment’, ‘Retrofit’, and ‘New build / building design’ simultaneously. The reviewed work focuses mainly on these, but it is nevertheless important to touch upon the other topics in the literature review as they are in the same sphere of research *User Behaviour*. Furthermore, at the end of this review, these topics will be used to illustrate the gaps in knowledge and the contribution *User Behaviour* will make.

Not all the work reviewed considers users’ domestic energy related behaviour (i.e. user behaviour assessment) against the background of an energy efficient home (i.e. new build / building design or retrofit), as *User Behaviour* will. However, regardless of the energy efficiency of the home, user behaviour affects energy consumption. In fact, it is suggested “user behaviour and how well the technology interacts with users’ requirements become more and more important the more energy efficient the buildings are”⁵. Furthermore, the examination of the role of housing associations in providing energy advice, as well as an analysis of the energy advice provided, will form a key component of *User Behaviour*. With the exception of one piece of research, all the studies included in the review relate to the provision of energy advice (i.e. active user education). The variety of work reviewed further serves to highlight the broad range of angles from which the questions asked in *User Behaviour* can be tackled.

Table 23: Research topics reviewed

Topic	Detail
Active user education	Phone calls, home visits, anything that is specific to the individual.
Passive user education	Leaflets, metering, anything not specific to the individual.
User behaviour assessment	Descriptions of energy-related behaviour; understanding changes in behaviour; estimations of energy saved based on changes in behaviour.
Producer-user interaction	The interaction of producers – i.e. makers of products and suppliers of energy – with users with respect to minimising energy consumption on the user side. This may also include feedback from users on ease-of-use of energy efficient products.
Product design	Issues about products that minimise the need for human intervention – be it user or adviser – in maximising energy savings.
New build / building design	Low energy buildings and issues similar to product design, but at a building level.
Retrofit	Energy efficient building refurbishment.

Existing work

The existing work identified as relevant to *User Behaviour* has been reviewed chronologically, rather than in terms of the topic areas they cover. This has the advantage of to some extent indicating the development of ideas in the relevant areas of work. Other ways of structuring this review would have been more contrived and more subjective. Studies with results that may give

⁵ Elmroth, 2003
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an idea of *User Behaviour's* possible findings have been presented in more detail. The summary after this subsection identifies the lessons to be drawn from the existing work, as well as the gaps in knowledge that *User Behaviour* will help to close.

Harrigan & Gregory 1994 – Do Savings from Energy Education Persist?

The report examines the Niagara Mohawks Power Partnerships Pilot Program. It compares the energy savings over three years of two groups of low-income households in New York State both of which had energy-efficient retrofit works carried out on their dwellings. In addition, one group received training on optimal use of the systems installed. This group achieved significantly higher savings (23.9%), than did the untrained group (13.8%). The persistence of the savings over the course of the three years was high for both groups at 85% and 90% of savings, respectively. Other factors considered, such as the type of tenure and the inclusion of insulation measures in retrofit work could not be used to explain the difference between the two groups' energy savings.

Auch & McDonald 1994 – Conservation Campaigns and Advertising Effectiveness Research

This report examines the success of NW USA's Puget Power's advertising campaign to improve the energy conservation behaviour of their customers. This 3-year campaign, the content of which was based predominantly on focus groups involving customers, achieved significant increases in customer investment in energy efficiency measures and energy conservation behaviour.

Rockwell & Rose 1994 – The Conservation Potential of Lifestyle Changes

This study mainly explores the potential for energy savings as a result of projected changes in user behaviour in British Columbia, building energy use scenarios for 2030. The identification of potential behavioural changes provides a useful list of energy-saving behaviours, ranging from 'minimal' to 'significant' in their degree of lifestyle impact.

Scherzer 1996 – Completing the Conservation Cycle: Customer Education & Customer Satisfaction

While not an assessment of user behaviour, Scherzer highlights the importance of user education by highlighting the important contribution that installers can make to maximise the energy savings potential of energy efficiency refurbishments. The author outlines a detailed set of recommendations for installers to take on board in order to educate users and change their behaviour. Achieving customer satisfaction and hence customer loyalty is regarded as the incentive for installers to do so.

Haakana et al 1997 – The Effect of Feedback and Focused Advice on Household Energy Consumption

This Finnish study examines the effects of a combination of detailed metering, feedback and tailored advice to householders wanting to reduce their energy consumption. Feedback was provided in the form of how each individual household's energy consumption compared to the Finnish average as well as the others in the experiment. It was found that metering and feedback had a moderate and strong positive effect on energy conservation habits, respectively. Furthermore, the study found that once feedback had been provided, individually tailored energy advice did not result in any further energy savings.

Cames 1999 – Differences in environmental consumption and perception between different social groups

This points out differences in user behaviour between different social groups. This is important from a fuel poverty perspective, and also due to the fact that *User Behaviour* will deal in the main with housing association tenants, who are more likely to be low to lower middle income.

Darby 1999 – Energy advice – what is it worth?

Darby's paper makes suggestions for possible best practice energy (efficiency) advice provision, as well as for its monitoring and evaluation. Different approaches to energy advice provision in terms of their (cost) effectiveness were assessed. The paper finds that a consistent methodology for evaluating energy advice programs is necessary in order to make such comparisons. The paper

makes an important distinction between advice, which is tailored to the individual, and information, which is general. EEPH 2002, which focuses on energy advice (see below), does not make that distinction.

Energy Action Scotland 2002 – Revisiting Easthall: 10 years on

Easthall in Glasgow is a group of dwellings refurbished to energy efficiency standards well ahead of their time in 1992. The main objective of the works was to eliminate dampness and make the dwellings easy to heat. EAS has since conducted a survey of the 42 refurbished dwellings and their inhabitants in order to assess the overall impact of the Easthall demonstration project in terms of its main objective, technology lifetime, energy conservation, and alleviation of fuel poverty. The research conducted is highly significant to *User Behaviour* as it includes an examination of the inhabitants' behaviour / interaction with refurbishment elements, in particular heating and ventilation systems and associated controls. Importantly, a brief post-assessment of the energy advice provided in the first two years after refurbishment has been included in EAS's report.

EEPH 2002 – Benefits of Energy Advice

The Energy Advice Providers' Group of the EEPH commissioned this UK study to examine the most effective delivery mechanisms for energy efficiency advice, explore motives for and barriers to advice uptake, look at actions resulting from advice, and to identify the benefits gained from following advice. 2000 energy advice clients were contacted by telephone for the study, of which 85% could recall the advice they received. One of the focal points of the study, the provision and impact of behavioural advice, is of particular relevance (as opposed to advice on installing measures), as *User Behaviour* will focus on advice provision and behaviour in already energy efficient homes (i.e. new build or retrofitted). Behavioural advice was divided into three main types: cooking, control of heating and water, lighting, and condensation control advice. Lighting behaviour advice was most fruitful, with 80% of those recalling advice having acted upon it. Installing measures as opposed to behavioural advice was less effective at 70%. However, the other three types of behavioural advice were markedly less effective, at 51% (cooking), 56% (heating and water), and 45% (condensation control). For all types of behavioural advice, verbal delivery was more effective than leaflets and reports. In the case of condensation control, verbal combined with written advice was most effective⁶. Recalling behavioural advice worked equally well for client-led and opportunistic provision, whereas client-led advice was more likely to be acted upon.

Darby 2003 – Making sense of energy advice

This psychology-related paper uses constructivism's perceived merits over behaviourism as a theoretical argument for site visits and face-to-face energy advice provision. In other words, energy efficiency advice schemes should recognise that tacit knowledge (experience and consciousness), which is not important in the behaviourists' view, is a crucial factor to be considered when aiming to provide effective advice. Yet again in other words, schemes should adapt to the context of the individual in question to ensure the advice provided bears fruit. More focal knowledge type approaches, as advocated by behaviourists, are never so successful (e.g. leaflets, home energy checks, telephone hotlines), although they are cheaper to carry out.

McCauley 2003 – From motivation and cognition theories to everyday applications and back again

This paper provides some useful information on the theories of behaviour change, in the context of energy conservation, which can potentially inform any recommendations that may result out of a study of user behaviour. Based on the simulation of user interaction with appliances (e.g. washing machine, thermostat) that are designed to provide users feedback on energy used, the effects of providing different types of information on saving energy were examined. These included asking users to 'do their best', set their own energy saving goals, or to assign goals for them, in the

⁶ This combination appears not to have been tried or sampled for the other three types of behavioural advice.
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contexts of asking them to fill out a home energy questionnaire first, providing them with specific and unspecific goals, specific and unspecific information, and provoking an anchoring bias. All of the results have the potential to inform the design of energy advice provision, in particular post-refurbishment / installation.

National Audit Office 2003 – Warm Front: Helping to combat fuel poverty

Warm Front formally provides energy advice as part of its range of measures, and this NAO report assesses every aspect of the Warm Front scheme. Once a household applies for a grant and fulfils basic eligibility criteria, a surveyor is sent to the dwelling to determine the measures most appropriate – energy advice is provided by the surveyor on this visit, which is prior to any installation of measures.

Defra employs quality assurance assessors to monitor all aspects of the delivery of the scheme. It is unclear whether the quality of energy advice provided is also monitored. EAGA and TXU Warm Front also carry quality assurance inspections of their work as managing agents of the scheme. Although customer satisfaction surveys are commissioned by the managing agents, only satisfaction in relation to comfort and warmth is assessed. The NAO is aware of the fact that improvements in energy efficiency are measured as potential, rather than achieved energy savings (i.e. SAP ratings, which assume efficient and effective use of installed measures), and that the benefits of improved energy efficiency may manifest themselves as energy savings and/or increased thermal comfort, depending on users' requirements and behaviour.

The only target Warm Front works towards is the number of households having received a grant, rather than fuel poverty reduction or energy efficiency improvement. There are no targets pertaining to user behaviour, post-installation of measures. At the same time, however, the NAO's stakeholder consultation on Warm Front identified people from numerous stakeholder groups⁷ as deeming "education on how to use central heating (and follow-up to check that it is being used correctly)"⁸ as important.

Summary

Lessons for User Behaviour

The list below outlines how *User Behaviour* is informed by previous work in order to help place it in the context of robust conclusions already drawn from this type of research, which will prevent *User Behaviour* from reinventing the wheel. *User Behaviour* is informed at theoretical, methodological and empirical levels, each outlined separately below.

Table 24: Lessons for User Behaviour

Theoretical
A distinction can be made between energy advice (specific) and energy information (general), which is equivalent to the distinction between active and passive user education.
Two theories on the psychology of learning inform the reviewed work, constructivism and behaviourism. In the behaviourists' view, a blanket approach to energy advice and information provision can be taken because they believe energy-related behaviour is governed by environmental or external variables, in particular by 'rewards' or 'punishments'. Constructivists on the other hand assume energy-related behaviour to be governed as much by internal variables such as existing knowledge and environmental / financial / health consciousness. This supports an argument for the provision of more individually tailored advice that caters for these internal variables in order to effect behavioural change.

⁷ Installers, surveyors, local authorities, healthcare workers, voluntary sector workers and EEACs.

⁸ NAO, 2003:39

To combine the above two points, it would appear that behaviourism favours an energy information approach to changing user behaviour, while constructivism prefers an energy advice approach.
Methodological
Consistency of approach is vital to ensure comparability between assessments of different energy advice programmes.
User behaviours are classifiable, but difficult to quantify. It is possible to estimate or quantify energy savings from (changed) user behaviours, but these should be treated with caution.
Empirical
Active user education is a central determinant of domestic energy savings from energy efficient technology, in particular in ensuring the persistence of energy saving behaviour.
One-to-one, tailored, and in particular face-to-face energy advice is deemed most effective at inducing (more lasting) behaviour change. At the same time, however, these types of energy advice provision are the most costly per client. Leaflets, television, and radio are cheaper per client, but deemed to be less effective. However, not only is cost-effectiveness in terms of £/kWh saved an important consideration, it must also be taken into account that different clients respond differently to different types of advice and information. In other words, the cost-effectiveness of different approaches to facilitating energy savings will vary according to the client base.
The question of who provides energy advice and when (in particular with respect to retrofitting) is a co-determinant of programme effectiveness.
The social and cultural contexts the clients find themselves in are co-determinants of the effectiveness of different approaches to changing user behaviour, as well as co-determinants of user behaviour itself.
Feedback is an important component of changing user behaviour that does not fit neatly into either the energy advice or energy information categories. Feedback is specific and tailored to the individual, but does not include any recommendations, it merely provides information with which the user is empowered to make his or her own recommendations.

The preparation and execution of *User Behaviour* will build on this existing knowledge in order to ensure an emphasis is placed on gaining new insights into energy consumption in energy efficient homes.

Gaps in knowledge

Overall, there are two studies closest in nature to *User Behaviour*. One is Harrigan & Gregory's exploration of the question 'Do energy savings from energy education persist?'. The other is the EEPH-commissioned survey 'Benefits of Energy Advice'. The latter is far more comprehensive in terms of its assessment of different types of energy advice, although it is less confident about what the quantitative impacts of the advice are. Also, in contrast to Harrigan & Gregory, it has nothing explicit to say about energy advice provision after retrofitting. However, 'Benefits of Energy Advice' is more pertinent to *User Behaviour* because it is recent and UK based.

Energy Action Scotland's a posteriori assessment of Glasgow's Easthall project is the next closest UK relative to *User Behaviour*. However, while 'Revisiting Easthall' does place a strong research emphasis on user behaviour (in particular in relation to heating controls), it does not consider the assessment of energy advice as important a component as Harrigan & Gregory, 'Benefits of Energy Advice', *User Behaviour*, or indeed the Easthall project itself. *User Behaviour* will combine the energy advice assessment component of Harrigan & Gregory's study and 'Benefits of Energy Advice' in particular with the emphasis on actual household behaviour of 'Revisiting Easthall' and examine these elements in the UK social housing context. Furthermore, *User Behaviour* aims to achieve statistically significant results, something for which the other related studies, apart from

'Benefits of Energy Advice', were too small-scale to consider. In this way, any conclusions drawn from the survey will have strong data support. 'Benefits...' had the requisite large sample to achieve statistical significance, but as mentioned before, did not focus so much on retrofit situations, but rather general energy advice provision.

It is not the case that any singular issue is under-researched, rather that each has been either researched in isolation, combined with just one other issue or only integrated only tentatively. Research to date has not seriously attempted to combine the issues in the way that *User Behaviour* will. Energy efficient homes, domestic energy behaviour and energy advice form a system of domestic energy consumption which *User Behaviour* will examine as a whole, placing appropriate emphasis on each of the three main components. Being an integrated research project, *User Behaviour* will take advantage of the associated knowledge synergies in order to gain fresh insights that can inform policy and decision-making validly and reliably.

APPENDIX 2 – RATIONALE FOR DESIRED RESULTS AND BEHAVIOUR STYLES

The two key indicators that were assessed from the survey data were Desired Results and Behaviour Styles. These were seen as independent of each other, so it was important to ensure that the same question on the survey was not used to inform both.

Desired Results

The key survey question which lead to this assessment was data ref. 5.84, part of the overall discussion on “how do you manage with your heating systems” specifically “Do you get the required results”.

This was a text response and produced a range of answers, which were classified yes or no as shown in Table 25.

Table 25: Responses to and classification of survey question 5.84

<i>Do you get the results you want</i>	<i>Total</i>	<i>Class'n</i>
Yes	67	Y
Yes just turn it off and on when wanted	6	Y
Yes but thermostat needs fixing	1	Y
Just leave controls as set by installer	2	Y
Thermostatic valves good but energy efficiency not	1	Y
Sometimes/most times	2	Y
Near enough (get help from estate office)	1	Y
Bathroom not warm enough*	2	Y
No difficult to control	1	N
No - need something sorted out	7	N
Don't use it	1	N
Radiators don't give off enough heat; rely on gas fire	1	N
No, radiators cut out	2	N
Either too hot or too cold, never just right	3	N
No - very inefficient	1	N
Impossible - house too draughty	1	N
No answer, inferred yes**	19	Y

* the text implied that they were happy with the rest of the home

** from other evidence in the same section or in 7.01 – any other comments, or because it was an opportunity for people to complain so it is more logical to assume ‘yes’

This produced the totals:

- yes = 101 (85.6%)
- no = 17 (14.4%)

Behaviour Styles

In considering how to classify Behaviour Styles we considered two aspects: whether the user took the recommended route for use of the system, which we called “policy” route; or whether they used a different approach – a “personal” approach.

There was then the discussion as to whether such behaviour was efficient or inefficient in terms of energy use. It was assumed that the recommended use of the system was efficient; it was

considered that manufacturers or best practice advice could not be assumed to be inefficient. Personal behaviour, however could be either efficient or inefficient depending on whether they used the system in a reasonable manner given their circumstances or whether they described one or more of the bad practices that have been referenced in other studies (e.g. Easthall).

The three styles are classification of the one “Behaviour Style” indicator. And have been labelled “Efficient” for the one that used a recommended approach, “Reasonable” for a personal style that was deemed efficient, and “Inefficient” for a personal style that showed poor practice.

The key questions used to determine which style was used were:

- 5.82 – text comments on understanding the use of the system
- 4.149 – description of the heating pattern
- 4.150 – thermostat setting taking into account location, existence of TRVs and the vulnerability of the respondent (primarily age and ill-health factors)

Where there was further doubt about the use of the Behaviour Style, other responses were used including general comments on the home in 7.01. Because of the complexity of the responses and the quantity of data, the responses have not been tabulated here. The overall split into the three classifications for the Behaviour Style indicator was:

- Efficient: 27 (22.8%)
- Reasonable: 64 (54.4%)
- Inefficient: 27 (22.8%)

APPENDIX 3 – NOTE ON STATISTICS

Survey sample size

We aimed to achieve a sample (total number of interviews) of the order of 300. This, by providing a 5.6% confidence interval at the 95% confidence level, would have given us ample scope for reliable and valid sub-groups and detailed analysis. In our estimate, a minimum of 250 would still have met this criterion (6.2% confidence interval). To this end we wanted to achieve 30 interviews in each of 10 case study groups, allowing for the possibility of 2 groups falling by the wayside for unforeseen reasons. Thirty respondents are considered the requisite number to achieve a normally distributed response to a given question – which would have allowed us to draw stronger *statistical* conclusions in the case study reports than is now the case. As a consequence, conclusions in the case study reports will be based more on qualitative rather than quantitative assertions than originally anticipated. Nevertheless, for the overall report, 118 respondents still allow for a good level of confidence in fairly accurate results (see “Results description”), and allow us to identify statistically significant large differences where they arise in the analysis (see “Results analysis” below).

Results description

For a sample of 118, we have a 9% confidence interval at the 95% confidence level. For example, we know 24 respondents (20.3%) said they have a coffee maker: if we were to repeat the survey 100 times, drawing our sample from the same population, then 95 of those surveys would return a result of between 22 and 26 (i.e. within +/- 9% of 24). In other words, we can be 95% sure that somewhere between 18.6% and 22% of the population (from which we sampled) actually have a coffee maker.

Results analysis

Any two groups, such as households with and without children, can be compared to one another in terms of their differing characteristics. Say if 90% of households with children achieved Desired Results and only 50% of those without did, then we need to be able to say whether this difference in response came about as a result of random chance or whether the difference is statistically significant – i.e. is representative of the population from which we sampled. Whether or not the difference is significant is a function of the number in each group responding to the question, the percentage of each group answering “Yes” to the question (i.e. 90% and 50%) and of course how large the percentage difference between the groups is for those responding “Yes”. It is also a function of the desired confidence level – which, at 95%, is appropriate for this kind of study. Consequently, there is still a 5% possibility that a difference identified as significant is down to random chance. Where differences are not significant in a statistical sense, but “noteworthy” or “marked”, a larger survey is generally advisable in order to increase the validity and reliability of any conclusions made.

APPENDIX 4 – SURVEY QUESTIONNAIRE

Delivering Real Warmth: user behaviour in energy efficient homes									
Interview data collection sheet									
Section 1: Introduction (5 minutes)									
Input Ref		1.01	Case study		1.02	English 2nd Language?		1.03	
Section 2 Background information (5 minutes)									
How long have you lived at this address			Type of house			Age of house			
less than a year		2.01a	Detached		2.02a	Pre 1919		2.03a	
1-2 yrs		2.01b	Semi-detached		2.02b	1919-1945		2.03b	
2-3 yrs		2.01c	end of terrace		2.02c	1945-1965		2.03c	
3-5 yrs		2.01d	mid terrace		2.02d	1966-1990		2.03d	
5-7 yrs		2.01e	maisonnette		2.02e	1990-2000		2.03e	
7-10 yrs		2.01f	converted flat		2.02f	post 2000		2.03f	
more		2.01g	pb flat low rise		2.02g				
			pb flat high rise		2.02h				
Household Details number			What rooms do you have here (number of each type)						
Adults Under 60		2.16	Porch		2.04	Bedrooms		2.10	
Adults over 60		2.17	Hall		2.05	Bathrm + wc		2.11	
Adults over 75		2.18	Living room L/R		2.06	Bath/shwr w/o wc		2.12	
Children under 11		2.19	Dining Room D/R		2.07	Sep wc		2.13	
Children over 11		2.20	Kitchen		2.08	Balcony/sunspace		2.14	
Infants (under 3)		2.21	Utility room		2.09	Conservatory		2.15	
Employment activity Number			Current Tenancy situation						
Full-time emp.		2.22	2.32 text						
part-time emp		2.23	Why did you move here						
self-emp		2.24	2.33 text						
unemployed		2.25	When were the energy efficiency improvements done						
ill-health		2.26	2.34 a/b						
retired		2.27	Before moved in		Go to Section 3A				
f/t carer		2.28	After moved in		Go to section 3B				
student		2.29	Where did you live before						
same region		2.30a							
different region		2.30b							
smaller property		2.31a							
same size		2.31b							
larger property		2.31c							

Section 3A Knowledge and expectation before moving in (15 minutes)									
Previous home, MAIN heating system			Other secondary heating				Insulation		
Gas c.h		3a.01a	Gas wall heaters		3a.02	CWI		3a.08	
Electric storage		3a.01b	Electric panel		3a.03	External walls		3a.09	
Gas fire (l/r)		3a.01c	electric portable		3a.04	Internal		3a.10	
Elec fire (l/r)		3a.01d	LPG		3a.05	Loft		3a.11	
Oil		3a.01e	Other		3a.06	HW cylinder		3a.12	
Wood		3a.01f	(specify)		3a.07 text	Windows		3a.13	
Other		3a.01g	<i>Leave blank if none or d/k</i>			Draught stripping		3a.14	
Can you remember how much your bills were in your last house						3a.15 text			
How much of the house did you heat									
Only the living room when in the house						3a.16a			
Only the living room when in the house, and other rooms as you occupy them						3a.16b			
Most of the rooms when in the house						3a.16c			
Most of the rooms most of the time						3a.16d			
Do you recall receiving any energy advice in your old home									
Yes		Who from/what about							
No									
3a.17a/b		3a.18 text							
What did you know about this house before you moved in						3a.19 text			

Section 3B Knowledge and expectations before low energy work was done (15 minutes)									
Before the low energy work was done what was the main heat			Describe other secondary heating				Describe any previous insulation		
Gas c.h		3b.01a	Gas wall heaters		3b.02	CWI		3b.08	
Electric storage		3b.01b	Electric panel		3b.03	External walls		3b.09	
Gas fire (l/r)		3b.01c	electric portable		3b.04	Internal		3b.10	
Elec fire (l/r)		3b.01d	LPG		3b.05	Loft		3b.11	
Oil		3b.01e	Other		3b.06	HW cylinder		3b.12	
Wood		3b.01f	(specify)		3b.07 text	Windows		3b.13	
Other		3b.01g	<i>Leave blank if none or d/k</i>			Draught stripping		3b.14	
Can you remember how much your bills were before the work						3b.15 text			
How much of the house did you heat									
Only the living room when in the house						3b.16a			
Only the living room when in the house, and other rooms as you occupy them						3b.16b			
Most of the rooms when in the house						3b.16c			
Most of the rooms most of the time						3b.16d			
Do you recall receiving any energy advice a while before to the work was done									
Yes		Who from							
No									
3b.17a/b		3b.18 text							
What did you know about the work that was going to be done before it happened						3b.19 text			
What were you looking forward to									
3b.20 text									
What were you concerned about						3b.21 text			

Section 4		Facts about their home (10 minutes)				
Heating Provision	Primary Heating fuel			Secondary fuel		
	Natural gas		4.01a	Natural gas	4.02	
	Peak Electric		4.01b	Peak Electric	4.03	
	Off pk Electric		4.01c	Off pk Electric	4.04	
	LPG		4.01d	LPG	4.05	
	oil		4.01e	oil	4.06	
	wood		4.01f	wood	4.07	
	Other		4.01g	Other	4.08	
	Don't know		4.01h	Don't know	4.09	
Primary Heating	Appliances		GAS	Radiators	No	
	CSPU		4.10a	L/R; D/R	4.11	
	Thermal Store		4.10b	Hall	4.12	
	Non-Cond Combi		4.10c	Bathroom/wc	4.13	
	Cond Combi		4.10d	Beds 1	4.14	
	Non-Cond Indir		4.10e	Beds 2	4.15	
	Cond Indir		4.10f	Beds 3	4.16	
	Other		4.10g	Beds 4	4.17	
	Don't know		4.10h	Kitchen/other	4.18	
	Electric	No		Emitters	No	
	Slim-line St		4.19a	L/R; D/R	4.20	
	Conv Store		4.19b	Hall	4.21	
	Fan-assist store		4.19c	Bathroom/wc	4.22	
	Panel Htrs		4.19d	Beds 1	4.23	
	Wet system		4.19e	Beds 2	4.24	
	Other		4.19f	Beds 3	4.25	
	Don't Know		4.19g	Beds 4	4.26	
				Kitchen/other	4.27	
	Secondary heating	Electric	No		Emitters	No
	Appliances	Panel heaters		4.28	L/R; D/R	4.32
Portable		4.29	Hall	4.33		
Fixed		4.30	Bathroom/wc	4.34		
Fan heater		4.31	Beds 1	4.35		
			Beds 2	4.36		
			Beds 3	4.37		
			Beds 4	4.38		
			Kitchen/other	4.39		
Gas		No		Emitters	No	
Open l/f			4.40	L/R; D/R	4.46	
Closed l/f			4.41	Hall	4.47	
Modern Radiant			4.42	Bathroom/wc	4.48	
W/M B/F			4.43	Beds 1	4.49	
Mobile LPG			4.44	Beds 2	4.50	
Other		4.45	Beds 3	4.51		
			Beds 4	4.52		
			Kitchen/other	4.53		

Primary Heating		tick time, temperature, type; detail in 4.149						
Control types	Gas	Time	Temperature	Location	No			
4.54 - 4.57	Mech 24 Hr							
4.58 - 4.61	Mech 7 day							
4.62 - 4.65	Digital 7 day							
4.66 - 4.69	Integral time/temp controller							
4.70 - 4.73	Boiler energy manager							
4.74 - 4.77	Intelligent controller							
4.78 - 4.81	Wall mounted room stat							
4.82 - 4.85	TRVs							
4.85 - 4.88	Bypass							
	Electric	Tariff	Storage	Panel	Fixed	Portable	Fan	
4.89 - 4.94	WM Off peak							
4.95 - 4.100	Com plus WM							
4.101 - 4.106	Com Plus WM TS							
4.107 - 4.112	External sensor							
4.113 - 4.118	Manual Input							
4.119 - 4.124	Auto input							
4.125 - 4.130	Appli Thermostat							
4.131 - 4.136	Appli Timer							
4.137 - 4.142	None							
4.143 - 1.148	Group Code							
Heating Pattern	4.149 text							
Describe hours and extent								
What temp do you set the wall stat at		Deg C		Deg C				
	4.150a	lower		22	4.150f			
	4.150b	18		23	4.150g			
	4.150c	19		24	4.150h			
	4.150d	20		25	4.150i			
	4.150e	21		higher	4.150k			
	4.151 text	Not applicable (electric storage)		None (gas htg with TRVs)		4.152 text		
What do you know about the insulation?				Glazing				
CWI		4.153		Ordinary Double			4.158	
External		4.154		High-e double			4.159	
Internal		4.155		Triple			4.160	
Loft insulation		4.156						
thickness		4.157						
Water heating	Combi	4.161		Immersion	off peak	on peak	4.165 a/b	
	CH system	4.162		back boiler		4.166		
	Electric point	4.163		Solar/dual coil		4.167		
	Gas point	4.164		range (e.g Aga)		4.168		
HW tank insulation	None	4.169	poor jacket	4.170	good jacket	4.171	solid foam 4.172	
Ventilation system	Passive			4.173 Active			4.174	

User behaviour in energy efficient homes

In the current home				
Appliances	Number		Energy label?	<i>Fill in if A/B/C/Other (inc cant remember which), else leave blank</i>
Electric cooker		4.175		4.176
gas cooker		4.177		4.178
gas/hob elec/oven		4.179		4.180
electric kettle		4.181		4.182
Microwave		4.183		4.184
washing machine		4.185		4.186
Dryer		4.187		4.188
Dishwasher		4.189		4.190
Fridge		4.191		4.192
Fridge Freezer		4.193		4.194
Freezer		4.195		4.196
Toaster		4.197		4.198
Coffee maker		4.199		4.200
Electric Iron		4.201		4.202
Elec Blanket		4.203		4.204
FluorescentL		4.205		4.206
CFLs		4.207		4.208
Halogens (per bulb)		4.209		4.210
Terr.TVs		4.211		4.212
Sat/cable/digi tv		4.213		4.214
VCR		4.215		4.216
DVDs		4.217		4.218
Hifi/stereo/mains radio		4.219		4.220
games console.e.g. X box		4.221		4.222
Computer		4.223		4.224

Section 5 Use of home and experiences of living in it (20 minutes)							
largely unused			additional living space			Heated?	
L/R		5.01	L/R		5.11		5.21
Hall		5.02	Hall		5.12		5.22
Bathroom		5.03	Bathroom		5.13		5.23
Beds 1		5.04	Beds 1		5.14		5.24
Beds 2		5.05	Beds 2		5.15		5.25
Beds 3		5.06	Beds 3		5.16		5.26
Beds 4		5.07	Beds 4		5.17		5.27
Kitchen		5.08	Kitchen		5.18		5.28
Sunspace		5.09	Sunspace		5.19		5.29
Conservatory		5.10	Conservatory		5.20		5.30
What use do you make of the front sunspace			What use do you make of the conservatory				
Sitting area		5.31	Laundry		5.36		
Drying clothes		5.32	Sitting area		5.37		
store		5.33	Drying clothes		5.38		
not used		5.34	store		5.39		
other (describe)		5.35 text	not used		5.40		
			other (describe)		5.41 text		
What sort of information have you had about using the following:							
	How it works	How to use it	Who from		When		
c/h system							5.42 - 5.45
TRVs							5.46 - 5.49
heating control							5.50 - 5.53
ventilation							5.54 - 5.57
Kitchen appliances							5.58 - 5.61
Lighting							5.62 - 5.65
other (specify)							5.66 - 5.68
5.69 text							5.70 - 5.73
5.74 text							5.75 - 5.78
What information, training or advice would you have liked							
Comments about the amount of information or training							5.79 text
Comments about when it was/could be given							5.80 text
Comments about the particular topics needed/not needed							5.81 text
How do you manage with your heating controls							
Understand use							5.82 text
Physical aspects(ease of use means stuff like easy to hold, turn, read etc Use the interviewee's words!)							5.83 text
Get required results							5.84 text
Change in use of systems over time		5.85 text					
<p><i>Association for the Conservation of Energy</i></p>							

User behaviour in energy efficient homes

Which of the following actions do you take?	1	2	3	4	5
Kitchen	Never	Sometimes	Fairly Often	Usually	Always
Try to cook several things in oven at once		5.86			
Always put lids on pans		5.87			
Use microwave rather than cooker		5.88			
Only put amount of water needed in kettle		5.89			
Adjust fridge so not too cold		5.90			
Not leave fridge door open longer than necessary		5.91			
Let food cool before putting in fridge		5.92			
Defrost fridge or freezer regularly		5.93			
Wash clothes at lower temperature		5.94			
Wait till full load of washing		5.95			
Dry clothes outside when possible		5.96			
Not leave appliances on standby		5.97			
Have you taken any of these actions to use less energy?			5.98 is spare		
Heating/Hot water	Yes/no				
Turned any heating thermostats down a notch or two		5.99			
Made more use of programmer		5.100			
Heating on only when someone at home		5.101			
Heating fewer rooms than before		5.102			
Controlled storage radiators more carefully		5.103			
Set hot water thermostat lower		5.104			
Set hot water to be ON fewer hours per day		5.105			
			5.106 to 5.109 are spare		
Lighting					
Use low energy bulbs in more lamps		5.110			
Turn off lights in empty rooms		5.111			
Turn off lights not needed		5.112			
Make more use of natural daylight		5.113			
Other					
Closed curtains or blinds at dusk		5.114			
Close internal doors		5.115			
Fitted heavier curtains		5.116			
Open blinds/curtains early to let sun in		5.117			

*Take care
Tenants may not have control
of many of these items*

Section 6 Impact of their home on their lives (15 minutes)										
On a scale of 1-5 how comfortable is your home					6.01					
1	2	3	4	5						
Very Unc	Uncom	OK	Com	Very C						
On a scale of 1-5 how easy/difficult is it to heat your home					6.02					
1	2	3	4	5						
Very Diff	Diff	OK	Easy	Very E						
On a scale of 1-5 how easy/difficult is it to heat your home compared with before					6.03					
1	2	3	4	5						
Very Diff	Diff	OK	Easy	Very E						
On a scale of 1-5 how draughty is your home					6.04					
1	2	3	4	5						
Always Draughty	Often	sometimes	rarely	just right						
On a scale of 1-5 how stuffy is your home					6.04					
1	2	3	4	5						
Very Stuffy	Often	sometimes	rarely	just right						
On a scale of 1-5 how easy is it to control your heating					6.05					
1	2	3	4	5						
Very Diff	Diff	OK	Easy	Very E						
How much do you pay for gas/electricity or other fuel										
		Weekly			Monthly			Quarterly		
gas/oil/other		6.06		6.07		6.08		6.11		
electricity		6.09		6.10		6.11		6.12		
Are you paying more or less than before					6.12					
1	2	3	4	5						
Much more	more	same	less	Much less						
Are you paying more or less than you expected					6.130					
1	2	3	4	5						
Much more	more	as expected	less	Much less						
Fuel debts OPTIONAL GROUP										
Previously did you face problems of unpaid fuel bills					Y/N		6.14a/b			
Has this problem improved since you moved to this house					Yes	Same	Worse	6.15a/b/c		
Do you have any fuel debts now					Y/N		6.16a/b			
How do you pay your fuel bills		Prepaid meter			6.17	Quarterly			6.20	
		Smart card			6.18	Direct debit			6.21	
		Book			6.19	other			6.22 6.23 text	
Have you changed either your electricity or gas supplier					Have you saved money since you moved supplier					
		Gas	Electricity				Yes/No	DK		
		Y/N	6.24 a/b	Y/N	6.27 a/b					
If so, from whom to whom					Gas				6.30 a/b/c	
		Gas	Electricity		Electricity				6.31 a/b/c	
from		6.25 text		6.28 text	If yes, by how much per week					
to		6.26 text		6.29 text	Gas			6.32		
Why have you changed/not changed		6.34 text			Electricity			6.33		

User behaviour in energy efficient homes

On a scale of 1-5, since you moved into this house have you noticed any improvement in either your health or the health of one of the other members of the household								
Your health		6.34	Key	1	2	3	4	5
any other		6.35		Much worse	worse	same	Better	Much bet
6.36 text response								
How do you feel about your home								
Likes 6.37 text								
Dislikes 6.38 text								
How does it compare with what you expected					6.39			
1	2	3	4	5				
Much worse	worse	same	Better	Much bet				
Have you changed anything about the house				6.40 text				
Have your needs changed				6.41 text				
Participation Are you involved in any tenants fora or committees which enable you to influence the type of service you receive								
No	6.42 a/b		6.43 text					
Yes	(add comments)							

Section 7 Ideas for the future and any other issues (10 minutes)		
General comments about the home	7.01	<i>include any other relevant comments made during the interview</i>

APPENDIX 5 – SUMMARY OF ADDITIONAL RESPONSES

Below are the classifications of text responses to relevant questions 6.34 to 7.01 from the survey. The exact wording of the questions is in sections 6 and 7 of the questionnaire, included in Appendix 4.

Table 26: Responses to “Why have you changed/not changed supplier?”

<i>Total who changed supplier</i>	<i>42</i>
Price/save money	19
Trouble with supplier/service	6
Got an incentive	6
Canvassing in area & family advice	3
Reliable/previous supplier	2
Different supplier before; this was there when they moved in	1
Better information	1
No standing charge	1
<i>Total not changed</i>	<i>61</i>
Happy with supplier	10
No need	6
Can't be bothered	5
Not considered it	4
Always used the supplier	3
Don't want hassle	3
Bill low, so no point	2
Not dissatisfied	2
D/K	1
Too busy	1
Convenient	1
Problems sorting out previous tenants debt	1
No point	1
They're all the same anyway	1
Previous bad experience	1
Why change?	1
Didn't know she could	1
Heard about other peoples problems	1
Only just moved in	1
Thinking of trying Staywarm	1

Table 27: Responses to whether health improved or worsened

<i>Total health improved</i>	<i>14</i>
Asthma	4
Wellbeing	2
“Positive on health”	2
Able to work better/move about in house	2
Heart problems	1
Chest infections	1
Air quality	1
Fewer trips to hospital	1
<i>Total health worsened</i>	<i>17</i>
Health worse nothing to do with house	5
Age	4
Chest infections	2
Depression	2
More colds	1
Memory is worse	1
Asthma	1
Arthritis	1

Table 28: Response to “What do you like about your home?”

<i>Response</i>	<i>No.</i>
Comfortable	17
Size	10
Location	9
Neighbourhood	9
Satisfactory	8
Cosy/warm	7
Easy to manage	6
Neighbours	6
Everything/almost	5
View	5
Fine/lovely	5
Safe/secure	4
Convenient	4
Garden	4
All on one floor	3
Feels like home	3
Estate	2
Energy saving factors in home	2
New windows	2
Easy access to town/transport	2
Own home improvements	2
HA support (sheltered housing)	2
Happy	2
Being able to switch on heating when needed	1
Easy to heat	1
Fewer children/behaviour problems	1

Having CH	1
No problems with neighbours now	1
First own home	1
Better than B&B	1
No damp	1
Fantastic windows	1
Work done on the houses	1
Peace & quiet	1
Privacy	1
Appearance/decoration	1
Social aspect	1
Bright, sunny	1
Radiator in downstairs W.C.	1

Table 29: Response to “What do you dislike about your home?”

<i>Response</i>	<i>No.</i>
Size	14
Maintenance issues	9
Nothing	7
Front door old and draughty	4
Kitchen	4
Parking (very little)	4
Noise (road/neighbours)	3
Location	3
Windows draughty	3
Druggies/vandals/graffiti	3
Garden	2
Need better heating controls	2
House design	2
Heating problems	2
Neighbours	2
Lack of cupboard space	2
Kitchen & hall plastering	1
specific situation of radiators	1
Exposed pipes	1
Hard to keep temperature constant	1
Need more electric sockets	1
Insulation needed in roof	1
Problems with damp	1
Location of boiler	1
Lack of heating in bathroom	1
Nowhere for kids to play football	1
Too many cats	1
Location on hill makes walking difficult	1
Conversion from studio to 1 bed cramped	1
Bit dusty	1
Carpet is too pale	1
Heating expensive	1
Bath/shower (needs walk-in)	1
Window faults	1

Downstairs W.C. very cold	1
Area	1
Combi boiler	1

Table 30: Response to “Have you changed anything about the house?”

<i>Response</i>	<i>No.</i>
Decoration	18
Shower	4
Kitchen	4
Flooring	3
Sliding door on kitchen	2
Draught strips	2
Interior doors	1
Knocked dining room into one	1
Use whole house now its warm	1
Added shelves	1

Table 31: Response to “Have your needs changed?”

<i>Response</i>	<i>No.</i>
Need special features (health)	7
Need larger property	4
Partner now disabled	3
Partner home all day now	1
Partner terminally ill	1
Need help with housework	1

Table 32: General comments about the home

<i>Needs/complaints</i>	<i>No.</i>
Draughts from windows and doors	6
Noisy	3
Needs upgrading	2
Radiators not in sensible position	2
Maintenance/installation poor	2
Kitchen design	2
Dials on storage radiators need fixing	2
problems with whole of heating system and HA attitude	2
Needs shower installed	2
Would like heating explained again	2
Kitchen cold and draughts from stairwell	1
More power points	1
Damp in kitchen	1
Lighting in rear needed	1
Draught from letter box	1
Boiler needs attention	1
HA doesn't fix faults and doesn't keep appointments	1
CH not helped wife's health	1
Landlord should use roof for solar energy	1
Size too small for needs	1
Needs help to get CH working right	1

No heating in bathroom	1
Boiler far too big capacity for small flat	1
Parking	1
Need help with garden now	1
Energy officer should come round when first move in	1
Gardeners should do plants not just grass	1
Would like ventilation	1
Would like instant heating not storage radiators	1
Would have liked more info on htg system when moved in	1
Survey irrelevant	1
Would like flashing light instead of door bell as getting deaf	1
<i>Likes/approvals</i>	<i>No.</i>
CH big improvement	2
No condensation or damp	1
Temperature much better since insulation work	2
Extremely pleased and thinks treatment has been fabulous	1
Happy with everything	2