TOO BIG TO BE WARM

FUEL POVERTY AND UNDER-OCCUPATION IN PRIVATE HOMES

Trevor Houghton and Hugh Bown

April 2012

National **RIGHT TO FUEL** *Campaign*

The National Right to Fuel Campaign

The National Right to Fuel Campaign is a company limited by guarantee with a membership comprised of voluntary organisations, individuals, local authorities, trade unions, academics and professionals in housing, welfare benefits and environmental health. The Campaign was formed in 1975 in response to record level fuel disconnections and rising hardship experienced by low-income households triggered by major increases in fuel prices. The organisation campaigns on behalf of the fuel poor and aims to put an end to fuel poverty by securing a dry, warm and well lit home for all, irrespective of income or location.

The NRFC publishes a newsletter - *Fuel News*

National Right to Fuel Campaign
c/o ECSC, Unit 216,
30 Great Guildford Street,
London, SE1 0HS
Tel: 020 7922 1665
Fax: 020 7928 8153
email: nrfc@ecsc.org.uk

The NRFC is grateful for the support of the Eaga Charitable Trust in undertaking this research study and the Eaga Partnership Charitable Trust for funding a workshop on the links between fuel poverty and under-occupation.

Contents

Executive summary

Methods

This study examines the links between under-occupancy and fuel poverty in private sector housing by:

- Reviewing national data primarily from the English House Condition Survey 1996 (EHCS), and the English House Condition Survey 1996 Energy Report, along with other publications and research findings;
- A technical assessment of 6 example houses;
- In-depth interviews with housing professionals, advice and care agencies.
- A workshop with housing professionals, advice and care agencies, Government departments and fuel poverty organisations.

Incidence of fuel poverty in under-occupied homes in 1996

- Two million or 29% of fuel poor households[1] in England were under-occupying their homes by two or more bedrooms over the English House Condition Survey bedroom standard. Four and half million or 64.6% of fuel poor households were under-occupying by one bedroom or more over the standard. In both instances, this is a smaller proportion than for the population as a whole;
- Owner-occupiers who are under-occupying by one or more bedrooms over a bedroom standard account for 39.5% of all fuel poor households;
- Fuel poor under-occupying households are primarily single householders over 60, couples who are over 60 or single adults under 60;
- Fuel poverty is more strongly related to living in homes at standard levels of occupation and overcrowded homes than in under-occupied homes;

[1] Throughout this report the term 'fuel poor households' refers to those households who need to spend more than 10% of their disposable income (excluding housing costs) in order to be warm.

Technical assessment of six example houses

Six example house types, (three and four bedroom dwellings) were used to assess energy running costs and internal temperatures if under-occupied by a single person. One and half million under-occupy in homes with two bedrooms whereas nearly three million under-occupy in larger properties with three, four and five bedrooms. It is in large houses, where householders under-occupy by having two or more bedrooms in excess of the standard, that the problems are most likely to be severe and for this reason six larger properties were chosen for analysis.

The national data shows that 2.3 million fuel poor households under-occupied in three bedroom houses in England in 1996. For this reason the results for House 2, which has three bedrooms, deserve particular attention. This analysis used seven different combinations of insulation, heating patterns and airflow to show that:

- Providing better insulation results in a range of savings (across all six house types) of between £154 and £309 per annum over the baseline energy costs. The savings in the three bedroom house are calculated as £169. This involves expensive improvements such as wall insulation and double glazing. This would effectively remove the health risks of living in cold conditions.

- Part house heating alone (a commonly adopted strategy) results in average savings in the range of £53 and £148 per annum over the baseline energy costs and this costs nothing to implement. The savings in the three bedroom house are calculated as £53. This strategy does have a cost in low temperatures in unheated rooms and particularly unheated rooms at night. This could be a health risk and could lead to increased risk of condensation. Limiting internal airflow in addition to part house heating results in a small additional average saving of £21 per annum that would be low cost to implement and would result in an improvement in comfort.

- Additional measures to reduce internal airflow and internal insulation in better insulated houses produces very modest additional savings and would involve expensive and disruptive measures (i.e. insulating internal walls);

- A combination of measures (better insulation, limiting internal airflows and part house heating) does result in significant savings on energy costs, but in most cases this would still not be sufficient to take most single, low-income under-occupiers out of fuel poverty.

- Low temperatures in unused rooms in part heated under-occupied homes are likely to result in elevated relative humidity and hence at risk of condensation and mould. However this effect is partly counteracted in larger under-occupied homes because the larger volume of air should result in lower moisture concentrations.

Health impacts

This study provides evidence that suggests that under-occupancy, when it results in part house heating, could lead to health risks such as hypothermia and cold stress.

There is also some indication that under-occupation might be linked to depression. Householder behaviour could significantly reduce these risks.

It is not clear whether there is a link between under-occupancy and respiratory illness resulting from living with damp and mould. On the one hand under-occupancy means that there is reduced moisture production and in large homes a large volume of air to carry that moisture which should reduce condensation problems. But on the other hand modelling demonstrates that there can be very low temperatures in fuel poor under-occupied homes that could greatly increase the risks of condensation.

Staying warm and staying put

The comments from our interviewees show clearly that:

- The insulation of only the parts of a dwelling that are being used is not a good use of resources and comments received back up our technical analysis which shows that the savings achieved are very small and the costs relatively large.

- Improving heating controls to enable background heating of unused rooms is worth consideration as this is likely to reduce the risk of damp and mould in these unused rooms. This option will only be effective if the use of the heating controls is well understood by the householder and where appropriate, ensuring that they are designed for easy manipulation by older people or people with disabilities. Whether householders will be prepared to pay for background heating for unused rooms is an unknown factor.

- Improved insulation to the whole property remains the best option. Having organised contractors to come to a property it is most economically efficient to have a complete job done. The main limitation on this option is cost and the adequacy of the current grant regime to meet these costs in larger dwellings. The technical analysis suggests that better insulation may be insufficient to take single under-occupiers in large properties out of fuel poverty, so additional measures would be needed.

- Raising sufficient funds to cover the cost of energy efficiency improvements and up-to-date heating systems and controls currently requires specialist advice, as there are multiple sources of possible funding. Some sources, such as the various equity release schemes, need careful consideration because of the longer-term commitments involved.

- Local authorities and Home Improvement Agencies have a key role in advising under-occupiers about their options for improving their homes and implementing improvements.

Moving on

- The need for affordable warmth is rarely sufficient reason on its own for an individual to move.

- If fuel poor owner-occupiers want to move to private sector housing, their choices are constrained by the equity they can realise, the very limited supply of energy efficient one and two bedroom dwellings, limited support and advice available, and increasing age and infirmity.

- Owner-occupiers who want to move into social housing may also face barriers of eligibility.

- Fuel poor under-occupiers in private rented accommodation who want to move are effectively limited to seeking housing from social landlords.

- Given that there are two million fuel poor households under-occupying by two or more bedrooms in England, there are insufficient smaller, affordable homes to make moving an option, even if the households wanted to.

Recommendations for the fuel poverty strategy

- Warm Front grants should be awarded on a sliding scale that is related to the size and state of repair of the property;

- Warm Front grants should cover the cost of draught proofing internal doors.

- Better integration of Warm Front grants with other funding sources (such as the Energy Efficiency Commitment) is needed to tackle fuel poverty in under-occupied homes;

- Central Government funding for Home Improvement Agencies should be increased so that there is coverage across the whole country;

- Home Improvement Agencies should be given the overall co-ordinating role for tackling fuel poverty and disrepair in private housing, working in partnership with local authorities and other agencies;

- In providing guidance to local authorities on the formulation of private sector housing strategies, the Government should require local authorities to put in place measures that will meet the target to eradicate fuel poverty by 2016 (consistent with the requirements of the Warm Homes and Energy Conservation Act 2000).

- Regional and local planning authorities should be placing a higher priority on the provision of smaller housing units in every community in regional planning guidance and local plans;

- Local planning authorities should use planning obligations to encourage developers to provide small affordable housing units;

- The Housing Corporation and local authorities should be providing encouragement to Registered Social Landlords (RSLs) to develop schemes that include smaller housing units (one and two bedrooms) for rent, shared-ownership and for sale;

- Local authorities and RSLs should ensure that their allocation policies allow low-income owner-occupiers to move into appropriate local social housing.

Two recommendations for action to tackle fuel poverty in under-occupied private sector households

Firstly, a programme, delivered prior to retirement, is suggested that would combine the following:

- Advice on staying put and moving on, including financial advice and assistance applying for grants;
- Production of an advice leaflet summarising the main points covered in face-to-face advice, that can be left with householder;
- A 'house health check' which would include damp proofing, roof repairs and a safety check on electrical wiring and fittings, gas appliances and systems (possibly funded through local authority grants);
- Energy efficiency improvements (funded by Warm Front, Energy Efficiency Commitment);
- Mobility and access improvements if appropriate (funded by Disability Facilities Grant);
- Organisation and supervision of any building works by an agency (Home Improvement Agency).

Secondly, it is recommended that planning advice is produced, with the aim of improving the provision of smaller homes in all communities in the long-term. The advice would be aimed at local authority planners and housing providers as part of the agenda for creating sustainable communities. A project to produce such advice might include:

- assessing current provision of smaller housing
- a survey of low-income 50-65 year olds to look at their attitudes to their future housing needs including the types and tenure of housing they would favour
- reviewing how this approach fits into the sustainable communities agenda
- setting out the benefits for the health and social services
- the market opportunities for private housing developers
- the planning response and use of planning obligations

Unanswered questions

- The research has identified a number of issues that need further investigation. A fundamental issue is the need to develop a more appropriate definition of under-occupation for housing policy makers.

- The different situations of under-occupiers in different age groups needs further study. In particular very little information was discovered about middle-aged under-occupiers. It also seems possible that very old (over 75 years) under-occupiers, who are increasing in number, will have special problems.

- The degree of under-occupancy associated with fuel poverty in the private rented sector has proved particularly hard to investigate and more work is needed.

- The general availability and affordability of small homes and retirement homes deserves further attention.

1 - Introduction

1. The origins of this study

This study was prompted by a paragraph about under-occupation that appeared in the Government's consultation draft "The UK Fuel Poverty Strategy" published by the DTI and the then DETR in February 2001:

> *"Dwelling size can be another important factor behind fuel poverty. Households in the worst degree of fuel poverty tend to occupy accommodation, which is, on average, some 13% larger in area than that of people who are not fuel poor. Principal reasons for under-occupation are where children have grown up and left the family home or where a spouse has died or left. Under-occupation is a complex issue, with often good social reasons for not moving to a smaller property. Older people in particular tend to rely on strong local community networks, and these links can have real health and other benefits."*

The Government commissioned research to look at under-occupation in social housing and this was published in April 2001 (Barelli and Pawson 2001). The research report included the following comment:

> *"Underoccupation, by contrast, is commonest in the private sector, particularly among home owners. Eighty two per cent of owner-occupiers have 'a spare room' on this measure nearly double the proportion of social rented sector tenants (42 per cent)."*

Earlier research commissioned by the then DOE (Barelli 1992) found that:

> *"…most under-occupiers were satisfied with their accommodation and hardly anyone with one spare bedroom felt that they have too much space".*

It is on the basis of these findings, that this study has focussed primarily on private sector housing and has given as much attention to strategies for 'staying put' as to the options for 'moving on'.

2. Aims of the research

The aims of this study are to:

- improve the understanding of the size of the problem of under-occupancy overall and particularly in owner occupied and private rented property related to fuel poverty
- explore the range of practical options to lift such households out of fuel poverty

It was an objective from the outset to put forward the basis for one or more practical options for the development of programmes to tackle fuel poverty in under-occupied homes.

3. Methodology

Review of national data sources, research and experience

The study has reviewed the existing data sources and literature relevant to fuel poverty and under-occupation which included:

- *A review of data from the English House Condition Survey 1996*

  The Building Research Establishment has supplied tabulations of the EHCS data requested by the research team and these have been used to estimate the incidence of fuel poverty in under-occupied private housing.

- *A review of research studies and advice from specialist agencies*

  These have included research studies addressing housing, the health impacts of fuel poverty and practical advice provided by caring agencies e.g. Age Concern, Help the Aged and Care and Repair.

The bibliography at the end of the report lists the documents reviewed for this study.

Technical assessment

Six example houses have been used to explore the technical options for tackling fuel poverty in larger under-occupied homes. This analysis gives the baseline of single householders living in poorly insulated homes then explores how partial heating, partial insulation, limiting airflow, full heating and full insulation might affect their living conditions (temperatures) and their energy expenditure. The effect of partial heating on humidity is also examined.

The details of this analysis are presented in Appendix 2. The results are summarised and discussed in the chapter on Analysis of Six Example Houses.

In-depth interviews

The project team carried out fifteen in-depth interviews with a range of housing professionals, specialist agencies and front line advice workers. The interviews included discussion of:

- the experience of the agency/organisation in relation to under-occupation and fuel poverty

- possible health impacts linked to fuel poverty and under-occupation

- their views on the practicality and acceptability of a range of options to improve householders' ability to live in their 'under-occupied homes' or to move to more 'fitting' homes.

- the financial options available to householders in under-occupied homes for investment in energy efficiency and heating improvements

The general topic guide used in the study can be seen in Appendix 3 and the list of interviewees Appendix 4.

Workshop

A workshop was held on 9th July 2002 to review the draft research report and particularly to look in some detail at the research team's recommendations, including the proposals for a practical programme. The outcomes of this workshop have resulted in some additional recommendations and amendments to the proposals for practical programmes.

The workshop participants are listed in Appendix 4.

2 - What is under-occupancy?

4. Definitions of under-occupation

Under-occupation exists where there is an excess of floor space relative to the number of people living in a dwelling. Floor space can either be measured by area or else by number of rooms. For simplicity we usually use number of bedrooms because with bedrooms it is easy to define a standard which any given composition of household can be reasonably said to 'require'.

For instance:

> *"…underoccupation is often said to exist where a household occupies their home at less than 0.5 persons per (habitable) room, or where it has 'a surplus' of two or more bedrooms in terms of the bedroom standard."*
> (Barelli and Pawson 2001)

Or if you want to look at floor space per occupant there are the Parker Morris standards. These were set out in the 1961 Parker Morris Report - *Homes for Today and Tomorrow* and were generous standards by current day, private sector standards. They were mandatory in the public sector for a period but were not accepted by the private sector. Increasing space has generally been associated with improving the quality of housing.

Barelli and Pawson also discuss *"resident-centred definitions"* which are subjective in that they are based on the feelings of having too much space. Unsurprisingly, far fewer householders feel they are under-occupying compared with definitions based on the amount of floor space or bedrooms per occupier.

In the English House Condition Survey Energy Report (DETR 2000), use was made of a composite index combining floor area and number of rooms. The algorithms that defined this index were not available to the research team when we specified our enquiries of the English House Condition Survey data, and in any case we found it easier to present tables based on one simple parameter.

Accordingly we have used the occupancy definition used in the EHCS. This is based on numbers of bedrooms, as set out in the glossary of the English House Condition Survey (DETR 1998):

> *"A separate bedroom is allocated to each co-habiting couple, any other person aged 21 or over, each pair of young persons aged 10-20 of the same sex, and each pair of children under 10 (regardless of sex). Unpaired young persons aged 10-20 are paired with a child under 10 of the same sex or, if possible, allocated a separate bedroom. Any remaining unpaired children under 10 are also allocated a separate bedroom."*

> *"The calculated standard for the household is then compared with the actual number of bedrooms available for its sole use to indicate deficiencies or excesses. Bedrooms include bed-sitters, box rooms and bedrooms which are identified as such by informants even though they may not be in use."*

There are limitations to this definition. As will be shown later, most households under-occupy under this definition. It could be argued that having a spare room contributes to a good quality of life as it provides space for visitors and leisure activities. In fuel poor households it is more appropriate to look at an excess of two or more bedrooms (as suggested by Barelli - see above) and we have focussed on this situation

5. A philosophical question

Society has an obligation to alleviate poverty. Individuals have the right to allocate their own resources.

One might compare two households each with an income of £7000 and houses that require £800 a year to heat. In the one case the £800 fuel bill is the result of poor insulation and in the other it is brought about by the excessive size of the house.

In the one case we apply Warm Front grants and insulate the home to bring the bills down to £600 and in the other we offer a move to a smaller house that would also bring the bills down to £600. In the first case the householders might not spend £600 on fuel, as they might prefer to sacrifice a bit of warmth to spend it on other things. In the second case the householders don't move. They also sacrifice a bit of warmth. They prefer other things, the comfort of homes they have grown used to and the community in which they have always lived.

Both are offered the choice of moving out of fuel poverty and both make their own choice to decline it. Yet a fuel poverty strategy may be deemed to have dealt with the former while the latter would probably still remain on the books as a problem to be dealt with.

It could be argued that fuel poor households choosing to remain in under-occupied homes should be taken out of the fuel poverty statistics. The counter argument is that fuel poor under-occupiers and particularly older people have a right to remain in their own home because of other benefits associated with familiar surroundings, social networks etc.

This points to the need to consider under-occupation in the broader context of all the factors that contribute to quality of life and well being.

6. Why does under-occupancy impact on fuel poverty?

From the discussion of definitions and the philosophical question we have posed, it can be seen that the linkage between under-occupancy and fuel poverty is not

straightforward and it cannot be assumed that under-occupancy in low-income households will automatically result in fuel poverty. For instance it is possible to conceive of reductions in occupation taking some households out of fuel poverty.

As a hypothetical example, take a household with an income of £9000 and 4 children that spends £320 a year on heating and £581 on hot water, cooking and electrical appliances. They would be spending more than 10% of their income on fuel and deemed to be in fuel poverty. When the 4 children leave home the heating bill might go up to say £380 because the house would lack the incidental gains available from the activities of four children. At the same time energy consuming activities of the four children such as cooking and use of hot water would be reduced by say £161.

The household would then be left with a total fuel bill of £800 (i.e. less than 10% of disposable income). So though the house is now under-occupied under the bedroom standard of under-occupation, the household could have been taken out of fuel poverty. The problem in this instance is the number of dependants on a small household income and not the size of the dwelling.

However it is also possible to point to some ways in which under-occupancy can exacerbate fuel poverty.

The most pertinent scenario is where a householder in their 60s is left in a large property perhaps after the death of a spouse and their children have left home. The property is probably Victorian with solid walls and inadequate insulation. They have central heating but the boiler is old and reaching the end of its useful life.

The individual then retires and their income drops. They are at home for most of each day increasing their requirements for energy services. They cannot afford to heat the whole of their home or to keep their home in good repair. They resort to a strategy of only heating their living room to an adequate temperature (21°C) and parts of their home are not heated at all (such as bedrooms, hall and bathroom).

In this instance under-occupation comes on top of energy inefficient housing in poor repair, a fall in income and a change of lifestyle. All these factors contribute to the fuel poverty of the householder.

The fuel poverty impacts of this situation could be:

- Increased condensation and associated mould in cold parts of the house with possible impacts on health, state of decorations, furnishings and possessions

- The poor state of repair of the house is exacerbated by deterioration of the building fabric caused by inadequate heating

- Potential health risks from moving from heated to unheated zones of the house, particularly where the individual is moving from a heated living room to an unheated bedroom

- Potential mental health impacts from living in a decaying home with a very restricted lifestyle.

In the next two chapters of this report we try to assess whether these potential fuel poverty impacts are prevalent (through analysis of national data) or likely (by modelling).

3 - Incidence of fuel poverty in under-occupied homes

7. Analysis of national data

Analysis of English House Condition 1996 (DETR 1998) data shows that the majority of English households are under-occupying against a bedroom standard.

Table 1: % Under-occupation in English Households (1996)

	1 more bedroom than standard	2 or more bedrooms than standard	all under-occupiers
% of non fuel poor households	37.9%	33.9%	71.8%
% of fuel poor households	35.5%	29.1%	64.6%
% of all households	37.1%	32.2%	69.3%

Derived from EHCS 1996

Table 1 shows that the proportion of fuel poor households[2] under-occupying is slightly less than the national average and less than non fuel poor households. As discussed earlier, the most significant figure in this table shows that 29.1% of fuel poor households are under-occupying by two or more bedrooms above the standard.

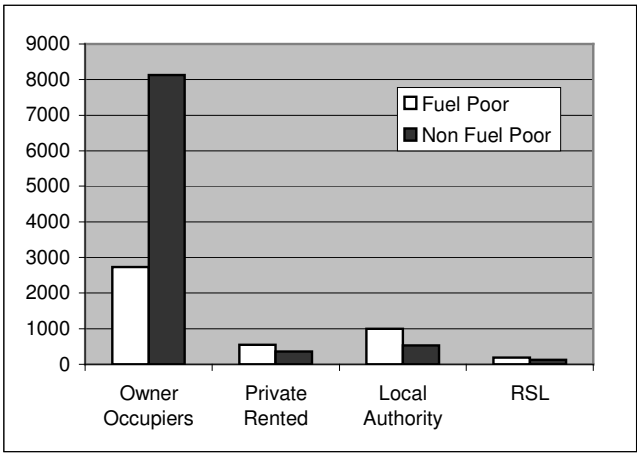


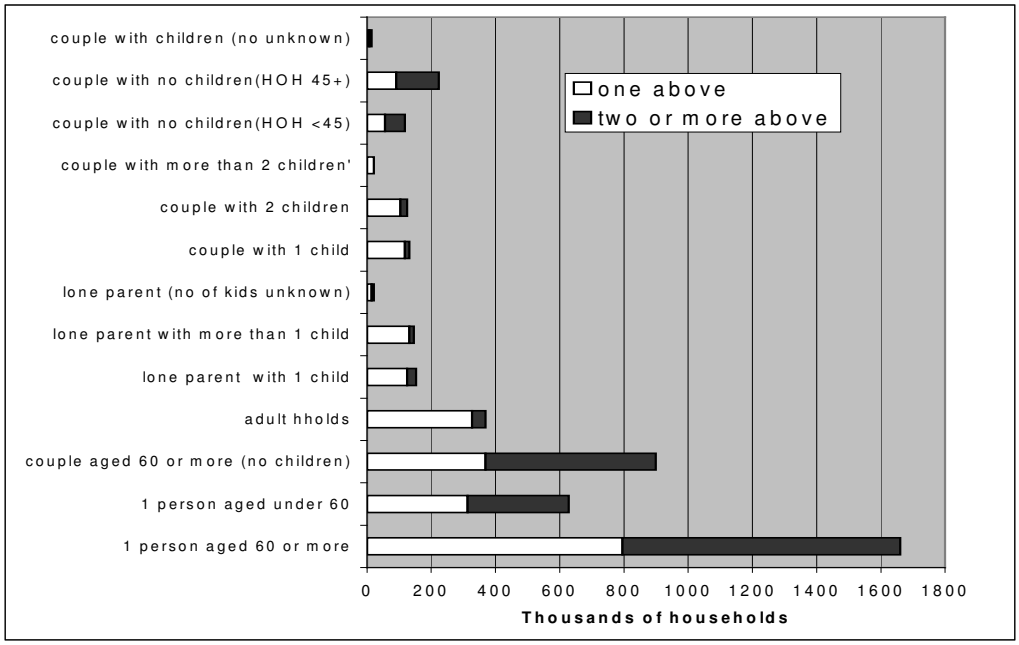
Figure 1: Under-occupation by tenure (in '000s)

Figure 1 shows that the majority of under-occupied households (under-occupying by one or more bedrooms) are owner-occupiers and of these 2,727,000 are fuel poor. This represents 39.5% of all fuel poor households in England. 545,000 fuel poor under-occupiers are in private rented accommodation. Under-occupation is most common in non-fuel poor, owner-occupied households.

Derived from EHCS 1996

[2] Throughout this report the term 'fuel poor households' refers to those households who need to spend more than 10% of their disposable income (excluding housing costs) in order to be warm.

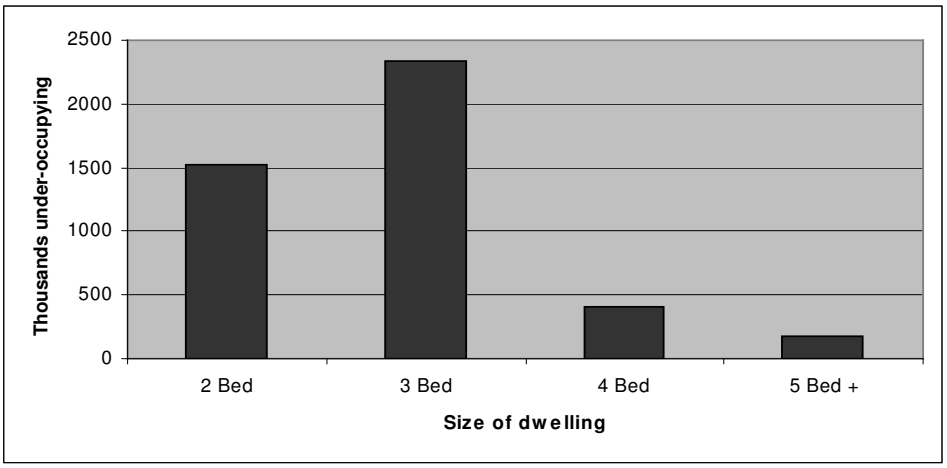
Figure 2: Number of fuel poor households under-occupying by household type



Derived from EHCS Data 1996

Figure 2 shows that the combination of fuel poverty and under-occupation is most common in older people's homes and predominantly single people over 60. There are however significant numbers of single adult and adult only fuel poor households under-occupying. In 1996, 2,475,415 fuel poor households had one bedroom above the standard, and 2,029,143 had two or more bedrooms above the standard. The latter figure is the most significant as these are the homes that are most likely to face real difficulties in maintaining healthy internal temperatures.

Figure 3: Numbers of fuel poor households under-occupying by size of dwelling (number of bedrooms)



Derived from EHCS 1996

Figure 3 shows that the majority of fuel poor households who are under-occupying (against the bedroom standard) are living in two and three bedroom dwellings.

In order to examine whether under-occupation could be seen as a cause of fuel poverty, the proportions of fuel poor households at various occupancy levels are presented as a ratio of the proportions for all households in Table 2. If the ratio is greater than 1.0 (presented in bold type) then the incidence of this level of occupancy is greater for fuel poor households than it is for the non-fuel poor.

The important thing to notice here is that fuel poor households are more likely to score highly in the cells that represent standard occupancy or below. In the cells which represent under-occupancy, the few ratios greater than 1.0, are only slightly over. And of course, for all households, the ratios in the under-occupancy cells are only 0.95 and 0.90 showing that there is less under-occupancy among the fuel poor.

Table 2: Incidence of fuel poverty for different household type (compared with average for each household type)

			Number of bedrooms compared with standard				
			Overcrowded			**Under-occupied**	
	Proportion in fuel poverty	Numbers '000	two or more below	one below	standard	one above	two or + above
1 person aged 60 or more	74.2%	3,045			0.91	**1.01**	**1.06**
lone parent with more than 1 child	69.8%	570		0.51	0.93	**1.21**	**1.02**
lone parent with 1 child	67.6%	609		**1.05**	**1.12**	0.95	0.70
adult households	56.9%	1,336	**1.87**	**1.09**	0.94	**1.05**	0.94
1 person aged under 60	47.4%	2,279			**1.33**	0.82	0.89
lone parent (no of kids unknown)	35.5%	118			**1.50**	0.67	
couple aged 60 or more (no children)	33.1%	2,927			0.71	**1.14**	0.97
couple with more than 2 children'	18.2%	845	**1.95**	**1.95**	**1.09**	0.65	0.00
couple with 1 child	12.4%	1,964		**1.43**	**1.26**	**1.01**	0.36
couple with no children(HOH 45+)	12.0%	2,200		0.00	**1.13**	**1.09**	0.90
couple with 2 children	11.2%	1,807		0.00	**1.17**	**1.01**	0.63
couple with no children(HOH <45)	10.6%	1,571			**1.82**	0.92	0.83
couple with children (no unknown)	7.1%	393		0.00	2.00	0.63	1.00
All households	35.5%	19,643	**1.25**	0.95	**1.18**	0.96	0.90

Derived from EHCS 1996

Table 2 shows that fuel poverty is more strongly related to households with standard levels of occupancy and overcrowding than with under-occupation. In a few household types (such as lone parents with more than one child and couples aged 60 or more with no children) there is an elevated proportion of fuel poor households in under-occupied homes.

On this evidence it would be hard to argue that under-occupation is a prime cause of fuel poverty.

Additional tables derived from the EHCS are presented in Appendix 1.

Poor housing and under-occupancy

Poor housing is defined in the EHCS 1996 (DETR 1998) as: *"that which is either unfit, in substantial disrepair or requires essential modernisation. 14.2% of all households live in poor housing."*

The tabulations from the EHCS, commissioned from BRE, for this study did not cover the links between under-occupancy and poor housing. We can however deduce from tables in the English House Condition Survey 1996 that there is a possible link but this is an area that needs further investigation. In Table 3 we focus on the household types where fuel poverty and under-occupancy are most numerous:

- 1,660,000 households made up of one person aged 60 or more
- 900,000 households made up of a couple aged 60 or more with no dependent children
- 728,000 households made up of one person under the age of 60

Table 3: Household type and poor housing

Household type	**in poor housing**	**% household type**
All tenures		
One person age under 60	404,000	17.80%
One person age 60 or more	583,000	20.90%
One person age over 75	320,000	22.90%
Private tenants		
One person age under 60	140,000	34.80%
One person aged 60 or more	76,000	37.60%
Owner occupiers		
One person age under 60	170,000	12.70%
One person age 60 or more	330,000	19.10%

Derived from EHCS 1996

The top half of Table 3 shows that there are large numbers of old and very old single householders in poor housing and that the proportion increases with age. The high percentage of private tenants in poor housing points to a particular concentration in this tenure.

Care and Repair quote statistics drawn from *The State of UK Housing* (Policy Press, 2000) stating that there are one and half million unfit homes in the UK and the majority of these are owner occupied. The tendency to live in poor conditions increases with age, particularly after 80 (Care and Repair 2002). We don't know from the figures what proportion of these very old householders are in fuel-poverty and are under-occupying but we believe this is an area that deserves further investigation.

The possible linkage of poor housing conditions to fuel poverty and under-occupation means that the costs of alleviating fuel poverty could be much higher in such housing as basic repairs will be needed alongside energy efficiency improvements.

8. Other Research Data

An Age Concern survey of 300 older people (55 and over) in England in November / December 2000 (Boyo 2001) shows that while 47% were single people living alone only 17% lived in 1 bedroom accommodation with the implication that 64% of the single householders surveyed were under-occupying. This is in line with our analysis of national data. The breakdown by ethnic origin (see Table 4) suggests that households of Indian origin do not show any incidence of under-occupation by single householders (caution being required because of the size of the sample).

Table 4: Persons and bedrooms per household (by ethnic origin)

Ethnic Origin	1 person households	1 bedroom accommodation	% single people under-occupying
All householders	47%	17%	64%
Bangladeshi	-	-	-
Pakistani	7%	3%	57%
Black Caribbean	52%	19%	64%
Indian	33%	33%	0%
Irish	50%	25%	50%
White	61%	20%	67%
Other	40%	30%	25%

Derived from Table 4 Boyo 2001

Table 5: Spaces unheated during winter (Age Concern survey of 300 households)

	Living room	Bedroom	Bathroom	Kitchen	Hall	All parts heated
All householders	6%	18%	14%	12%	20%	57%
Council tenants	6%	13%	12%	13%	13%	62%
HA tenants	9%	17%	13%	13%	22%	44%
Private rented	10%	30%	30%	10%	25%	40%
Owner occupiers	5%	19%	14%	13%	22%	61%

Reproduced from Boyo 2001

This same survey included the observation:

> *"Some older people said they lived in large, draughty homes that needed urgent repairs and improvements including double glazed windows to keep them warm. It is obvious that the bigger the home the more it will cost to heat."*

The survey revealed lower than average use of central heating systems. Table 5 shows the parts of the home that were unheated during winter by tenure.

9. Causes and trends

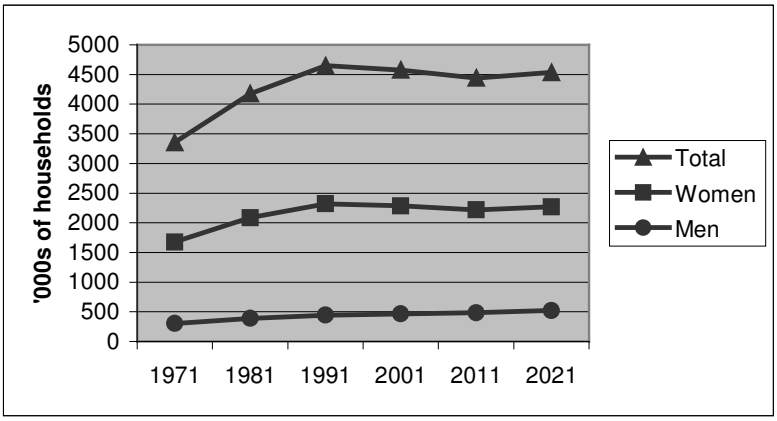
Barelli and Pawson point to three main causes of under-occupation in social housing:

- children leaving home
- the death of a spouse
- relationship breakdown

Their findings amongst social housing tenants suggest that the first two causes are much more significant than relationship breakdown. However a study into the impacts of relationship breakdown on housing demand (Holmans 2000) observed that following divorce 33,000 male and 48,000 female owner-occupiers had remained in the matrimonial home accounting for 39% of all the people surveyed. This suggests that relationship breakdown could be a more significant cause of under-occupation amongst homeowners.

The trends in numbers of widows and widowers living alone as one person households is provided in the *Projections of Households in England 2021* (DTLR 2001) and shown in Figure 4.

Figure 4: Numbers of widowed one person households in England



Derived from *Projections of Households in England 2021* (DTLR 2001)

This shows that the sharp rise in widows living alone seen up to the mid 1990s has now flattened out because falling births, year by year between 1910 and 1930. The gradual increase in widowers living alone is as a result of increasing male longevity.

The projections also show that the age profile of widowers and widows living alone is changing with a forecasted increase in the proportion of very old people living alone.

These trends indicate that the increasing age of under-occupiers will become a factor to be tackled by any programme to address fuel poverty in under-occupied homes.

10. Monitoring fuel poverty in under-occupied homes

Local authorities, mainly as a result of their duties under the Home Energy Conservation Act (1995), are monitoring the overall energy efficiency of the housing stock and incidence of fuel poverty in their areas. They are using stock condition surveys that usually include an energy profile of the stock based on the Standard Assessment Procedure (SAP). They are also commissioning random telephone surveys, the results of which are analysed using the HECAMON software, particularly to monitor the private housing stock. It is not possible to pick up on fuel poverty that is partly caused by under-occupation by either of these methods. SAP is based on the assumption of standard occupancy in arriving at an energy rating for a property.

Local authorities need to be asking relevant questions in housing surveys in order to know about the incidence of under-occupancy in the private stock. They also need to be using more appropriate tools to monitor fuel poverty.

NES has been working on the 'Affordable Warmth Index' which provides a simple yet accurate assessment of whether a householder can afford the energy required for their specific property. The assessment is carried out using a computer program based on technology developed for calculating Energy Ratings that are already widely used by social landlords and fuel poverty groups. The AWI is a module that can be purchased as an add-on to the Evaluator, Builder, Auto Evaluator and Surveyor versions of the National Home Energy Rating software. The AWI is based on the energy running costs of a property (excluding maintenance) and the income level of the householder. Most importantly for addressing under-occupation, it requires the number of occupants to be inputted and there is the option for entering occupancy patterns. The range of the AWI is between 0 and 140 and relates to the levels of fuel poverty as follows:

Table 6: Levels of fuel poverty related to the Affordable Warmth Index

Level of fuel poverty	**% of disposable income spent on energy running costs**	**AWI**
Affordable	<=10%	>=100
Marginal	>10% - <=15%	80 - 99
Moderate	>15% - <20%	60 - 79
Severe	>=20% - <30%	20 - 59
Extreme	>=30%	<20

Madeleine Makarab of the Cold Line, Age Concern Hackney (a qualified NHER site surveyor) commented that SAP failed to take account of the high number of air changes in older properties and the number of hours a property was occupied. However she felt that the AWI would require very expert staff and direct contact with clients. This might make it too expensive and cumbersome to be used widely. John Buckham of Newcastle City Council commented that *"SAP can mask anything"* and that it was clearly irrelevant to under-occupation. He thought that he probably would use the AWI in the future.

4 - Analysis of six example houses

11. Six example houses and seven scenarios

We have made calculations in relation to six example house types using the Building Research Establishment Domestic Energy Model (BREDEM XII).

The types are:

- H1 – 1900 terrace house, 4 bedroom, traditional construction
- H2 – 1926 semi-detached, 3 bedroom, traditional construction
- H3 – 1930 semi-detached, 4 bedroom, traditional construction
- H4 – 1937 semi-detached, 4 bedroom, rendered brickwork
- H5 – 1960 terrace patio, 4 bedroom, brick block cavity crosswall, timber framed panels
- H6 – 1964 terrace/cluster patio house, 4 bedroom, concrete system

These types have been chosen as those most likely to lead to the worst problems of under-occupancy, and yet offer some possibilities of internal division between occupied and unoccupied rooms. They have been taken as representative of different periods of building.

It has been shown elsewhere (see page 15) that, among those in fuel poverty, one and a half million under-occupy in homes with 2 bedrooms whereas nearly 3 million under-occupy in larger properties with 3, 4 and 5 bedrooms. As discussed earlier, it could be argued that having a spare room is the norm and it is in larger houses, where low-income householders under-occupy by having two or more bedrooms in excess of the standard, that they are likely to face the most severe problems. For this reason we have chosen six larger properties for analysis. Five examples have four bedrooms and one has three (H5). Table 7 shows the measures that could be taken to reduce airflows to unused parts of the houses.

The national data shows that 2.3 million fuel poor households under-occupied in three bedroom houses in England in 1996. For this reason the results for House 2, which has three bedrooms, deserve particular attention.

Table 7: Measures to reduce airflow to unused parts of the 6 example houses

House 1 1900 Terrace	Use ground floor living room as a bedroom. Access to the garden can be through the kitchen. Maintain access to first floor bathroom, close off, curtain and/or draught-strip all bedroom and study doors.
House 2 1926 Semi	Use one ground floor living room as a bedroom, maintain access to first floor bathroom, close off, curtain and/or draught-strip three bedroom doors.
House 3 1930 Semi	Use ground floor living room as a bedroom. Maintain access to first floor bathroom, close off, curtain and/or draught-strip all bedroom doors.
House 4 1937 Semi	Use dining room as ground floor bedroom. Maintain access to first floor bathroom, close off, curtain and/or draught-strip all bedroom doors.
House 5 1960 Terrace patio	Use ground floor bedroom. Maintain access to first floor bathroom, close off, curtain and/or draught-strip all bedroom doors.
House 7 1964 Terrace/cluster	Use ground floor bedroom. Maintain access to first floor bathroom. Close off landing to bedrooms 1 and 2 with curtains, or preferably a new draught-stripped door, Curtains and/or draught-strip all bedroom doors.

It can be seen from Table 7 that maintaining access to first floor bathrooms prevents consideration of sealing off the stairs and significantly increases the circulation space that ideally would be heated.

We have made calculations relating to each of the six example houses with different levels of heating, insulation of the building envelope, internal airflow and internal insulation. In all scenarios we have assumed a single occupant. Seven different scenarios were assessed for each example house type, which progressively reduce the annual energy costs:

1. Poorly insulated (e.g. no wall insulation, single glazing, some draught proofing, and about 4" roof insulation) with whole house heating (demand temperature in living room 22℃ - appropriate for older people). This represents the baseline for the other scenarios.
2. Poorly insulated but only heating parts of the house being used and leaving any unused rooms unheated.
3. As 2 but in addition taking common sense measures to limit airflows between heated and unheated zones of the house (e.g. keeping doors closed, draught proofing internal doors).
4. Better insulated (e.g. 4" roof insulation, wall insulation, double glazing) with whole house heating (as 1).
5. Better insulated but only heating parts of the house being used and leaving any unused rooms unheated.
6. As 5 but in addition taking common sense measures to limit airflows (as 3).

7. As 6 but in addition insulating internal walls and ensuring there are thick carpets on floors. NOTE scenario 7 has been included for completeness but we don't believe that the expense of internal wall insulation is ever likely to be justified. Some expense on internal draught proofing could be.

The results are summarised in Figures 5 & 6. A full explanation of the assumptions used in this analysis and a full set of tables is provided in Appendix 2.

Figure 5: Average annual energy costs for 6 example houses with different levels of heating, insulation and internal airflow assuming single occupant

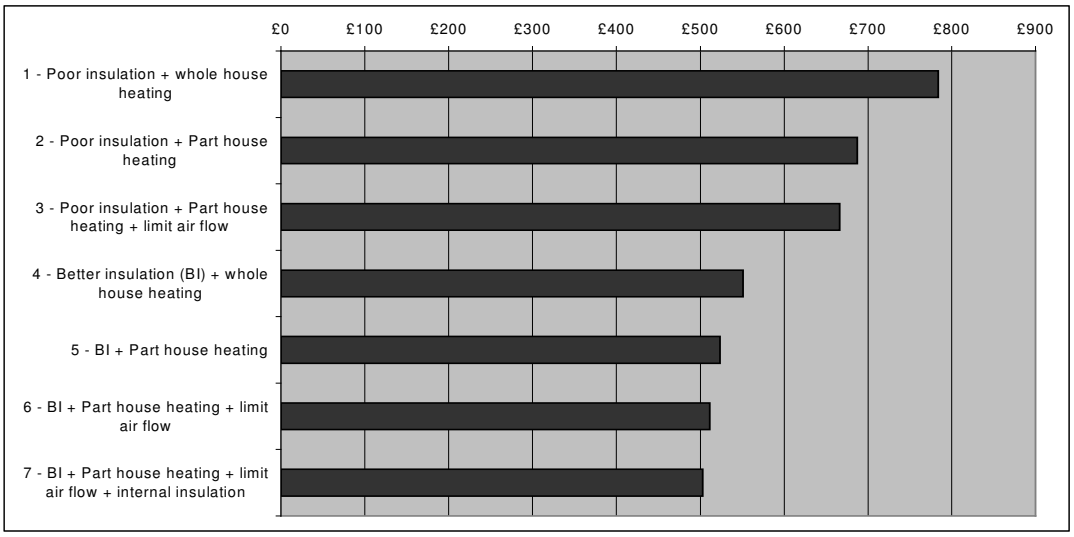
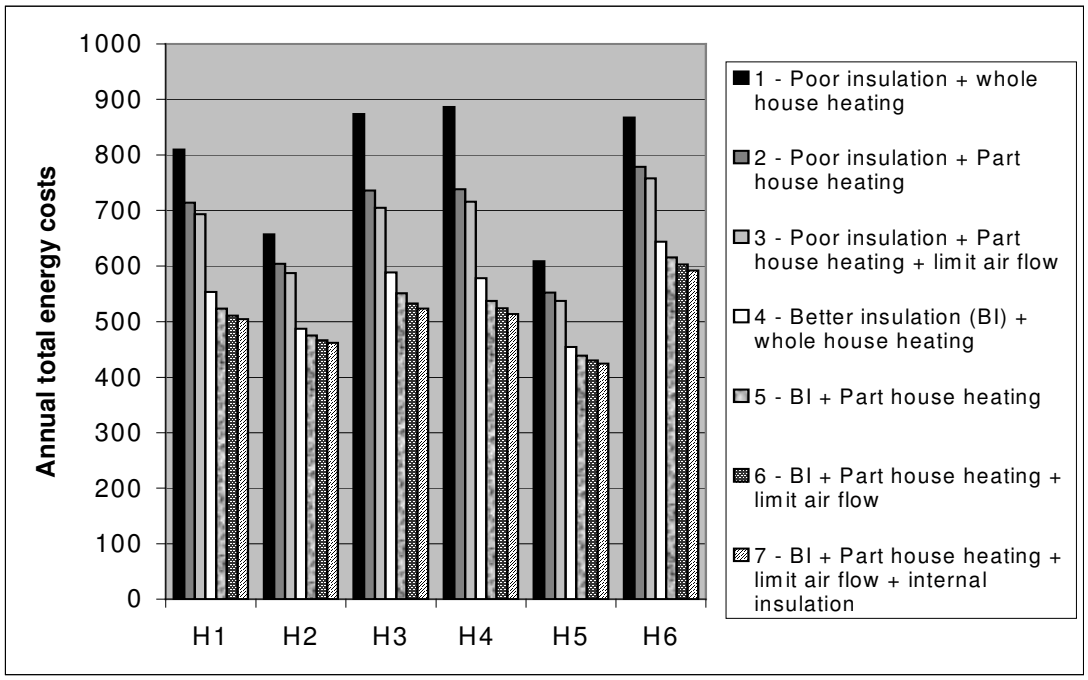


Figure 6: Annual total energy costs for 6 example houses with different levels of heating, insulation and internal airflow assuming a single occupant



12. Temperature

Internal temperature is a key factor affecting the health of the occupants of any dwelling. Here we set out the results of the modelling of temperatures in the six example houses. There is a fuller discussion of the health impacts of these temperatures in the next chapter but as a general guide Collins (1986) has identified a range of temperatures necessary to maintain health, as follows:

- 18-24℃ - no risk to sedentary, healthy people
- below 16℃ - diminished resistance to respiratory infections
- below 12℃ - short term increases in blood pressure which can result in cardiovascular problems

Other research (Wilkinson et al. 2000) shows that at temperatures below 10℃ the risk of hypothermia becomes appreciable, especially for the elderly.

Assuming the heating system is switched off for eight hours through the night, the temperature of a dwelling will decay through the night towards the outside temperature. The better the insulation the longer it takes to reach the external temperature. A fully occupied house benefits from the heat gains from occupants and hence temperatures do not sink as low as they would in an under-occupied house.

Table 8 shows the lowest temperatures you might expect in our six example houses when under-occupied and the outside temperature is:

- 3℃ (winter average)
- -2℃ (coldest)

These temperatures are for the parts of the house that are heated in the daytime.

As would be expected the night-time temperatures for the six houses are elevated with better insulation by approximately 3℃ with average winter temperatures outside and by nearly 4℃ on very cold nights. The temperatures shown here are only marginally lower than in fully occupied houses. Additional measures in better insulated houses such as limiting internal airflows or internal insulation have almost no benefit in terms of temperature (see section 34 Appendix 2). In all instances the temperatures fall well below 16℃ and would present a health risk and the very low temperatures when poorly insulated are low enough to induce hypothermia.

Table 8: Night-time temperatures in the six example houses - part house heating (°C)

Night-time temperatures poor insulation part house heating under-occupied

	H1	H2	H3	H4	H5	H6	Averages
Average winter night	9.73	11.46	10.47	9.98	12.48	12.4	**11.09**
Coldest night	6.62	8.82	7.58	6.96	10.13	10.02	**8.36**

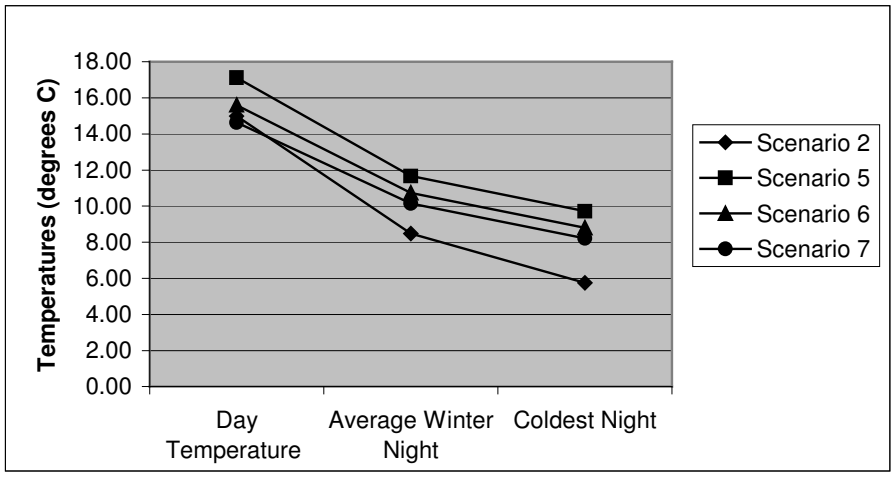
Night-time temperatures better insulation part house heating under-occupied

	H1	H2	H3	H4	H5	H6	
Average winter night	13.32	14.2	13.9	13.77	15	14.69	**14.15**
Coldest night	11.16	12.26	11.9	11.75	13.29	12.9	**12.21**

The temperatures in unheated spare rooms have also been calculated and the results are shown in Figure 7. This shows the average temperature for the six example house types for four of the scenarios - all of which assume part house heating.

- Scenario 2 assumes poor insulation
- Scenario 5 assumes better insulation
- Scenario 6 assumes better insulation plus limiting internal airflows
- Scenario 7 assumes insulation plus limiting internal airflows and internal insulation

Figure 7: Temperatures in unheated spare rooms with part house heating



It can be seen in scenario 5 (better insulation - squares) that daytime temperatures are acceptable and should present no health risks for the householder if they had to enter these rooms. Night-time temperatures are low in all scenarios but as would be expected Scenario 2 (poor insulation - diamonds) produces extremely low temperatures (below 6°C on coldest nights). In all scenarios the coldest night temperatures could induce cold stress (see page 30) if the householder had to enter

these rooms. These are temperatures that could be experienced if the householder had to go to the toilet in the middle of the night.

In all the earlier calculations there is the assumption that living rooms are maintained at 22℃ and in all seven scenarios energy expenditure is probably higher than could be afforded by single low-income householders. Calculations were made to ascertain the average internal temperatures in the six houses if energy expenditure was limited to 10% of the income of a single older person on a state pension (assuming they own their home outright).

Table 9: Average daytime internal temperatures - fuel expenditure limited to 10% of single pensioner income

	H1	**H2**	**H3**	**H4**	**H5**	**H6**	**Average**
Poor insulation	13.75	15.36	13.48	13.36	16.24	13.29	**14.25**
Better insulation	17.08	18.21	16.49	16.70	19.16	15.57	**17.20**

This demonstrates that improving insulation is not enough to lift single low-income under-occupiers in many larger properties out of fuel poverty. The temperatures set out in this table for five of the example houses if poorly insulated would be a health risk. Temperatures are still dangerously chilly in several of the house types even with better insulation.

13. Humidity

As examined earlier, part house heating in poorly insulated under-occupied homes is an obvious strategy to minimise energy costs. There are however risks in doing this if the air from the heated part of the dwelling circulates to unheated parts, which is very likely to be the case with a heated living room on the ground floor of a two-storey house. In this situation, air that might avoid condensation in the warmer living room, can produce condensation when it comes into contact with significantly cooler surfaces in unheated rooms.

The limited analysis undertaken for this study (see Appendix 2 section 35) shows that in larger under-occupied houses there is likely to be lower concentrations of moisture in the air (due to the greater overall volume relative to the moisture production). The large house with a lower concentration of moisture can afford to have lower temperatures without risk of condensation. On the other hand a smaller house will have to keep its temperatures much higher because the moisture concentration of the air is higher and the risk of condensation is greater.

The modelling in the previous section does indicate that temperatures in unused rooms in cold weather at night would be low enough to result in condensation even allowing for the impact of the greater volume of many under-occupied homes.

It is possible to draw a number of general conclusions from the analysis of humidity in dwellings.

- Lower indoor temperatures tend to increase relative humidity and the risk of condensation.
- Partial heating results in lower temperatures in certain rooms, and tends to increase the relative humidity and condensation in those rooms, particularly when air from heated rooms circulates to unheated rooms.
- Larger houses are likely to have lower relative humidity for a given standard of heating and level of moisture generation by virtue of the larger volume of air they contain.
- Moisture generated in kitchens and bathrooms through cooking and washing is best dealt with by extraction at source using cooker hoods and extractor fans.
- Un-flued heaters using LPG or kerosene generate significant moisture and should always be used in a ventilated room. (Ventilation is needed not only to deal with moisture but also with other combustion products, including carbon dioxide.)

14. Conclusions

The results of the analysis of the seven scenarios against the six example house types show that:

- Providing better insulation results in a range of savings (across all six house types) of between £154 and £309 per annum over the baseline energy costs. The savings in the three bedroom house are calculated as £169. This involves expensive improvements such as wall insulation and double glazing. This would effectively remove the health risks of living in cold conditions.

- Part house heating alone (a commonly adopted strategy) results in average savings in the range of £53 and £148 per annum over the baseline energy costs and this costs nothing to implement. The savings in the three bedroom house are calculated as £53. This strategy does have a cost in low temperatures in unheated rooms and particularly unheated rooms at night. This could be a health risk and could lead to increased risk of condensation.

- Limiting internal airflow in addition to part house heating results in a small additional average saving of £21 per annum that would be low cost to implement and would result in an improvement in comfort.

- A combination of part house heating and better insulation results in savings in the range of £169 to £349 per annum. The savings in the three bedroom are calculated as £182. Night-time temperatures are still potentially detrimental to health.

- Additional measures to reduce internal airflow and internal insulation in better insulated houses produce very modest additional average savings of £20.47 per annum and would involve expensive and disruptive measures (i.e. insulating internal walls estimated average cost of £442).

- Scenario 7 represents the implementation of the obvious measures to reduce energy costs in an under-occupied larger home[3]. It would not however take most single low-income under-occupiers out of fuel poverty. The average energy costs for this scenario represent about 13.3% of the disposable income of a single older person on a state pension (assuming they own their home outright).

- Low temperatures in unused rooms in part heated under-occupied homes are likely to result in elevated relative humidity and hence risk of condensation and mould. However this effect is partly counteracted in larger under-occupied homes because the larger volume of air should result in lower moisture concentrations.

[3] A key measure that has not been included in these calculations is the installation of a more efficient boiler.

5 - Health Impacts

The possible health impacts of fuel poverty are now fairly well documented. In her introduction to *Cutting the cost of cold* (Rudge and Nicol 2000), Brenda Boardman reviews the evidence on health impacts and increased winter mortality presented in the book. This includes the following findings:

- the presence of central heating is one of the simple indicators associated with a decreased risk of winter death;
- there is a greater increase in winter mortality from respiratory disease than from circulatory (coronary), and that respiratory health is more related to indoor temperatures and cardiovascular to outdoor cold;
- with reference to coronary disease, the shock of cold mornings might cause too much cardiovascular strain, particularly if leaving a cold dwelling. The effect is less if leaving a warm dwelling;
- with reference to asthma caused by dust mites the main comment is that dust mites are more commonly associated with warm, damp homes, whereas mould is associated with cold and damp;
- in a study in Tower Hamlets depression or worry associated with wallpaper peeling off in damp conditions was reported in fuel poor homes.

In addition to these health impacts there is another that may have some relevance to under-occupied homes, and is referred to in the UK Fuel Poverty Strategy (DTI/DEFRA 2001):

> *"Research indicates that domestic accidents, including fatalities, are common in cold homes in winter."*

The question for this study is - does under-occupation exacerbate any of the general health impacts of fuel poverty? The study team contacted a number of people with expert knowledge to explore the possible impacts.

15. Cold Stress

Professor Bill Keatinge commented on the potential hazard of cold stress resulting from moving from a heated to an unheated zone in a home:

> *"We have several lines of evidence indicating that cold exposure, however produced, is a hazard to people over the age of about 50. There is not a threshold at which cold exposure becomes hazardous - mortality is minimal at about the point at which people are in thermal comfort, and it goes up progressively as they come under increasing cold stress (or heat stress).*

> *Indoor cold exposure and outdoor cold exposure are both associated with increased mortality."*
>
> *"We interpret this as meaning that living areas of a home where people rest should be about 21^{o}C, areas where they are physically active are best a little cooler. Very ill or otherwise immobilised people may need rather higher temperatures. The guide is simply whether they feel in thermal comfort, and ideally they can regulate room temperature to provide this."*

There is evidence of increased cardiovascular strain for old people who have to move repeatedly between cold and warm rooms (Collins 1986) and so we asked: Is short exposure to cold temperatures as much of a problem as longer exposure? i.e. the difference between visiting the WC (5 minutes exposure) compared with sleeping in an unheated bedroom (several hours).

> *"Short exposure is definitely less of a hazard than longer exposure to cold. 5 minutes is generally a minor exposure but the fact of being partially undressed will increase the problem."*

We also asked: Is the body more capable of coping with the cold if it starts warm?

> *"Starting warm is normally a help, particularly if the following cold exposure is a brief one, but much depends on the previous state of hydration and acclimatisation".*

The evidence of the modelling of the temperatures in the six example houses does show temperatures falling below healthy temperatures in under-occupied and partially heated larger dwellings even with better insulation.

16. Impacts on mental health

Impacts on mental health were reported by a number of our interviewees. David Eggett commented that older people living on their own were more likely to be isolated, psychologically and socially, and this would be likely to be worse in a larger property where problems about the state of repair of the house, and the burden of caring for a large house would add to their worries. A HEES installer described meeting single elderly householders who were afraid to open their living room doors to the rest of their home, partly through fear of losing heat but also through fear of what they would find on the other side of the door.

Several interviewees expressed concern about the mental health and emotional impacts of older people leaving their family home to move to smaller accommodation. Depression can result from the move and they need support. Noel Olsen, an independent public health physician pointed to a number of factors that need to be addressed to maintain mental health and well being in older people including:

- having wider community networks;

- a familiar and secure home;
- 'defensible space' including personal possessions.

Anne Gleeson, former head of Bristol Care and Repair pointed to the issue of where can people go for advice and support when they move, to help them deal with the disruption and the emotions caused by moving.

17. Health impacts of damp and mould

As discussed earlier there are risks of damp and consequent mould in poorly heated under-occupied homes. Damp conditions also result in the proliferation of the house dust mite but this is less prevalent in cooler homes.

Unused and unheated rooms and spaces will be prone to condensation problems particularly where the householder does not take care to restrict the diffusion of moist air (from cooking and washing) to cold areas of the home. However the biggest source of moisture are the householders: *"…occupants who spend all day inside the dwelling, such as retired couples, will result in increased occupant moisture production when compared to working couples."* (Oreszczyn and Pretlove 2000).

Respiratory conditions including asthma are associated with damp homes. Studies of the causes of asthma in damp homes point to the main allergen being the house dust mite rather than mould spores (Howieson and Lawson 2000). However coughing and wheezing are associated with fungal mould when present at higher levels in damp homes.

Damp homes with mould are also associated with depression. Damp and mould result in deterioration of house decorations e.g. peeling wallpaper, discolouration of painted walls, and this can have an adverse impact on mental health (Khanom 2000).

The evidence of the modelling of six example houses shows that low temperatures in unused rooms in part heated under-occupied homes are likely to result in elevated relative humidity and hence at risk of condensation and mould. However this effect is partly counteracted in larger under-occupied homes because the larger volume of air should result in lower moisture concentrations. The evidence is inconclusive and more research is required into this factor.

18. Conclusions on health impacts

This brief review of possible health impacts of fuel poverty does indicate that under-occupancy, when it results in part house heating, could lead to health risks such as hypothermia and cold stress. Although there is a lack of data, we can assume from anecdotal evidence, and from studies into the general aspects of poverty, that these negative health impacts are likely to increase with age.

Our modelling of temperatures in larger under-occupied homes indicates that in poorly insulated dwellings the lowest temperatures will be extreme enough for occupants to experience cold stress when moving about their homes in winter months. In some instances, conditions will also be created that are likely to result in condensation and mould problems but the findings here are less clear.

Householder behaviour could reduce the health risks for instance by:

- wearing warm clothing when moving into unheated parts of their home, treating it like going outside;

- taking simple measures, such as extracting moist air at source, and closing bathroom and kitchen doors to reduce the passage of moist air to unheated parts of a dwelling.

Mental health impacts could be a problem where individuals are isolated in poor housing but it should be borne in mind that moving house might also result in isolation and depression. This aspect of potential health impacts in under-occupied homes requires further investigation.

6 - Staying put?

19. Factors that stop people from moving

Research in the social housing sector (Barelli 1992) indicates that the majority of under-occupiers do not want to move. This finding in the social housing sector was backed up by anecdotal reports in interviews for this study with reference to private sector householders.

Several respondents put forward factors that stop people from moving. These include:

- Emotional attachment to the family home
- Not wishing to lose contact with networks of friends and relatives in the immediate locality
- Wanting to have space for relatives and friends to stay
- Wanting to remain near to the grave of a spouse/relative
- Not wanting to have to dispose of furniture and effects because of less space
- Fear of the upheaval of moving and damage to possessions
- Worries about the cost of moving

There are also reasons that are more specifically about moving to communal sheltered housing:

- Desire to retain independence e.g. being able to make a cup of tea for visiting friends /relatives
- Fear of losing their pets
- Loss of a garden

Again anecdotally, fear of leaving a property may increase with age. If the step is not taken close to retirement, it becomes an even greater ordeal for the householder.

There are also wider concerns about the impacts on communities of losing mature people. For all these reasons the likelihood of under-occupiers moving solely because they are in fuel poverty is small.

It can be seen by this list of factors that decisions are complex and the factors will be different for every individual. In the rest of this chapter we examine the available options for keeping warm while staying put.

20. Comments on options for staying warm and staying put

In the interviews, respondents were asked to comment on the usefulness, cost-effectiveness and practicality of a number of options that might enable under-occupiers to stay warm while staying put. The literature review also identified a number of studies and projects that included information on which measures would improve access to affordable warmth in under-occupied homes.

Installing good levels of insulation and draught proofing to the whole home

These measures had the universal support of all interviewees, and Peter Archer, Chair of Care and Repair England, described it as the ideal solution. There was however recognition that financial constraints frequently made this unachievable. David Fotheringham of the CIH very much favoured the development of Equity Release schemes (discussed later) and emphasised that energy efficiency improvements would add to the value of the property and make it a more saleable asset. David Eggett, formerly of Anchor Staying Put, pointed out that once you had contractors on site, financially you might as well do the whole job.

It should be noted that the modelling of six example houses demonstrated that even a combination of part house heating, better insulation and other measures to reduce internal air flows might still fail to take a single older householder on a state pension out of fuel poverty. So though this is the best option, it may in many cases be insufficient and extra measures will be required.

Improving the controls on the heating system

The main objective of this measure would be to enable under-occupiers to provide background heat in little used rooms and full heating in main living spaces. Madeleine Makarab of Cold Line, Age Concern Hackney said that this was a common approach taken by the mobile repair service operating in the borough. Anne Gleeson, former head of Bristol Care and Repair pointed out that there is a problem with people remembering how to work heating controls. Sue Adams, Director of Care and Repair England, said that a further difficulty was the design and siting of heating controls often causing problems for those suffering from visual impairment, arthritis or other conditions that limit mobility and dexterity. The Hackney Staying Put project is working with post graduate students from Guildhall University on a range of aspects of heating controls including central heating controls, timers, instructions and problems for Asian language speakers. John Buckham of Newcastle City Council pointed to their House for Life project which showed that remote handsets were becoming relatively cheap and easy to manufacture.

Insulating and draught proofing only the parts of the home that are being used

Few respondents thought that this was a good long-term option as it is likely to result in deterioration of the unused parts of a property and is unlikely to suit future occupants. Some interviewees thought that this approach could be considered if there was no other option (because of financial constraints) or there was a very acute need. Generally this option was seen to have doubtful benefits and was likely to be a poor use of resources.

This viewpoint is confirmed by the findings of a project undertaken by the Housing Development Directorate of the then Department of the Environment in the mid-1970s (DOE 1978). The project was set up to explore the technical implications of doing energy efficiency and heating improvements to the homes of the elderly. Thirty owner occupied dwellings in Coventry, South Tyneside and the London Borough of Wandsworth were 'improved' by simple non-structural measures such as draught-stripping, insulation and new heating systems. Most of the dwellings could be said to be under-occupied in that there were rooms and in some cases, whole floors that were not being used. Most of the occupants were in their 70s and 80s, frequently living alone and about half had mild disabilities. A common approach was to seal off unused rooms by draught-stripping doors. Where the occupant was living only on the ground floor, insulation was laid directly on the floor of unused rooms on the first floor. In most cases the occupants reported feeling warmer and more comfortable after the work but direct monitoring still showed that homes were cold by today's standards. For example, temperatures recorded in the winter 1976/77 in one case study house were still falling below 16°C in 8 out 13 weeks in the living room and below 9°C in 6 out of 13 weeks in the bedroom.

Moving basic facilities to one floor

This strategy is usually undertaken because of mobility problems but if remaining floors are shut off this can also aid being warmer on the one floor in use. Anne Gleeson said that this was not an uncommon response by Home Improvement Agencies when people can't move on and is partly driven by the drying up of local authority grants. Howard Price of the CIEH was not in favour of this option on grounds of fuel poverty alone, it would only be justified if there were mobility problems as well. Madeleine Makarab of Cold Line, Age Concern Hackey said that in their experience there were often practical obstacles to this approach, it was expensive and often ground floors had damp problems. She also pointed out that if the householders are restricted to one floor they are left worrying about what is happening upstairs.

Dividing properties into smaller units

Anne Gleeson referred to a now defunct programme (withdrawn 10 years ago) run by Housing Associations, where they would buy a portion of the property, convert it and then be responsible for the maintenance. It required a lot of support to talk through the process with the householder. It was restricted to properties suitable for

splitting into two smaller dwellings. Peter Archer said that this was very rare in the UK but he did know of a scheme in Amsterdam.

A couple of interviewees also mentioned the possibility of linking this strategy to providing accommodation for student teachers and student nurses. David Eggett, reported that there is a scheme called Homeshare that tries to match older people who need a little help with younger people prepared to do this for a low rent.

A specific suggestion arising from the consultation on the UK Fuel Poverty Strategy was for the Government to provide tax incentives to householders/ or social housing providers to convert over-large properties into multiple (energy efficient) units.

21. Funding for making homes fit to stay put

In this section we describe the sources of funding available to householders to raise capital for improvements to their home that would enable them to stay put. We focus primarily on the suitability and availability of each option for funding energy efficiency improvements to under-occupied and larger homes of low-income householders. They fall into three broad categories:

- Energy specific grants such as Warm Front and funding through the Energy Efficiency Commitment from energy suppliers
- Grants/loans from the local authority and the Benefits Agency
- Capital raised by the householder against the value of their home

Energy specific grants

Warm Front (previously the Home Energy Efficiency Scheme or HEES) is the main Government funded scheme to tackle fuel poverty. The basic Warm Front grant provides up to £1500 for insulation and heating improvements and cavity wall insulation and draught proofing. The grant is targeted on households with children under 16 years of age in receipt of income-related benefits and households in receipt of disability-related benefits. In addition women in receipt of a maternity certificate and an income-related benefit are eligible for Warm Front. Warm Front Plus provides up to £2500 to improve insulation or to purchase gas or electric heating systems for the main living areas. Warm Front Plus is targeted on the over 60s in receipt of income-related benefits. The maximum grant level is the same whatever the size or condition of the property.

Warm Front grants do not normally cover draught proofing of internal doors, which can be a useful measure in an under-occupied home. If the householder requests they can have the living room door draught-proofed. In larger homes the Warm Front Plus grant may only cover the cost of central heating without adequate insulation.

Many of our interviewees were asked questions about the adequacy of the Warm Front grants to tackle fuel poverty in larger homes. It should be noted that they were interviewed before the Warm Front and the Warm Front Plus grants were increased

by £500. David Eggett, formerly of the Anchor Trust Staying Put programme saw the grants as being insufficient and didn't see Warm Front as *"sufficiently robust and flexible"*. David Fotheringham, Head of Policy at the Chartered Institute of Housing wanted greater flexibility. John Buckham from the Newcastle Energy Centre stated that Warm Front *"doesn't see the difference",* referring to the single grant level whatever the size of the property. Madeleine Makarab of Cold Line, Age Concern Hackney indicated that larger properties needed grants in the range of £3-4000. The general message was that Warm Front was not up to tackling fuel poverty in larger homes.

Sue Adams, Director of Care and Repair England, pointed out the particular problems in rural areas. Properties may be isolated, detached, and often not of standard construction making them more difficult and expensive to improve. Oil-fired central heating is not covered by the Warm Front grant but often there is no gas supply.

Energy Efficiency Commitment (EEC) funding from energy suppliers is the other very significant source of funding for domestic energy efficiency. A key feature of EEC is that at least 50% of the energy savings must be targeted at customers receiving certain income-related benefits or tax credits. There are a large number of energy supplier schemes addressing fuel poverty supported at least in part by EEC funding. Two examples that are particularly relevant to fuel poor households in under-occupied homes are:

- TXU's 'StayWarm' programme which is specifically designed to help state pensioners keep their homes heated, especially in winter. StayWarm consists of a fixed payment for gas and electricity for a year, based on the number of bedrooms and people in a property. Customers can pay weekly, fortnightly, or monthly by cash or direct debit - whatever suits them best. The fee remains fixed even in the colder winter months, encouraging householders to leave their heating on during colder weather. Costs are lower because there are no meter readings.

- NPower's 'Health Through Warmth' programme is a link up with NHS workers to target assistance at people suffering ill health due to their living conditions. Nurses and care workers are trained to help spot people at risk from fuel poverty and refer them on to sources of grant aid. This programme has just been rolled-out nationally and is worth £10 million and aims to help 300,000 households. (Ofgem 2002)

A concern expressed by workshop participants was that EEC funding is too focussed on social housing and insufficient funds are available for improvement to the private housing stock.

Energy suppliers are also the main source of funding for the Warm Zones pilot programme discussed below.

Co-ordination of energy efficiency programmes for the fuel poor

Several of our interviewees commented on the poor co-ordination and links between the Warm Front (formerly HEES) and EEC. In their response to the UK Fuel Poverty Strategy the CIH stated:

> *"The strategy talks about joining up schemes to 'interact and complement' each other but in practice this is not working. An example of this is that the New HEES and SoP Schemes (Energy Efficiency Commitment) should be able to work together but the HEES managing agents are not prepared to work with other bodies for the benefit of the householder."* (CIH 2001)

Tackling fuel poverty in under-occupied homes is one of the areas where there is a real need for EEC funding to supplement the inadequacies of Warm Front in improving energy efficiency in larger homes.

An integrated approach is being tried in the Warm Zones. The Warm Zones pilot programme is a new Government initiative, exploring whether all the various English fuel poverty schemes can be co-ordinated, enhanced, and made more efficient in terms of delivery. To date, Warm Zones have been established in five pathfinder areas with a varied mix of authority type and demographic make-up. Initial estimates of the level of fuel poverty in the Zones ranges between 17% and 45%. Underlying the programme is a simple analysis of a complex problem - identify all the fuel poor in an area and give them all available measures in a concentrated, cost-effective way. At present five pathfinder Warm Zones have been established, in Hull, Newham, Northumberland, Sandwell and Stockton.

More recently, Eaga Partnership and British Gas have launched a new programme called 'HELP' which combines Warm Front and EEC funding. The HELP package includes a benefits health check and disability advice (Eaga 2002).

Local authority grants

Local authorities in England have had powers to provide discretionary grants to private householders to repair and improve their homes, primarily through:

- Home Repair Assistance grants for minor works
- Renovation Grants for more major works

This framework for grants, as of May 2002, is gradually being replaced by a general power to *"give assistance in any form and to any person to improve living conditions in their area"* (DTLR 2002). Mandatory Disabled Facilities Grants will remain unchanged. Local authorities will now have to produce Private Sector Renewal Policies setting out their proposals for assisting people in poor housing.

The Government also intends that local authorities should have greater discretion on funding relocation costs and it promises: *"more flexibility to help homeowners move out of obsolete housing"* (DTI/DEFRA 2001).

Overall the Government has given greater flexibility to allocate capital spending on housing by creating the 'single capital pot' for housing. In December 2000, the Government launched *Quality and Choice: a decent house for all - the way forward for housing.* This included the target to ensure that all social housing is of a decent standard by 2010, with a third of improvements taking place by 2004. This is a worthy ambition but it has had a knock on effect on local authority funding for improvements to poor private housing.

A number of our interviewees pointed to local authority funding to private sector housing being cut in favour of improving the council owned stock to meet the Decent Homes target. Howard Price of the Chartered Institute of Environmental Health was very concerned that local authorities would not use their new freedoms in *"a constructive way".*

In its response to the Government consultation on private sector housing renewal Care and Repair England stated:

> *"Without a legal obligation to address private sector disrepair and Government targets for improvement in the housing stock conditions in the private sector (in line with the targets set for improvements in the condition of public sector stock), there is little incentive for authorities to allocate any resources to private sector renewal."* (Care and Repair 2001)

The availability of local authority grants is very variable:

> *"Unfortunately, in some areas it may not be easy to get this type of grant, perhaps due to council cutbacks".* (Russell 2000)

At the sharp end, Madeleine Makarab of Cold Line, Age Concern Hackney was experiencing an effective moratorium on HRA grants with money being restricted to helping people leave hospital and the one remaining ring fenced grant - the Disability Facilities Grant.

Capital raised by the householder

Homeowners could seek unsecured loans from banks and building societies and other financial institutions to provide funds for energy efficiency improvements. However lenders are generally unwilling to provide loans to people on low incomes and many older people are uncomfortable with the idea of borrowing. The Benefits Agency may provide 'Income Support for Mortgage Interest' (ISMI) for people on Income Support or Income-Based Jobseeker's Allowance to cover the interest on loans or an extension to a mortgage. ISMI can cover interest on loans for repairing an existing heating system (but not replacement), home insulation and a range of measures to tackle disrepair.

The alternative for homeowners is to raise loans against the value of their home. In the case of older householders they may well be in the position of having paid off the mortgage and therefore possessing a valuable asset but at the same time being on a very modest income. The concept of releasing the value of a home to help pay for

other needs has become known as 'equity release'. Age Concern publish an advice book entitled *Using Your Home as Capital - A guide to raising cash from the value of your home* (Hinton and McGrath 2001) which details the various methods of equity release. These include:

- **Home Reversion Schemes** - where the householder sells all or part of their home to a company and continues to live in it as a tenant rather than a full owner. On death the plan provider receives the full value of the part of the property sold. Some schemes offer a lump sum and some offer a regular income.

- **Home Income Plans** - which are based on a mortgage taken out on the householders' property. Money raised is used to buy an annuity that provides a lifetime income and pays the interest on the loan. On the death of the householder (or the death of the second partner in the case of a couple) the home is sold and the proceeds used to pay off the capital borrowed with any balance going to the householder's estate. In March 1999, the Chancellor removed MIRAS tax relief for all new schemes and this has resulted in a general decline in Home Income Plans - they are now only suitable for single people in their late 70s and couples in their late 80s.

- **Roll-up loans** - where the householder mortgages their property for part of its capital value but, unlike normal mortgages, no repayments of capital or interest are required; instead interest is added to the initial loan amount - or-rolled up. The loan and accumulated interest is only repaid when the property is ultimately sold.

- **Interest-only loans** - where a capital sum is advanced to the householder by a building society or bank and only interest has to be paid. The loan is repaid on the death of the householder or earlier sale of the property. Smaller loans are possible with this option but income becomes a factor with larger amounts. Most lenders are only willing to advance three times a single pensioner's income or two and half times a couple's joint income.

Both Home Reversion Schemes and roll-up loans could provide substantial amounts of capital to address problems of energy inefficient homes and associated poor state of repair and are not restricted by the income of the householder. But they also have disadvantages including:

- With Home Reversion Schemes the householder does not gain from any increase in the value of their home.

- With roll-up loans, the loan debt accumulates rapidly as it builds up on a compound interest basis. This means that the younger the householder when taking out the loan, the greater the potential debt.

- With all the options, receiving a cash sum is likely to affect eligibility for State Benefits. This is a major bar to accessing this funding for the many low-income householders who are reliant on benefits.

- Both Home Reversion Schemes and roll-up loans are unlikely to be suitable for raising smaller sums of money. Home Reversion Schemes are often offered on a minimum sale proportion of around 30-50% of the total value of the property. In practice few roll-up loans are arranged below £10,000. So interest-only loans are likely to be the main option for smaller sums i.e. in the range £1000 - £9000.

Most major providers of home income plans and equity release schemes have agreed to operate in accordance with a strict code of practice and belong to the Safe Home Income Plans (SHIP). John King, the chair of SHIP was interviewed for this study and offered further comment on the schemes currently available.

- Age restrictions on the products available are creeping downwards. There are now schemes where eligibility starts at 55 years but basically - the older you are - the more favourably the loan providers will view you.

- The condition of a property need not be a bar to accessing this kind of funding. The market value of a property is the key criteria. So for example a near ruin in the South East of England could still have a substantial market value. However in areas where the housing market is not so buoyant and house prices are low, disrepair could be a real bar to accessing this type of funding.

- Carers can be in a difficult position as they often have no right of occupation when the homeowner dies and the property has to be sold to pay off the loan.

Lord Richard Best of the Joseph Rowntree Foundation has suggested that Care and Repair could act as an intermediary with Equity Release schemes. The individual homeowner would open an account with the local Care and Repair scheme and draw down from that account up to a quarter of the value of their home for maintenance and improvement of their home or care needs. The debt outstanding would be repayable when the property is sold and would roll-up interest, taking into account the capital growth of the property. The advantage of the proposal is that it would give householders access to smaller sums than standard Equity Release schemes (Best 2001).

Care and Repair have proposed that the Government should strongly encourage local authorities (through national guidance) to "…take on the role of lender for small loans (under £5,000) (Care and Repair 2001).

Home Improvement Agencies

Local authorities provide funding to Home Improvement Agencies (HIAs) with the Government matching this funding with £8.5 million per annum. HIAs are independent organisations providing personal advice and help to older people, people with disabilities and those on low incomes who need to carry out repairs, improvements and adaptations in order to remain independent in their own homes. HIAs should not be seen as a source of funding but rather as a conduit to other funding sources described here through their advice role and their co-ordinating function organising repairs for householders. There are not HIAs in all areas; for example Newcastle does not have an HIA.

22. Pensioners Energy Plan

There has been at least one attempt to bring together both grant funding and funding raised by the householder to address fuel poverty in pensioner homes (many of which could be considered as under-occupied).

In 1996, the EST gained funding from the DoE (now DEFRA) to conduct a pilot 'Pensioners Energy Plan' scheme. The scheme was designed to assist pensioners who own their own homes to contribute towards the cost of energy efficiency improvement works by taking out an 'equity release' loan which was combined with local authority grants.

Caseworkers helped the householders at every stage in the process, providing the kind of advice now given by Home Improvement Agencies.

The pilot scheme was run in five areas and 70 cases were completed, 55 of which were monitored in depth. Improvements included installing central heating, increasing loft insulation and adding draught proofing. The average SAP ratings of the properties were improved by 29 points (from 28-50). The average score on the Affordable Warmth Index rose from 43 to 66 (Chapman and Scannell 2000). This represents a shift from severe fuel poverty to moderate fuel poverty (on page 30).

Additional reported benefits (Best 2002) flowing from this scheme were:

- improved health;
- improved affordable warmth;
- other improvement works often took place at the same time;
- lengthens amount of time pensioner can live in their own home;
- peace of mind for relatives;
- increased property value.

Despite these benefits the pilot scheme did not result in a wider rollout, as the costs of administering the scheme were too high for the savings achieved. It appeared that older people needed considerable amount of 'hand holding' as they went through the process. It was also found to be essential to discuss the implications of equity release finance with close relatives (usually the children). Both of these factors contributed to the high costs of the scheme. There is no publicly available report of the project but SAP and AWI monitoring data from the project has been published (Chapman and Scannell 2000).

23. Conclusions on staying put options

The comments from our interviewees show clearly that:

- The insulation of only the parts of a dwelling that are being used is not a good use of resources and comments received back up our technical analysis which shows that the savings achieved are very small and the costs relatively large.

- Improving heating controls to enable background heating of unused rooms is worth consideration as this is likely to reduce the risk of damp and mould in unused rooms. This option will only be effective if the use of the heating controls is well understood by the householder and, where appropriate, ensuring that they are designed for easy manipulation by older people or people with disabilities. Whether householders will be prepared to pay for background heating for unused rooms is an unknown factor.

- Improved insulation to the whole property remains the best option. Having organised contractors to come to a property it is most economically efficient to have a complete job done. The main limitation on this option is cost and the adequacy of the current grant regime to meet these costs in larger dwellings. The technical analysis suggests that better insulation may be insufficient to take single under-occupiers in large properties out of fuel poverty, so additional measures would be needed.

- Raising sufficient funds to cover the cost of energy efficiency improvements and up-to-date heating systems and controls currently require specialist advice, as there are multiple sources of possible funding. Some sources such as the various equity release schemes need careful consideration because of the longer-term commitments involved.

- Local authorities and Home Improvement Agencies have a key role in advising under-occupiers about their options for improving their homes and implementing improvements.

7 - Moving on?

24. A major life decision

While most under-occupiers are unlikely to want to move, in some circumstances the need for affordable warmth may combine with other factors to encourage some to consider moving on. The interviews and literature review carried out for this study indicate that these include:

- Feeling overburdened by the cost of keeping a large property in good repair and meeting the overall running costs;
- Desire to move nearer relatives and friends;
- Wanting better access to basic services e.g. shops, social clubs, doctor, place of worship;
- Needing a property without stairs and/or adapted for disability.

As stated earlier, the Government has now given greater freedom and encouragement to local authorities to support householders in moving out of unfit or inappropriate housing. Fears were expressed by some of our interviewees about this change as moving someone out of unfit accommodation was a cheap option compared with bringing it back into good repair. Sue Adams, Director of Care and Repair England, referred to the possibility of householders being faced with 'Hobson's Choice' - either staying in a cold house, unfit house or having a grant to move.

25. Availability of suitable housing

The summary of responses to the Fuel Poverty Strategy consultation provides the following common view about under-occupation:

> *"It was generally acknowledged that the problem was more difficult in the private sector than the social sector, where problems could be readily solved by helping tenants to move to smaller properties in the same landlord's stock - if suitable ones were available. But it was agreed by eight respondents that there was a shortage of suitable homes within many local communities: older people would rarely want to trade down to a bedsit, and recent housing policies had focussed on dwellings for families, which left older people fewer options when looking for homes locally."* (DTI website 2002)

Several interviewees pointed to the need to develop a wider range of housing options for older people. The planning system was seen as one way of addressing

this need. Howard Price of the CIEH suggested the use of planning agreements to promote these needs to developers.

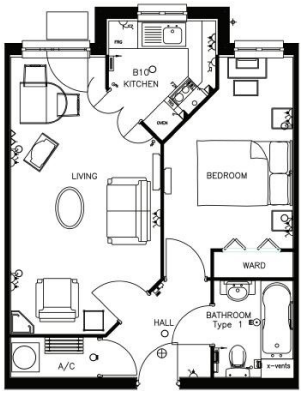
Sue Adams pointed out that options for moving in rural areas are often more limited. The provision of sheltered housing in rural areas has been built on the assumption that one housing scheme for older people will service a number of villages. Yet most people don't want to move from their own village where they have informal support networks to another village which may also have limited services.

Peter Archer reported that there are some developers providing leasehold housing designed for older people such as McCarthy and Stone and an innovative 'retirement village' which has been developed by Joseph Rowntree Foundation. However, these are few compared with the demand.

McCarthy and Stone claim to provide two thirds of the private retirement flats in the country. They offer a standard package around the country that includes:

- A flat with one or two bedrooms on a leasehold basis
- A service charge to cover management, maintenance, services for communal areas and water rates
- Guest suites for visiting relatives and friends
- Residents lounge, laundry
- Part exchange and help with selling and moving are also available

The cost of flats varies by location. For example, in April 2002, the same one bedroom flat shown below would have cost £59,950 in Colwyn Bay, North Wales and £173,950 in Bromley London (McCarthy and Stone 2002).



Sue Adams expressed some concern about the security of tenure in private retirement housing schemes. She pointed to conditions attached to some leases whereby if there is a conflict with fellow residents or if a person's health fails and they are no longer able to look after themselves they have to move out.

These issues have been addressed in an innovative approach to retirement housing. The Joseph Rowntree Housing Trust has developed the first Continuing Care Retirement Community in the United Kingdom at Hartrigg Oaks on the outskirts of York (JRF 2002). The 'village' provides accommodation in 152 bungalows and 41 en-suite bed sitting rooms in the Care Centre. The Oaks Centre in the heart of the village includes a large restaurant and coffee shop and a range of leisure facilities. There are a variety of ways to pay to live in the village varying from outright purchase to paying a standard fee. For example it would be possible for an individual under-occupier to sell their home for £75,000 (this is the currently the minimum required to enter the scheme) and allowing them to pay £2,500 per year till death having paid a lump sum of between £25,000 and £30,000. Part of the concept is that residents pay a predictable amount that covers not only their accommodation but their future care needs and that they can remain in the village even if they require care.

Some other RSLs offer retirement housing for sale. For instance part of the Anchor Trust, Guardian Retirement Housing offers leasehold housing or homes on a part-rent, part-buy scheme that can make purchasing a property more affordable. These are again fully managed properties. Guardian was managing 5,500 properties in 1999/2000.

It can be seen that all these options described above are very dependent on the equity of an individual's home. So although they address many of the concerns of under-occupiers, people unable to raise at least £60-80K from the sale of their home will not be able to access these options. More research is required to identify how many under-occupiers would be in a position to raise these sums from the sale of their homes. The shared ownership options provided by some RSLs do enable individuals with more limited equity to consider buying a smaller home.

26. Moving into social housing

The ease of moving into social housing

Age Concern's response to the Fuel Poverty Strategy consultation included this comment:

> *"We are aware that some older owner occupiers would like to move to the rented social sector. They would be assured of security of tenure whilst some of the burdens of home maintenance would be reduced. However, it is very difficult for owner occupiers to become social housing tenants as they are not seen as a priority."* (Age Concern 2001)

The problems of eligibility and priority are real barriers to a move from an under-occupied owner occupied home to the social housing sector. However, it is possible to argue that some older residents might have priority under housing legislation because of their *need for settled accommodation because of medical or welfare needs* (Russell 2000).

David Fotheringham of the CIH, pointed out that eligibility barriers are easing with the introduction of 'choice based letting schemes' in some parts of the country. In areas where the demand for housing is not so strong, the choice based schemes that do exist are more open and transparent than traditional schemes. This is in the sense that available properties are advertised and eligibility criteria (the rules on who can apply) are often much less restrictive than they used to be. But in London and the south, where demand for housing is very high, there are also choice based schemes which are transparent, but for which eligibility may still be tightly restricted, as the need to make properties available to groups with high priority under homelessness legislation is the priority.

The CIH's response to the Fuel Poverty Strategy consultation puts forward a more radical proposal:

> *"In relation to over-large owner-occupied properties, a scheme where local authorities and or RSLs purchase a property and offer a tenancy on a more suitable property, for example a sheltered property, could be considered. This would increase social housing stock, which would have positive social and potential environmental benefits."* (CIH 2001)

Types of social housing available

For older people, local authorities remain the largest providers of retirement housing for rent and there are a number of RSLs that specialise in providing housing for older people.

Anchor Retirement Housing is one of the biggest providers of retirement housing for rent with a stock of 22,863 flats (including 1,010 Extra Care flats). Self-contained flats, studio flats and bungalows are available to rent at more than 650 locations around the country. Properties usually offer facilities such as a laundry, hairdressing salon, guestroom and communal lounge. A scheme manager is responsible for security, repairs and running the building and can also organise care services if they are needed. In some properties 'extra care' is available for residents who need more help with day-to-day living.

Assistance for people to move

It is possible for people claiming either Income Support or Income-Based Jobseeker's allowance to obtain Community Care Grants for removal expenses. Local Authorities may also provide grant assistance to help people move out of unfit or under-occupied housing.

H.O.M.E.S. (Housing Mobility and Exchange Services) works with councils and registered social landlords throughout the UK, offering a wide range of services that help people move home. They administer HOMESWAP, which is a UK-wide register of council, housing association and housing co-operative tenants who want to swap homes. This includes details of shared ownership housing but they state that priority is usually given to council or housing association tenants, those on the council

waiting list, first-time buyers and those that need to move for social reasons such as overcrowding or to receive support (HOMES 2002).

HOMES also gives access to the Seaside and Country Homes scheme for tenants of London Boroughs, the City of London Corporation, or registered social landlords in London. To be eligible the individual has be at least 60 years of age and capable of independent living. Applicants are considered within a "points system" with priority going to applicants who are currently living in an under-occupied home. The scheme managed by North British Housing Association, has approximately 3,200 flats and bungalows (with about 250 vacancies a year). All the bungalows have two bedrooms. The flats have either one or two bedrooms. The rents vary depending on size, location and services.

While HOMES is a service primarily for social housing tenants, the evidence presented in this report suggests that its client base should be expanded to include low-income owner occupiers and private rented tenants who need to move into social housing.

27. Conclusions on 'Moving On' options

The need for affordable warmth is rarely sufficient reason on its own for an individual to move.

If fuel poor owner-occupiers want to move to private sector housing, their choices are constrained by:

- the equity they can realise from the sale of their home - in some regions with low house prices this is an effective bar to moving into more fitting good quality private housing;
- the very limited supply of energy efficient one and two bedroom dwellings;
- the very limited support and advice available to help owner occupiers make informed choices;
- increasing age and infirmity that can make the disruption and distress of moving more traumatic.

Owner-occupiers who want to move into social housing may also face barriers of eligibility.

Fuel poor under-occupiers in private rented accommodation who want to move are effectively limited to seeking housing from social landlords.

Local authorities with their new duty to prepare strategies for private housing should not view moving people on from unfit housing as the cheap and easy option. They should be ensuring that householders get good advice on their housing options and adequate support, including grant aid, if they choose to move or choose to stay put.

The views reported here also point to a more fundamental need. This is to create more sustainable communities that provide appropriate housing for people throughout their lives without requiring them to move outside their community. Retaining the experience of older citizens is valuable for any community. This is an issue that should be addressed by local authority planners, perhaps through planning agreements with developers to ensure a sufficient supply of smaller homes particularly suited to older people.

Given there are two million fuel poor households under-occupying by two or more bedrooms in England, there are insufficient smaller, affordable homes to make the option of moving available, even if the households wanted to.

Most fuel poor households in unfit and under-occupied homes will need assistance to remain in their home rather then to move.

8 - Strategies for fuel poor householders remaining in under-occupied homes

The strategies set out here are for use by people advising fuel poor under-occupiers.

28. Short-term strategies

These strategies are suggested as short-term measures only, to try to keep living spaces as warm as possible while possibly making modest savings on energy costs. A key concern is to avoid deterioration of unused rooms.

- Householders should keep doors to little used rooms closed and where possible draught-proof these internal doors;
- Householders should try to prevent moist air from travelling into unheated parts of the home by:
  - using a cooker hood vented to the outside and a bathroom extractor fan;
  - avoiding the use of un-flued heating appliances;
  - drying clothes outdoors whenever possible;
  - venting tumble driers to the outside or use condenser models;
  - keeping kitchen and bathroom doors closed when in use, and not opening doors into unheated rooms.
- If there are adequate heating controls, the heating system should be set up to provide only background heat to unused rooms;
- If there are no or inadequate heating controls, heating only the parts of the home that are in regular use should be considered. Householders should be made fully aware of the health risks of moving into and spending time in unheated parts of the home and advised:
  - to try to avoid visiting unheated rooms in cold weather;
  - during cold weather, to treat moving into unheated parts of their home like going outside by dressing warmly;
  - to ensure that they sleep in a warm room.

29. Longer-term strategies

The long-term aim should be to improve insulation, efficiency and control of the heating system. Improving insulation would assist in attaining healthy temperatures in unheated rooms.

- Seeking advice from the local energy efficiency advice centre about grants and financial assistance for energy efficiency improvements;

- Contacting the local authority housing department or Home Improvement Agency to seek advice on other financial support for improving your home.

- Older home-owners should investigate the options for releasing some of the equity tied up in the value of your home to finance improvements. Age Concern publishes helpful advice on these topics.

9 - Issues for the Fuel Poverty Strategy

30. Actions suggested to date

The main suggestions for action to address fuel poverty in under-occupied homes in the *UK Fuel Poverty Strategy* (DTI/DEFRA 2001) is with reference to social housing. It does refer to recommendations from charitable organisations for improving older people's housing:

- *"Locating new housing for older people (both private and public) to take account of their need to be near family and public amenities;"*
- *"Providing a wider range of housing options to single householders, e.g. one and two bedroom houses, flats and bungalows rather than unpopular bed-sitters."*

The comment and evidence from this study would support both of these recommendations. However the strategy only puts forward one other tentative proposal for dealing with fuel poverty in under-occupied private sector homes:

> *"Many local authorities already have strategies for addressing under-occupied and unused stock in the private rented and owner-occupied sectors, and they may be able to adopt some of the guidance provided for social landlords, but their relationship with people in these sectors is clearly different, and they need to approach this sensitively."*

31. Questions and answers

Poverty and poor housing are the fundamental problems. The findings of this study show that under-occupation is one factor that exacerbates these problems and makes it more expensive to implement solutions. In most circumstances, the primary solution should be to improve housing conditions to enable people to stay put. A secondary solution is to support those who want to move to more fitting accommodation. Any solutions need to be holistic, dealing not only with fuel poverty but the broader housing needs and the general well being of householders.

We suggest that the following questions need to be addressed by the Fuel Poverty Advisory Group and the Inter-Ministerial Group on Fuel Poverty. We have also suggested some possible responses based on the findings of this study.

How should the Warm Front grant be revised so that it is adequate for improving larger dwellings?

- Warm Front grants should be awarded on a sliding scale that is related to the size and state of repair of the property;

- Warm Front grants should cover the cost of draught proofing internal doors.

How can funding sources be better integrated so that unfitness, disrepair and fuel poverty can be tackled together with one hit on each dwelling?

- There should be better integration of Warm Front grants with other funding sources (such as the Energy Efficiency Commitment). The scheme's managing agents should be contractually required to improve integration and to work with other agencies;

- Central Government funding for Home Improvement Agencies should be increased so that there is coverage across the whole country;

- Home Improvement Agencies[4] should be given the overall co-ordinating role for tackling fuel poverty and disrepair in private housing working in partnership with local authorities and other agencies;

- In providing guidance to local authorities on the formulation of private sector housing strategies, the Government should require local authorities to put in place measures that will meet the target to eradicate fuel poverty by 2016 (consistent with the requirements of the Warm Homes and Energy Conservation Act 2000).

How can the provision of advice to older householders be improved, particularly at the point of retirement, so that they can make informed choices about their housing options and ensure they have housing appropriate for their needs in old age?

- Our response to this question is our suggested programme outlined in the next section.

How can the availability of small homes within all settlements, particularly for older people (owner-occupiers and those in private rented properties), be improved so as to create more sustainable communities?

---

[4] It should be noted that Howard Price at the Chartered Institute of Environmental Health strongly disagreed with this recommendation. He stated that: "The statutory responsibilities for energy efficiency and for housing conditions lie with local authorities; why things are not happening as they should be currently is that they are having to work with too many other organisations and with too many different funding streams. Our position here is that all that should be simplified and centralised".

- Regional and local planning authorities should be placing a higher priority on the provision of smaller housing units in every community in regional planning guidance, and local plans;

- Local planning authorities should use planning obligations to encourage developers to provide small affordable housing units;

- The Housing Corporation and local authorities should be providing encouragement for RSLs to develop schemes that include smaller housing units (one and two bedrooms) for rent, shared-ownership and for sale;

- Local authorities and RSLs should ensure that their allocations policies allow low-income owner-occupiers to move into appropriate local social housing.

How can the needs of the growing number of very old under-occupiers be addressed?

- The costs of support services for staying put or for moving on are going to increase with the increasing age of clients and this needs to be reflected in funding regimes.

10 - Recommendations for action to tackle fuel poverty in under-occupied homes

Our research has provided a range of approaches for tackling fuel poverty in combination with other factors facing low-income older householders in under-occupied homes. In this chapter, we look at two recommendations for action.

32. Pre-retirement advice and home improvement programme

Firstly, we put forward a suggested new programme based on proposals presented by Gretel Jones of Age Concern to the Fuel Poverty Working Group of the Energy Efficiency Partnership for Homes in March 2001 (Jones 2001). It is founded on the concept that there are key trigger points in people's lives when it would be particularly appropriate to encourage spending money on energy efficiency measures, either using householders' own resources, grant aid or both.

Retirement is a key point when people's housing needs change. But action at an earlier point when people are still earning is an appropriate time to consider the options for meeting an individual's housing needs for possibly the next 20-30 years.

A programme to address people's housing needs (including under-occupancy) in later life might combine the following:

- Advice on staying put and moving on, including financial advice and assistance applying for grants;
- Production of an advice leaflet summarising the main points covered in face-to-face advice, that can be left with the householder;
- A 'house health check' - which would include damp proofing, roof repairs and a safety check on electrical wiring and fittings, gas appliances and systems (possibly funded through local authority grants);
- Energy efficiency improvements (funded by Warm Front, Energy Efficiency Commitment);
- Mobility and access improvements if appropriate (funded by Disability Facilities Grant);
- Organisation and supervision of any building works by an agency (Home Improvement Agency).

This proposal would tie in with a new initiative being developed by Care & Repair England. They are developing a new national programme - 'Should I Stay or Should I Go' - which aims to stimulate the provision of a number of demonstration 'Housing Options' services. Funding for the programme has been secured from HACT, the Tudor Trust and the Rank Foundation. Other contributors to national and local work include the Countryside Agency and Help the Aged.

Specialist housing options advisers will be located within different older people's services including home improvement agencies, Age Concern projects and housing advice centres. At least one project will be located in an area with a high proportion of black and ethnic minority groups. The advisers will offer information, advice, support and practical help for older people living in poor or unsuitable housing and/or considering the options for 'moving on'.

The provision of practical support and better housing advice for older people about housing options fully accords with the Government's strategy for older people's housing as set out in *Quality and Choice for Older People's Housing: A Strategic Framework*.

The participants at the workshop on under-occupation and fuel poverty, convened for this project, examined various aspects of this programme. Five questions were discussed:

- ***Is this a useful proposal?*** While most participants supported the idea, some saw it as too complicated, involving too many parties, and therefore making it difficult to co-ordinate and fund. This relates to the experience of the EST's Pensioners' Energy Plan initiative described earlier, which failed to progress beyond a pilot stage because of the costs of administration and support.

- ***Is pre-retirement the right time?*** The general conclusion was that it is a right time but that there may be other 'trigger points' that should be considered, such as at the point of buying or selling a home and after the death of partner. In all cases it was recognised that there are difficulties in reaching those who have given no consideration to their housing in later life. It was suggested that employers could have a role in delivering advice as part of the pre-retirement courses offered by some larger companies.

- ***What should the package try to cover?*** The package as described received general approval. There was wide support for the suggestion that there should be more research into older people's own perspective on the issue to identify what they see as their needs.

- ***Who could fund it?*** It was strongly stated that it would be unrealistic to expect all the funding to come from the public purse and that it would be reasonable to look to self-funding by householders where they had equity tied up in a home. Energy Efficiency Commitment funding from fuel suppliers was considered to be a possible source of finance but at present too little of this funding was being directed at private households.

- ***Who should implement it?*** There was some support for the proposal that Home Improvement Agencies were in the best position to co-ordinate such a programme. Others suggested Age Concern and Help the Aged. There was general concern that this would be a very big programme and that currently there was no agency with the capacity to implement it. This implies that there would need to be an injection of Government funding into any agency taking on the co-ordinating role.

33. Planning advice

The second recommended action is to address long-term planning for housing provision.

We have reported that some of our interviewees indicated the poor availability of more 'fitting' housing in the immediate community as a reason why fuel poor under-occupiers are unwilling to move. In the post war period most local authorities would include old people's bungalows in any council housing development allowing people who no longer needed their family homes, to move 'down the road' to more fitting housing. In more recent times, this practice has disappeared along with much of the council housing. Today it might be more appropriate for more mixed tenure provision but the important point is that it should be available in the immediate vacinity, not the next village or the next district but where people have their social networks.

Improving the provision of smaller homes is not something that can be changed quickly but might be influenced over the long-term by advice to planners and housing providers as part of the agenda for creating sustainable communities. A project to produce such advice might include:

- assessing current provision of smaller homes
- a survey of low-income 50-65 year olds to look at their attitudes to their future housing needs including the types and tenure of housing they would favour
- reviewing how this approach fits into the sustainable communities agenda
- setting out the benefits for the health and social services
- the market opportunities for private housing developers
- the planning response and use of planning obligations

11 - Unanswered questions

Any research study throws up more questions than it answers and this study is no exception. The study has shown there is a complex relationship between issues that link under-occupancy and fuel poverty in private housing. This study has only been able to examine some of the main issues and some of those have only been partially addressed. We list here the issues that deserve further investigation.

- Much policy has been developed around over-crowding in housing but under-occupation is still poorly defined. It has been apparent in this study that under-occupation, as defined by the English House Condition Survey's standard, is the norm. It would be useful to develop a definition that is more appropriate for developing policies dealing with the efficient use of housing resources or the social and health costs of people living in overlarge homes.

- This study has not included direct survey work with private sector under-occupiers. A compendium of their attitudes and views about how to meet their future housing needs is an essential requirement for any strategy to tackle fuel poverty in under-occupied homes.

- Under-occupiers are a diverse group. Age seems to be a key factor that could differentiate under-occupiers. We have found ample information about the over 60s but almost none about middle aged under-occupiers as there seem to be no representative organisations and most national data sources do not identify this age group. This group needs further investigation.

- There is better information about the very old under-occupiers (over 75 years of age) but how to meet their special and often more acute needs should be a particular focus for further study.

- We have found very little information about fuel poor under-occupiers in the private rented sector. The information we have found suggests that many members of this group live in some of the worst conditions. Under-occupation in the private rented sector seems counter intuitive, as rationally you would think that low-income householders would seek the cheapest and therefore the smallest properties. The fact that under-occupation in this sector is shown in the national statistics, points to either a failure of the definition of under-occupation, or an imbalance in the size of properties available. The private rented sector has always been difficult to address and this needs further research.

- Advising householders about appropriate strategies and ultimately improving thermal insulation can reduce most of the health risks of fuel poverty in under-occupied homes. However further research is needed into controlling damp, condensation and mould in unused rooms.

- There are important questions that cannot be answered satisfactorily on the basis of calculations made in this report about the impacts of relative humidity in under-occupied homes. The uncertainty arising from the lack of measured data suggests that further research is required, not only in under-occupied houses but also in the wider household population. Measurements should include ventilation rates and temperature, as well as moisture content.

- It was beyond the resources of this study to fully examine the mental health impacts of fuel poverty and more generally about the mental well-being of people living in poor living conditions. Anecdotally, they appear to be significant and are likely to be resulting in significant costs to the National Health Service.

- It was beyond the resources of this study to quantify the number of fuel poor under-occupiers living in their own homes who would have sufficient equity to buy into one or other of the 'moving on' options. This information would be a necessary component of any strategy to tackle fuel poverty in under-occupied homes.

- Our review of providers of retirement housing does indicate that there is in all likelihood a big shortfall in the supply of this type of housing compared with the actual and potential demand. This should be systematically quantified to provide a baseline for initiatives to improve the supply of smaller properties of all tenures.

Bibliography

ACE (2001), *Affordable Warmth for 'Hard to Heat' Homes: Finding a Way Forward - Initial Report*, Association for the Conservation of Energy
Age Concern (2001), *UK Fuel Poverty Strategy* (consultation response), Age Concern England
Aylin P et al. (2001), Temperature, housing, deprivation and their relationship to excess winter mortality in Great Britain 1986-1996, *International Journal of Epidemiology* 2001; 30:1100-1108
Barelli (1992), *Underoccupation in local authority and housing association housing,* HMSO
Barelli J and Pawson H (2001), *Underoccupation in social housing*, DETR
Best (2001), Address by Lord Richard Best at the Care and Repair England's Seminar *Housing and Older People - Fresh thinking and new ideas* 6th December 2001 held at the Royal Institute of British Architecture
Boyo S (2001), *When a house is not a home - older people and their housing*, Age Concern England
Bradford I, Bullock T, and Duke A (2001), *In Good Repair,* Care and Repair England & Scope
BRE (2002), *Under occupancy characteristics from the 1996 EHCS,* Data produced by the BRE Housing Centre on behalf of Hugh Bown
Care and Repair (2001), *Consultation paper: Private Sector Housing Renewal - Response from Care and Repair England,* Care and Repair England
Care and Repair (2002), http://www.careandrepair-england.org.uk/facts.html
CIEH (2002), *Fuel Poverty in the Private Sector - A Strategy Framework*, Chartered Institute of Environmental Health
CIH (2001), *Consultation Paper Response - The UK Fuel Poverty Strategy,* Chartered Institute of Housing
Chapman and Scannell (2000), The Affordable Warmth Index, in Rudge J, and Nicol F (Editors) (2000), *Cutting the Cost of Cold,* Spon
Collins KJ (1986), Low indoor temperatures and morbidity in the elderly, *Age and Aging*, Vol 15, 212-220
DETR (1998), *Unlocking the potential - financing energy efficiency in private housing*, General Information Report 50, Energy Efficiency Best Practice Programme, BRECSU
DETR (1998), *English House Condition Survey 1996,* DETR
DETR (2000), *English House Condition Survey 1996, Energy Report,* DETR
DETR (2000), *Quality and Choice: A Decent Home for all,* DETR
DETR (2001), *Managing Underoccupation - A guide to good practice in social housing*, DETR
DOE (1978), *An exploratory project on heating for the elderly*, Housing Development Directorate, Department of the Environment
Donaldson GC and Keatinge WR (1997), Early increases in ischaemic heart disease mortality dissociated from and later changes associated with respiratory mortality after cold weather in South East England, *Journal of Epidemiology and Community Health,* Vol 51, 643-648

Donaldson GC and Keatinge WR (2002), Excess winter mortality: influenza or cold stress? Observational study, *BMJ* 2002; 324:89-90 (12 January)
Donaldson GC et al. (1998), Winter mortality and cold stress in Yekaterinburg, Russia: Interview Survey, *BMJ* 1998;316:514-518 (14 February)
DTI Website (2002)
http://www.dti.gov.uk/energy/consumers/fuel_poverty/index.shtml
DTI/DETR (2001), *The UK Fuel Poverty Strategy - Consultation Draft,* DTI/DEFRA
DTI/DEFRA (2001), *The UK Fuel Poverty Strategy,* DTI/DEFRA
DTLR (2000), *Projections of Households in England 2021,* DTLR, London
DTLR (2001), *2000/01 Survey of English Housing: Preliminary Results,* Housing Statistics Summary Number 10, 2001, DTLR
DTLR (2002), *The Regulatory Reform (Housing Assistance) (England and Wales) Order 2002,* Statement by DTLR April 2002
Eaga (2002), *Eaga Partnership to deliver HELP from British Gas to Fuel Poor Households,* Press Release 24th July 2002
Holmans AE (2000), *Divorce, Remarriage and Housing,* DTLR
Homes (2002) http://www.homes.org.uk
Hinton C and McGrath D (2001), *Using Your Home As Capital*, Age Concern England
Jones G (2001), *Promoting Energy Efficiency Among Homes Owners,* paper presented to the Fuel Poverty Working Group of the Energy Efficiency Partnership for Homes
JRF (2002), http://www.jrf.org.uk/housingtrust/hartriggoaks/default.asp
Khanom L (2000), Impact of fuel poverty on health in Tower Hamlets, in Rudge J, and Nicol F (Editors) (2000), *Cutting the Cost of Cold,* Spon
McCarthy and Stone (2002) http://www.mccarthyandstone.co.uk/
Ofgem (2002), *Social Action Plan - Annual Review,* Office of Gas and Electricity Markets
Olsen NDL (2001), Prescribing warmer, healthier homes, *BMJ* 2001; 322: 748-749 (31 March)
Oreszczyn T and Pretlove S (2000), Mould Index, in Rudge J, and Nicol F (Editors) (2000), *Cutting the Cost of Cold,* Spon
Pezzey (1984), *Economic Assessment of some energy saving measures in housing and other buildings* – BRE
Rudge J, and Nicol F (Editors) (2000), *Cutting the Cost of Cold,* Spon
Russell L (2000), *Housing Options for Older People*, Age Concern England
State of UK Housing Policy, Policy Press 2000
Thomson H, Petticrew M, and Morrison D (2002), *Housing Improvement and Health Gain: A summary and systematic review*, Occasional Paper No 5, MRC Social and Public Health Sciences Unit, Glasgow University
TXU - Staywarm (2002) http://www.txu.com/eu/uk/ourbus/uk/sus/staywarm.asp
Wilkinson P, Landon M, Stevenson S, (2000), Housing and winter death: epidemiological evidence, in Rudge J, and Nicol F (Editors) (2000), *Cutting the Cost of Cold,* Spon

Appendix 1 - National Data

The study team commissioned BRE to produce a number of tables from data collected for the English House Condition Survey 1996 and the English House Condition Survey Energy Report.

In this study we only had limited funds to make enquiries from the English House Condition Survey. The Building Research Establishment was extremely helpful in enabling these funds to stretch as far as possible. Nevertheless many of the research needs described above could well benefit from further access to a housing database - preferably more recent than 1996.

Both of the consultants involved on the technical side of this study believed that for the purposes of this study and because of its wider application, there should be more research into heat flows and air flows within dwellings and their implications for part house heating. We have been able to make some useful comments on part house heating. We believe that under-occupiers should consider part house heating provided they obey certain caveats related to moisture generation and the avoidance of health risks. However, we feel there is more to be done. The jury may be still out on these matters and our ideas should be given a bit more exposure before we would recommend going as far as incorporating them in any Government backed advice leaflet.

Reproduced here are tables derived from the tabulations drawn form the English House Condition Survey 1996 supplied by BRE:

Household composition by bedroom standard - In fuel poverty (disposable income) (in '000s)

	Bedroom standard, 1996						
Household composition	**two or more below**	**one below**	**at standard**	**one above**	**Two or more above**	**no response**	**Total**
1 person aged 60 or more	0.000	0.000	571.786	794.922	864.652	34.865	2259.252
1 person aged under 60	0.000	0.000	446.272	313.785	313.785	6.973	1080.815
couple aged 60 or more (no children)	0.000	0.000	55.784	369.569	529.948	6.973	969.247
adult households	20.919	48.811	313.785	327.731	41.838	6.973	760.057
lone parent with 1 child	0.000	13.946	237.082	125.514	27.892	0.000	411.407
lone parent with more than 1 child	6.973	13.946	230.109	132.487	13.946	0.000	397.461
lone parent (no of kids unknown)	0.000	0.000	20.919	13.946	6.973	0.000	41.838
couple with 1 child	0.000	6.973	104.595	118.541	13.946	0.000	244.055
couple with 2 children	0.000	0.000	69.730	104.595	20.919	0.000	202.217
couple with more than 2 children'	6.973	34.865	97.622	20.919	0.000	0.000	153.406
couple with no children(HOH <45)	0.000	0.000	41.838	55.784	62.757	0.000	167.352
couple with no children(HOH 45+)	0.000	0.000	34.865	90.649	132.487	0.000	264.974
couple with children (no unknown)	0.000	0.000	13.946	6.973	6.973	0.000	27.892
	34.865	**125.514**	**2245.306**	**2475.415**	**2029.143**	**62.757**	**6973.000**

Household composition by bedroom standard - all households ('000s)

Household composition	Bedroom standard, 1996						
	two or more below	**one below**	**at standard**	**one above**	**Two or more above**	**no response**	**Total**
1 person aged 60 or more	0.000	0.000	844.649	1060.722	1100.008	39.286	3044.665
1 person aged under 60	0.000	0.000	707.148	805.363	746.434	19.643	2278.588
couple aged 60 or more (no children)	0.000	0.000	235.716	982.150	1650.012	39.286	2926.807
adult households	19.643	78.572	589.290	550.004	78.572	0.000	1335.724
lone parent with 1 child	0.000	19.643	314.288	196.430	58.929	0.000	608.933
lone parent with more than 1 child	0.000	39.286	353.574	157.144	19.643	0.000	569.647
lone parent (no of kids unknown)	0.000	0.000	39.286	58.929	0.000	0.000	117.858
couple with 1 child	0.000	39.286	667.862	942.864	314.288	0.000	1964.300
couple with 2 children	0.000	39.286	530.361	923.221	294.645	19.643	1807.156
couple with more than 2 children'	19.643	98.215	491.075	176.787	39.286	0.000	844.649
couple with no children(HOH <45)	0.000	0.000	216.073	569.647	707.148	58.929	1571.440
couple with no children(HOH 45+)	0.000	19.643	255.359	687.505	1217.866	19.643	2200.016
couple with children (no unknown)	0.000	19.643	98.215	157.144	98.215	0.000	392.860
	78.572	**373.217**	**5382.182**	**7287.553**	**6325.046**	**196.430**	**19643.000**

Under-occupation by tenure (in '000s)

	Below or Meets Bedroom Standard	**Above Standard**	**No Response**	**Total**
ALL HOUSEHOLDS (% of total)				
Owner Occupiers	13.3%	54.4%	0.6%	13581
Private Rented	4.5%	4.7%	0.2%	1817
Local Authority	9.5%	7.9%	0.3%	3340
RSL	3.3%	1.6%	0.0%	905
Total	5915	13524	204	19643
NOT IN FUEL POVERTY (% of total)				
Owner Occupiers	16.7%	63.8%	0.8%	81.2%
Private Rented	2.4%	2.8%	0.2%	5.5%
Local Authority	5.9%	4.2%	0.1%	10.2%
RSL	2.1%	1.0%	0.0%	3.1%
Total	27.0%	71.8%	1.1%	12740
IN FUEL POVERTY (% of total)				
Owner Occupiers	7.4%	39.5%	0.2%	47.1%
Private Rented	8.0%	7.9%	0.1%	16.0%
Local Authority	14.5%	14.5%	0.5%	29.5%
RSL	4.6%	2.7%	0.1%	7.4%
Total	34.5%	64.7%	0.9%	6903

Under-occupation by size of dwelling

Households not in fuel poverty ('000s)

Size of dwelling	Below Bedroom Standard	Above Bedroom Standard	Numbers	
1 Bed	940.00	0	940	7.38%
2 Bed	1085.00	1901	2986	23.44%
3 Bed	1408.00	4711	6121	48.04%
4 Bed	78.00	1939	2017	15.83%
5 Bed +	6.00	526	532	4.18%
Don't Know	73.00	73	145	
Totals	**3590**	**9150**	**12741**	

Households in fuel poverty ('000s)

Size of dwelling	Below Bedroom Standard	Above Bedroom Standard	Numbers	
1 Bed	1177.00	0	1177	17.05%
2 Bed	711.00	1521	2232	32.34%
3 Bed	461.00	2333	2794	40.48%
4 Bed	34.00	411	445	6.45%
5 Bed +	17.00	178	195	2.83%
Don't Know	30.00	30	59	
Totals	**2430**	**4473**	**6902**	

Appendix 2 - Technical assessment

34. Calculations applied to the six example houses

We have made calculations in relation to six example house types.

The types are:

H1 – 1900 terrace house, 4 bedroom, traditional construction.
H2 – 1926 semi-detached, 3 bedroom, traditional construction
H3 – 1930 semi-detached, 4 bedroom, traditional construction
H4 – 1937 semi-detached, 4 bedroom, rendered brickwork
H5 – 1960 terrace patio, 4 bedroom, brick block cavity crosswall, timber framed panels
H6 – 1964 terrace/cluster patio house 4 bedroom 6 person concrete system

These types have been chosen as those most likely to lead to the worst problems of under-occupancy, and yet offer some possibilities of internal division between occupied and unoccupied rooms. They have been taken as representative of different periods of building.

We have made calculations related to poorly insulated and better insulated instances of each of the six examples, assuming that for the poorly insulated state all the simple measures have been undertaken, leaving only double glazing and the insulation of solid walls to divide the two states.

Heat losses in W/mK have been calculated as:

	H1	H2	H3	H4	H5	H6
Heat Loss Poor Insulation	434.2	324.2	474.3	486.6	292.0	463.6
Heat Loss Better Insulated	253.3	210.7	279.4	272.5	191.8	318.3

For the one pre-WWI and the three pre-WW2 houses we have assumed U Values of 2.1 without insulation and 0.85 with insulation. (Values taken from: Pezzey - *Economic Assessment of some energy saving measures in housing and other buildings* - BRE 1984)

For the Cavity walled house H5 we have assumed an uninsulated U value of 0.87 capable of being reduced by cavity fill to 0.43 and for the concrete example H6 we have assumed an uninsulated U value of 2.54 and an insulated value of 1.52.

Single glazed windows are assumed to have a U value of 4.8 and double glazed 2.8.

The additional draught sealing effect of double glazing is assumed to bring the average air change rate down from 0.8 to 0.5.

Interzone airflow is assumed to be the equivalent of 2 air changes per hour in a vertical direction or 1 air change in a horizontal direction. Common sense draught sealing and keeping doors shut is expected to reduce this interzone flow in both cases to 0.5. Very little is known about internal airflow between zones and these figures must be taken to be illustrative.

We have then done BREDEM type calculations on all 6 houses. We assume a demand temperature appropriate to older people of 22℃ and a difference between the living room and other parts of the heated zone, a difference that we establish using the table laid down in the Standard Assessment Procedure. Thus when we quote average temperatures for the heated part of the house we get something less than 22℃.

Energy consumption is calculated assuming that the spare rooms remain totally unheated and the heat loss of the rest of the house includes the external walls, roof and windows etc. and also the loss through the interzone partitions and through the external elements of the spare rooms.

We assume a gas boiler for heating and hot water with an efficiency of 65%.

We take the requirement for cooking, electric appliances and hot water to be as laid down in the specification for BREDEM XII but taking the suggested options of reducing consumption for low-income families by 40%.

35. Results

Summary - annual energy costs £	H1	H2	H3	H4	H5	H6	**Average**	**Savings over baseline**
1 - Poor insulation + whole house heating Baseline	810	657	874	887	608	867	**783.85**	
2 - Poor insulation + Part house heating	715	604	736	738	552	778	**687.33**	96.52
3 - Poor insulation + Part house heating + limit airflow	694	587	705	716	538	758	**666.27**	117.58
4 - Better insulation (BI) + whole house heating	554	488	589	578	454	644	**551.00**	232.85
5 - BI + Part house heating	524	475	551	538	439	616	**523.61**	260.23
6 - BI + Part house heating + limit airflow	511	466	533	524	430	603	**511.26**	272.58
7 - BI + Part house heating + limit airflow + internal insulation	504	462	524	513	424	592	**503.14**	280.70

Scenario 1: Baseline - Whole house heating with poor insulation

Table 1: Baseline	H1	H2	H3	H4	H5	H6
Whole House						
Heating Cost	£575.93	£425.08	£639.33	£654.13	£378.46	£626.19
All Fuel Costs	£809.88	£657.23	£873.57	£886.74	£608.26	£867.39

Comparison between whole house heating and Scenario 2: part house heating for an under-occupied house with poor insulation.

The greatest savings from part house heating occur where the house is still poorly insulated. Still, part house heating may cost nothing whereas insulation, particularly of solid walled properties, is expensive.

Table 2: Whole House vs. Part House Heating (Poor Insulation)	H1	H2	H3	H4	H5	H6
Whole House						
Heating Cost	£575.93	£425.08	£639.33	£654.13	£378.46	£626.19
All Fuel Costs	£809.88	£657.23	£873.57	£886.74	£608.26	£867.39
Part House						
Heating	£480.68	£372.21	£501.89	£505.79	£322.27	£537.20
All Fuel	£714.62	£604.36	£736.13	£738.39	£552.08	£778.40
Difference	£95.25	£52.87	£137.44	£148.35	£56.19	£88.99
% of heating	16.54%	12.44%	21.50%	22.68%	14.85%	14.21%

Scenario 3: If the house is poorly insulated and you take some common sense measures to isolate spare rooms then the saving from part house heating is slightly greater than the amounts shown above in table 2.

Table 3: Poor Insulation + part heating + limit airflow	H1	H2	H3	H4	H5	H6
Whole House						
Heating Cost	575.93	425.08	639.33	654.13	378.46	626.19
All Fuel Costs	809.88	657.23	873.57	886.74	608.26	867.39
Part House + limit airflow						
Heating	459.90	355.32	470.65	483.34	307.82	516.62
All Fuel	693.85	587.47	704.89	715.94	537.62	757.83
Difference	£116.03	£69.76	£168.68	£170.80	£70.64	£109.57
% Difference	14.33%	10.61%	19.31%	19.26%	11.61%	12.63%

Comparison between under-occupied houses with poor insulation and Scenario 4: better insulation.

The savings achieved here are far larger than those achieved by part house heating.

Table 4: Under Occupied Better Insulation vs. poor Insulation	H1	H2	H3	H4	H5	H6
Poor Insulation						
Heating Cost	£575.93	£425.08	£639.33	£654.13	£378.46	£626.19
All Fuel Costs Whole House	£809.88	£657.23	£873.57	£886.74	£608.26	£867.39
Better Insulation						
Heating Cost	£319.65	£255.37	£354.40	£345.35	£224.55	£402.70
All Fuel Costs	£553.60	£487.52	£588.64	£577.95	£454.35	£643.91
Difference	£256.28	£169.71	£284.93	£308.79	£153.91	£223.49
% of heating	31.64%	25.82%	32.62%	34.82%	25.30%	25.77%

Comparison between whole house heating and Scenario 5: part house heating for an under-occupied house with better insulation.

With better insulation there is less to be gained by part house heating. The amounts being roughly one tenth of the savings achieved by insulation.

Table 5: Whole House vs. Part House Heating (Better Insulation)	H1	H2	H3	H4	H5	H6
Whole House						
Heating Cost	£319.65	£255.37	£354.40	£345.35	£224.55	£402.70
All Fuel Costs	£553.60	£487.52	£588.64	£577.95	£454.35	£643.91
Part House						
Heating	£289.71	£242.69	£316.85	£305.00	£209.20	£374.30
All Fuel	£523.65	£474.84	£551.08	£537.61	£439.00	£615.50
Difference	£29.94	£12.68	£37.56	£40.35	£15.35	£28.40
% of heating	9.37%	4.97%	10.60%	11.68%	6.84%	7.05%

Scenario 6: Savings from part house heating in better insulated houses but assuming that some simple measures are taken to limit heat flow between zones.

Table 6: Whole House vs. Part House (Better Ins. + reasonable measures to close off spare rooms)	H1	H2	H3	H4	H5	H6
Whole House						
Heating Cost	£319.65	£255.37	£354.40	£345.35	£224.55	£402.70
All Fuel Costs	£553.60	£487.52	£588.64	£577.95	£454.35	£643.91
Part House						
Heating	£277.06	£234.09	£298.73	£291.71	£200.36	£361.67
All Fuel	£511.00	£466.24	£532.96	£524.32	£430.17	£602.88
Difference	£42.59	£21.28	£55.68	£53.64	£24.19	£41.03
% of heating	13.33%	8.33%	15.71%	15.53%	10.77%	10.19%

Scenario 7: If you take additional measures to limit heat flow between the main house and spare rooms (insulating walls and ensuring that there are thick carpets on floors) then the savings are increased by the small amounts shown below.

Table 7: Part House Heating + Better Insulation + spare rooms insulated	H1	H2	H3	H4	H5	H6
Limited Measures						
Heating	319.65	255.37	354.40	345.35	224.55	402.70
All Fuel	553.60	487.52	588.64	577.95	454.35	643.91
With Internal Ins						
Heating	270.21	229.38	289.60	280.81	194.30	350.64
All Fuel	504.15	461.53	523.83	513.41	424.10	591.84
Difference	£49.44	£25.99	£64.80	£64.54	£30.25	£52.06
% difference	8.93%	5.33%	11.01%	11.17%	6.66%	8.09%
Cost Internal Insulation	£240.00	£326.40	£427.20	£614.40	£321.60	£724.80

36. Temperatures

Internal temperatures in under-occupied houses during heating hours - assuming part house heating.

Assuming a householder living on a single pension of £72.50 a week and assuming fuel expenditure is limited to 10% of this income.

In making these comparative figures the reduction in expenditure is applied to both heating and to other fuel uses. It is assumed that the occupants can cut into their expenditure on cooking, hot water and use of electrical appliances in the same proportion, as they have to cut into their heating.

Under Occupied - Internal Temperatures fuel expenditure limited to 1 pensioner's income (°C)

Fully Heated						
Poor Insulation	20.77	20.93	20.75	20.65	20.93	20.97
Better Insulation	21.19	21.24	21.14	21.11	21.24	21.24
Heated within income						
Poor Insulation	13.75	15.36	13.48	13.36	16.24	13.29
Better Insulation	17.08	18.21	16.49	16.70	19.16	15.57

Figures recalculated assuming household income of £6000 of which £600 can be spent on fuel. The additional income makes a considerable difference to internal temperatures.

Fully Occupied - Internal Temperatures fuel expenditure limited to 2 pensioners' income (°C)

Warm Home						
Poor Insulation	20.90	21.12	21.01	20.95	21.25	21.24
Better Ins.	21.33	21.41	21.39	21.38	21.49	21.46
Limited Heat						
Poor Insulation	15.92	17.56	15.27	15.00	18.94	15.47
Better Ins.	19.48	20.13	18.70	18.62	16.70	17.90

Night-time Temperatures

(A) Night-time temperatures in heated area of the house

(The heated area of the house means the whole house in the case of full occupation and it means the rest of the house less the closed off spare rooms in the case of under occupation).

These temperatures are the lowest you might expect them to reach when the outside temperature is 3℃ (winter average) and -2℃ (coldest).

The figures are calculated assuming an exponential decay towards the outside temperature. The better the insulation the longer it takes to reach the external temperature.

The night-time period in which the heat is switched off is assumed to be 8 hours.

A1 and A2 are for fully occupied houses

(A1) for a fully heated, fully occupied house - poorly insulated

The fully occupied house benefits from the heat gains from occupants and hence the temperatures do not sink as low as they would in an under-occupied house.

Night-time temperatures poor insulation fully heated fully occupied (℃)

Temperature Night Winter Ave.	9.78	11.55	10.58	10.10	12.65	12.54
Temperature Night Coldest	6.67	8.91	7.69	7.08	10.30	10.16

(A2) for a fully heated, fully occupied house - better insulated

Night-time temperatures better insulation fully heated fully occupied (℃)

Temperature Night Winter Ave.	13.40	14.30	14.05	13.93	15.17	14.84
Temperature Night Coldest	11.23	12.37	12.05	11.91	13.46	13.04

A3, A4, A5 and A6 refer to under-occupied houses

(A3) part house heating, poorly insulated

Night-time temperatures poor insulation part house heating under-occupied (℃)

Temperature Night Winter Ave.	9.73	11.46	10.47	9.98	12.48	12.40
Temperature Night Coldest	6.62	8.82	7.58	6.96	10.13	10.02

(A4) part house heating, better insulation

Temperatures are slightly lower than for the fully occupied house. Incidental heat gains from people and other activities must go down at night, but whatever there are will contribute more to the temperatures in the house with more occupants.

Night-time temperatures better insulation part house heating under-occupied (℃)

Temperature Night Winter Ave.	13.32	14.20	13.90	13.77	15.00	14.69
Temperature Night Coldest	11.16	12.26	11.90	11.75	13.29	12.90

(A5) part house heating, better insulation and spare rooms closed off.

The effect of the spare rooms being slightly colder makes little difference to the temperatures in the main part of the house.

Night-time temperatures better insulation part house heating under-occupied limited airflow to spare rooms (℃)

Temperature Night Winter Ave.	13.34	14.21	13.92	13.79	15.02	14.71
Temperature Night Coldest	11.17	12.28	11.93	11.76	13.31	12.91

(A6) part house heating, better insulation and spare rooms closed off and insulated

Nor does it make much more difference if there is insulation between the main house and the spare rooms.

Night-time temperatures better insulation part house heating under-occupied insulation between zones (℃)

Temperature Night Winter Ave.	13.35	14.21	13.93	13.80	15.03	14.72
Temperature Night Coldest	11.18	12.28	11.94	11.78	13.32	12.92

(B) Day and Night-time temperatures in unheated areas of the house

(applies only to under-occupied houses with part house heating)

(B1) With poor insulation

Temperatures in spare rooms (under occupied) poor insulation (℃)

Temperature Day Spare Rooms	14.37	15.77	13.86	14.11	15.79	16.03
Temp. Night Winter Ave. Spare	7.30	9.03	7.57	7.39	9.77	9.82
Temp. Night Coldest Spare	4.19	6.38	4.68	4.37	7.41	7.43

(B2) With better insulation

Temperatures in spare rooms (under occupied) better insulation (℃)

Temperature Day Spare Rooms	16.79	17.82	16.44	16.64	17.46	17.56
Temp. Night Winter Ave. Spare	10.83	12.10	11.07	11.12	12.52	12.33
Temp. Night Coldest Spare	8.66	10.17	9.08	9.09	10.81	10.54

(B3) With better insulation and spare rooms closed off.

Closing off the spare rooms does not make much difference to their night-time temperatures. The main factor that affects these temperatures is the heat loss through external walls to the outside rather than the little extra warmth they gain from being enclosed in a house with other warmer rooms).

Temperatures in spare rooms (under occupied) better insulation limited airflow to spare rooms (℃)

Temperature Day Spare Rooms	15.14	16.18	14.45	15.30	16.12	16.45
Temp. Night Winter Ave. Spare	9.89	11.09	9.88	10.32	11.63	11.62
Temp. Night Coldest Spare	7.72	9.16	7.88	8.29	9.92	9.83

(B4) With better insulation and spare rooms closed off and insulated

Again the insulation of the spare rooms has little effect on their night-time temperatures.

Temperatures in spare rooms (under occupied) better insulation between zones (℃)

Temperature Day Spare Rooms	14.22	15.28	13.45	14.20	15.19	15.48
Temp. Night Winter Ave. Spare	9.37	10.54	9.28	9.66	11.03	11.00
Temp. Night Coldest Spare	7.20	8.61	7.28	7.64	9.32	9.21

37. Humidity

Relative humidity and condensation

Relative humidity (RH) is a measure of the water content of air that relates well to the effect of moisture on both people and objects within buildings. Dry air (RH< 40%) tends to cause irritation to skin and eyes and, if cool, induces transpiration that can contribute to dehydration. Excessive dryness also leads to the build-up of static electricity on certain surfaces, which can lead to electric shocks. Moist air (RH>70%) produces condensation on cool surfaces and, if warm, inhibits transpiration, causing thermal discomfort. Frequent occurrence of condensation leads to mould growth, which is recognised as a significant risk to health. High relative humidity has also been found to sustain dust mite populations in dwellings. All things considered, RH is arguably the most important single factor determining indoor air quality in a typical UK dwelling.

In dwellings, RH needs to be maintained between 40% and 70% to avoid the effects mentioned in the previous paragraph. Normal activities within dwellings produce water vapour, which tends to raise the moisture content of the indoor air above that of air outdoors. However, the saturated vapour pressure of air rises significantly with temperature, which means that RH falls when the air is heated. Consequently, indoor air in heated buildings typically has lower RH than outdoor air, despite having higher moisture content. Whether or not this is so in practice depends on the balance between moisture generation, ventilation rate and heating.

Excessively low RH is rarely encountered in dwellings in the UK, although it may be in other buildings. However, excessively high RH can easily occur in dwellings especially if they are poorly heated or have high levels of moisture generation. Poor ventilation can exacerbate problems with high humidity, leading to problems with condensation even in well heated dwellings.

Condensation occurs when moist air comes into contact with surfaces cooler than the dew-point of the air, the temperature at which the vapour pressure of the air reaches saturation. The higher the RH, the closer the dew-point is to ambient temperature and the more likely that condensation will occur. For example, air at 21°C with an RH of 50% has a dew-point of 10.4°C, which means that condensation is likely to occur only on the inner surfaces of single glazing in typical winter conditions. At an RH of 80%, the dew point of air at 21°C becomes 17.5°C, and condensation would be likely on the inner surfaces of external walls and top-floor ceilings unless they are well insulated.

The effect of partial heating on humidity and condensation

When some parts of a dwelling are heated to higher temperatures than others, the risk that condensation will occur is greater. As unheated rooms have lower air temperatures, the drying effect arising from heating will be reduced in those rooms, leading to higher relative humidity. Also, the temperatures of the internal surfaces of elements exposed to the outside will be cooler. Those effects can be aggravated if air from the heated part of the dwelling circulates to unheated parts, which is very likely to be the case with a heated living room on the ground floor of a two-storey house. In this situation, air, which might avoid condensation in the warmer living room, can produce condensation when it comes into contact with significantly cooler surfaces in unheated rooms.

The previous section of this appendix includes calculated values for temperatures in unheated parts of under-occupied dwellings with part-house heating. This shows temperatures in the unheated rooms of poorly insulated houses to be no more than 16°C, which implies a surface temperature of around 11°C on an un-insulated solid wall. With full mixing of the air throughout the dwelling and air at RH = 60 % in the heated areas, RH in the unheated areas would rise to over 80% in unheated rooms and condensation would form on the insides of external walls. Although full mixing of the ventilation air may be the worst case, it is very difficult to prevent partial mixing, especially in a two-storey house, where the buoyancy of heated air tends to cause circulation to upstairs rooms. Any moisture generating activity within unheated areas would only serve to exacerbate the problem.

Taking account of the preceding paragraph, it is reasonable to conclude that partial heating does little to reduce the risk of condensation in unheated areas unless it is possible to stop circulation of air between heated and unheated areas. It also suggests that insulating only heated areas is not advisable, and insulating heated from unheated areas could actually increase the risk of condensation in the latter.

Moisture production in dwellings

Typical moisture generation rates for household activities are given in the British Standard BS5250: 1989 *Code of practice for control of condensation in buildings.* It shows typical moisture production for a 1-person household to range from 3.5 to 9 kg/day and for a 2-person household from 4 to 8 kg/day. The lower number relates to 'dry occupancy', which is described in the standard as 'where there is proper use of ventilation' and includes buildings that are unoccupied during the day. The higher number relates to 'wet occupancy' described as 'where ventilation is never used' and with 'high moisture generation'. Clearly, moisture production covers a broad range, dependent on household practices.

The total moisture load in dwelling may be used to calculate the mean increase in moisture content caused by household activities using the formula:

$$?m = C/(24NV\rho) \text{ kg/kg}$$

where C = daily moisture production in kg/day

V = building volume in m^3

N = ventilation rate in air changes per hour.

ρ = density of dry air

It may be noted that the larger the building volume, the lower the increase in moisture content for given rates of moisture production and ventilation. This has a beneficial consequence for a small household in a large property: the humidifying effect of occupancy is lower than it would be in a smaller property.

House	Volume (m3)	Moisture content (kg/kg)	T_{in}=10°C	T_{in}= 15°C	T_{in}=20°C	Temperature for RH = 60%
			Mean indoor relative humidity (%)			
H1	343	0.0059	78	55	40	14
H6	228	0.0064	83	57	43	15
Flat	96	0.0084	100	79	67	19

Table A: Effect of dwelling volume on moisture content and relative humidity.

It is of interest to consider the effect of house volume for one person households in our example properties compared to a small flat of 40m^2 floor area. Table A above shows the results of calculations based on typical outdoor winter conditions, with a temperature of 5°C and RH of 90%. The calculations assume a ventilation rate of 0.6 air changes per hour and moisture generation of 6 kg/day, which is the mid range value given in BS 5250, corresponding to 'moist occupancy'. As expected, the increase in moisture content is much lower in example properties H1 and H6, which are respectively the largest and smallest of those described above for the energy calculations, than in the small flat. When added to the moisture content of the incoming external air, this results in significantly lower indoor moisture content (in column 3) in the larger properties.

Columns 4, 5 and 6 of Table A show the relative humidity that would result from heating to a mean temperature of 10, 15 and 20°C respectively. As this refers to the whole house 24-hour mean temperature, it corresponds to higher temperatures during hours of heating and in the heated areas of partially heated dwellings. The highest mean temperature shown (20°C) would only be achieved in a fully heated house with a good standard of insulation, while 10°C and 15°C span the range corresponding to partial heating in the poorly insulated and better insulated cases. The final column shows the mean internal temperature required to achieve an RH of 60%.

The results given in Table A show that the small flat requires a much better standard of heating to maintain a satisfactory level of RH than the larger houses drawn from our examples when having to accommodate the same moisture loading. This suggests that, although under-occupancy is likely to cause problems with the affordability of heating, its effect on indoor relative humidity through reduced temperatures is mitigated by the presence of a larger volume of indoor air to absorb moisture.

The calculations behind Table A are based on sound physical principles but it would be unwise to attach too much significance to the actual values they produce. This is because there is so much uncertainty attached to data from which they were

calculated: moisture production rates and ventilation rates in dwellings have never been measured in enough cases to be representative of household population as a whole, let alone typical under-occupying households. Also, the calculations have been done on a whole house basis, assuming uniform release and full mixing of moisture, which would not apply if good moisture management was practised, for example by using a cooker hood and bathroom extractor fan.

BS5250 also lists contributions to moisture generation arising from various household activities. People typically generate between 40 and 55 g/hour (1 to1.3 kg/day if always at home) depending on whether they are asleep or active. Other significant contributions listed include cooking (2 to 3 kg/day) and drying clothes indoors (1.5 kg/day), washing clothes (0.5 kg/day), dishwashing (0.4 kg/day) and bathing/washing (0.2 kg/person/day). Apart from the contribution from people, the quantities listed must vary considerably from household to household but they are a useful guide to the relative significance of the various sources. They also serve to pinpoint the locations of most moisture production: the kitchen and the bathroom.

BS5250 also gives moisture generation rates from the combustion of various fuels. Where combustion appliances are vented to the outside, the water vapour they produce does not affect indoor air humidity, but that is not the case for portable heating appliances using liquefied petroleum gas (LPG) or paraffin. Heaters of this type emit around 100g of moisture for each kWh of heat they produce, and if used extensively can add considerably to total moisture production. Depending on ventilation rates, the effect of the heat produced in this way may either raise or lower RH, aggravating or ameliorating problems with condensation accordingly.

Moisture management in dwellings

The balance between moisture generation, heating and ventilation has been mentioned above. To avoid excessive RH, moisture generation should be kept to a minimum and heating should be adequate and uniform throughout the dwelling. Ventilation affects RH in a complex manner. Very low rates of general ventilation are likely to raise RH by reducing the capacity for removing moisture generated within the dwelling, while very high rates will tend to outweigh that effect by increasing heat loss and reducing temperature. In broad terms, increasing the general ventilation rate is not an effective means of controlling humidity in dwellings.

From the description of moisture generation in Section 103, it is possible to distinguish between the continuous generation of moisture that arises from people and the sporadic generation that arises from specific activities such as cooking and bathing. The effect of the latter category can be greatly reduced if the moisture they generate is prevented from circulation to the rest of the dwelling by immediate extraction from the point at which they are generated. As they typically occur in just two rooms – the kitchen and the bathroom – they can be effectively dealt with by the use of extractor fans. A good cooker hood vented to the outside[5] will extract most of

[5] A recirculating cooker hood may be beneficial in removing grease and cooking smells but will have no effect on moisture generated by cooking.

the water vapour generated by cooking and, if the cooker is fuelled by gas, by the combustion of the fuel. And an adequately sized extractor fan running on a timer or a humidity controlled switch can remove most of the moisture arising from bathing or showering.

Another means by which households can reduce the effects of moisture generation is to avoid drying clothes indoors whenever possible. If a tumble drier is to be used, it should be vented to the outside or operated on the condensing principle, which is used in washer-driers. The use of un-vented heaters is best avoided altogether but, if they are to be used, it should be a room which is ventilated to the outside but with doors to the rest of the dwelling kept closed.

Conclusions from the technical analysis of humidity

It is possible to draw a number of general conclusions from the analysis of humidity in dwellings above.

- Lower indoor temperatures tend to increase relative humidity and the risk of condensation.

- Partial heating results in lower temperatures in certain rooms and tends to increase the humidity and condensation in those rooms, particularly when air from heated rooms circulates to unheated rooms.

- Larger houses are likely to have lower relative humidity for a given standard of heating and level of moisture generation by virtue of the larger volume of air they contain.

- Moisture generated in kitchens and bathrooms through cooking and washing is best dealt with by extraction at source using cooker hoods and extractor fans.

- Un-flued heaters using LPG or kerosene generate significant moisture and should always be used in a ventilated room. (Ventilation is needed not only to deal with moisture but also with other combustion products, including carbon dioxide.)

Care should be exercised, however, in using the results of the calculations given in this section of the report. They depend on inputs with a high level of uncertainty, including ventilation and moisture production rates. Accordingly, there are important questions that cannot be answered satisfactorily on the basis of calculations.

- Will partial heating cause problems with condensation? All other things being equal, it is likely to increase the risk but the uncertainties are too great to give a clear answer for individual cases.

- Is it helpful to insulate the heated part of a house from the unheated part? Fabric insulation should probably not be applied, unless airflow from the heated to the unheated part can be restricted. However, measures aimed at reducing air-flow,

such as draught-stripping internal doors, may be helpful and should at worst do no harm.

The uncertainty arising from the lack of measured data suggests that further research is required, not only in under-occupied houses but also in the wider household population. Measurements should include ventilation rates and temperature, as well as moisture content.

Despite the uncertainties, it is possible to give helpful advice to households on the management of moisture. The key points are:

- Use a cooker hood vented to the outside and a bathroom extractor fan
- Avoid the use of un-flued heating appliances
- Dry clothes outdoors whenever possible
- Vent tumble driers to the outside or use condenser models

Appendix 3 - Topic guide for interviews

Definition

Does your organisation use or recognise any particular definition of under-occupancy?

Incidence and impact

Do you have any information about or knowledge of:

- the incidence of fuel poverty in under-occupied owner occupied homes?
- private rented homes?
- possible health impacts of under-occupation and fuel poverty?
- the relationship between under-occupation and disrepair and fitness?
- regional differences in the incidence of under-occupation?
- any differences between under-occupation in rural and urban homes?

Staying put

Other research indicates the majority of people in 'under-occupied' homes do not want to move to smaller properties. There is also evidence that householders on low incomes commonly adopt a strategy of heating only part of their homes (particularly if they are under-occupied) in order to save money.

What comment would you make on the following strategies to improve access to affordable warmth in under-occupied homes (benefits, problems, cost-effectiveness):

- installing good levels of insulation and draught proofing to the whole home
- insulating and draught proofing only the parts of the home that are being used
- improving the controls on the heating system to allow background heat in little used rooms and full heating in main living spaces
- moving basic facilities to one floor and shutting off the rest of the property

- dividing properties into smaller units

Do you know of any other strategies that would address the problem of fuel poverty while allowing people to continue to live in 'under-occupied' homes?

Energy efficiency assessment and programmes

Energy efficiency assessments of property using SAP assumes standard occupancy and whole house heating which fails to reflect the reality in under-occupied homes.

Do you have any views about the assessment of energy efficiency in under-occupied homes?

The main energy efficiency programme addressing fuel poverty is Warm Front (HEES). This provides standard grants for a range of measures according the eligibility of the householder.

Do you have any views about the adequacy and appropriateness of the Warm Front programme for under-occupied fuel poor households?

Moving on

While it seems most householders in under-occupied homes don't want to move, some do want to move to smaller more manageable properties. Research about householders in under-occupied social housing indicates that most would like to move to self-contained properties, such as bungalows, rather than communal sheltered housing.

Do you have any views/knowledge about?

- the availability of suitable housing in the private sector
- the ease by which private tenants and owner occupiers can move to more suitable social housing
- the possibility of adapting for use in the private sector, social housing schemes to encourage 'under-occupiers' to move to smaller homes (such as the Seaside and Country Homes Scheme managed by NBHA on behalf of the London Boroughs)

Do you know of any other approaches/initiatives to help private householders to move to more 'fitting' energy efficient homes?

Lifetime homes concept

While the research team recognises that under-occupancy and fuel poverty are primarily problems of older housing, we also believe some attention should be given to the new homes that are being built.

The Joseph Rowntree Foundation has developed the Lifetime Homes concept - to encourage new housing to be designed with features that ensure it will meet the needs of most households whatever the mix of ages and mobility. The main emphasis is currently on accessibility but we want to explore the idea that this concept might also be applied to changing needs for space and warmth. This might include encouraging more flexible housing that could easily be divided.

Do you have any views on this topic?

Further information

Do you know of any other sources that would be relevant to this research?

Do you know of any other contacts that it would be useful for us to talk to?

Appendix 4 - Authors, Interviewees, Steering Group and Workshop Participants

38. Authors

Trevor Houghton MSc, is a senior consultant at CAG Consultants and is a member of the steering committee of National Right to Fuel. He has undertaken a number of major studies into fuel poverty issues including:

- Houghton, Winter and King (1997) - *Better the devil you know? The impact on low-income households of South West Gas Competition*
- Houghton, Winter and Anderson (1997) - *Gas competition - a better deal for all?*
- Anderson and Houghton (1998) - *Counting the Hidden Disconnected*

He is currently managing a major project for Office of the Deputy Prime Minister addressing the planning response to climate change.

Hugh Bown MA, an independent researcher (previously employed by BRE). Hugh is a member of the steering committee of National Right to Fuel. He was previously the Director of NBA Techtonics. He co-authored the BRE's Domestic Energy Fact File (1989, 1992). He was the principal author of the *Fuel Poverty Fact File* published by London Electricity and National Right to Fuel in April 2000.

The authors were assisted by:

- Val Smith of CAG Consultants who carried out some of the interviews and managed the project
- Alison Curtis who supplied the plans for the six example houses
- George Henderson who provided technical input on potential condensation problems in under-occupied homes

39. Interviewees

The research team is grateful for the valuable contributions from our interviewees.

The following individuals were consulted:

Sue	Adams	Director of Care and Repair England
Peter	Archer	Chair of Care and Repair England and board member of the Anchor Housing Trust
Lee	Best	Development Co-ordinator at National Energy Services (NES)
John	Buckham	Newcastle City Council - Energy Centre
John	Crowe	Independent Financial Advisor and Child Poverty Action Group
David	Eggett	Formerly Anchor Staying Put
David	Fotheringham	Chartered Institute of Housing (CIH)
Anne	Gleeson	South Gloucestershire Joint Health & Social Services planning team and former Director of Bristol Care and Repair
Professor William	Keatinge	Queen Mary and Westfield College, University of London
John	King	Chair of Safe Home Income Plans (SHIP)
Madeleine	Makarab	Cold Line, Age Concern, Hackney
Dr Noel	Olsen	Independent Public Health Practitioner
Jacky	Pett	Association for the Conservation of Energy (ACE)
Howard	Price	Chartered Institute of Environmental Health (CIEH)
Dr Janet	Rudge	University of North London and editor of *Cutting the Cost of Cold*
Dave	Steckles	Manager of Warm-up-Wearside
Richard	Wilson	Head of Policy at Help the Aged

40. Steering group

The steering group was made up of:

Alison	Curtis	Architect / Independent researcher
George	Henderson	Independent energy researcher and consultant
Gretel	Jones	Policy officer at Age Concern, England
Michael	King	Chair of the National Right to Fuel Campaign
Valerie	Smith	CAG Consultants
Lois	Temel	Administrator of the National Right to Fuel Campaign
Dr Joanne	Wade	Observer for the Eaga Partnership Charitable Trust

41. 9th July 2002 Workshop Participants

Gordon	Angus	Eaga Partnership
Paul	Bandi	Housing and Environmental Health, London Borough of Harrow
Hugh	Bown	National Right to Fuel, report author
Stephen	Boyo	Age Concern, England
Naomi	Brown	Trust Administrator, Eaga Partnership Charitable Trust
John	Chesshire	Chair, Eaga Partnership Charitable Trust
Alison	Curtis	Architect / Independent researcher
Terry	Durn	City Design, Newcastle City Council
George	Henderson	Independent energy researcher and consultant
Trevor	Houghton	CAG Consultants, report author
Gretel	Jones	Age Concern, England
Michael	King	Chair of National Right to Fuel
Madeleine	Makarab	Cold Line, Age Concern, Hackney

Nick	Merleau-Ponty	National Energy Action
Dr Noel	Olsen	Independent Public Health Practitioner
Priya	Patel	Administrator of National Right to Fuel
Jon	Pearce	Fuel Poverty Team, DEFRA
Leslie	Petrie	Department of Trade and Industry
John	Riley	Building Research Establishment
Joanne	Wade	Trustee, Eaga Partnership Charitable Trust