CENTRE FOR SUSTAINABLE ENERGY

FUEL POVERTY AND NON-TRADITIONAL CONSTRUCTIONS

Final report

Prepared for the HTT Sub-Group of the Energy Efficiency Partnership for Homes

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EXECUTIVE SUMMARY

Project Outline

The Hard-to-Treat (HTT) Sub-Group of the Energy Efficiency Partnership for Homes (EEPfH) has commissioned this research to investigate how many non-traditionally constructed homes still exist in the UK, and the risk of fuel poverty within them. Although non-traditional housing only represents around 5% to 6% of the UK's stock, a clearer picture of their distribution and thermal efficiency is essential as a basis for future research.

In addition to investigating the current prevalence of non-traditional properties in the UK and the risk of fuel poverty within them, the HTT Sub-Group also hopes that the results will help identify examples of best practice and potential case study areas.

Non-traditional properties are generally referred to as system built or pre-fabricated. These systems fall into four broad categories which refer to their wall construction, i.e. in-situ concrete (concrete poured on site but normally using pre-fabricated shuttering), precast concrete (precast panels and/or frames assembled on site), metal frame (sometimes using concrete or brick cladding) and timber frame (sometimes using concrete or brick cladding).

The UK has considerable experience of prefabrication for house construction with around 1 million dwellings constructed by such methods. The majority of these dwellings were built between the end of the World War II (WWII) and the early 1970s, as a result of the need for quick building and the replacement of housing. The range of systems and construction techniques used has been extremely varied. The Building Research Establishment (BRE) has listed over 500 systems built between 1919 and 1976[1].

The thermal efficiency of these non-traditional housing varies significantly by design. In practice, the majority of investment has occurred in those properties that were designated as potentially defective under the 1984 Housing Defects Legislation; later the Housing Act of 1985. Therefore the study has ensured that information best practice and case study information has been requested on both non-traditional housing in general and designated properties.

Methodology

The project team has utilised published datasets to identify areas with both high proportions and numbers of non-traditional houses, and to assess the thermal efficiency of properties and the risk of fuel poverty within them. The study team felt that this represented better value for money than contacting all UK local authorities.

[1] Excluding Rationalised Traditional Systems or post 1976 timber frame.

Energy efficiency and fuel poverty in non-traditional properties

The study has used data from all four national house condition surveys (HCS) to provide reasonably large samples of non-traditional housing. Unfortunately, these samples are insufficient to calculate numbers of non-traditional properties by type for each authority. However, for each nation, the data sets have been used to breakdown cases by sub-category, and where possible proprietary system. The subsequent sub-samples have been used to provide SAP ratings and fuel poverty estimates for these. The categories used match those classifications used in the England and Northern Ireland surveys.

The English (EHCS) sample enabled the team to provide reasonably representative SAP ratings for eight individual systems i.e. Wimpey nofines; Easiform; Airey; Cornish Unit; Reema; Unity; Wates; and B.I.S.F. Overall, the study has captured 76 different proprietary systems for England, comprising 13 insitu concrete, 32 precast concrete, 17 timber frame and 14 metal frame systems. In addition, the Scottish sample provides 14 named systems, 6 insitu-concrete, 2 pre-cast concrete and 6 metal frame systems, the latter including four systems not in the England sample.

Thus, in total 80 proprietary systems have been identified and the SAP ratings are provided for each system. Although these are not necessarily representative of the stock of such dwellings, they do provide an indication of the possible range of energy efficiency ratings for each system.

Once a typical range of SAP ratings was established for each sub-category of non-traditional dwelling, an assessment of fuel poverty risk was made. Fuel poverty estimates have been provided for the ‘full’, ‘basic’ and ‘residual’ income definitions, using comprehensive data on income, housing benefits and housing costs collected by the HCS.

Number and Type of non-traditional homes

CSE has compiled a database of total numbers of non-traditional housing for each local authority in the UK based on a combination of data drawn from English Housing Investment Programme (HIP) returns, the Northern Ireland Housing Executive (NIHE), existing ODPM and BRE studies, the WHCS and SHCS. The database provides total numbers of non-traditional properties, total households and where possible the numbers and proportions of those non-traditional properties designated as potentially defective.

Examples of best practice and potential case studies

The project team initially performed a desk based study to identify and collate existing case studies, guidance and best practice examples of energy efficiency solutions for different non-traditional dwelling types (e.g. existing Energy Efficiency Best Practice Publications, BRE literature and published articles in energy / technical journals).

The team used the database of non-traditional housing in the UK to identify 52 local authorities who have high levels of non-traditional properties. The number of authorities selected from each country is based on the proportions of total houses in each nation.

The team contacted the HECA and Housing teams of each area to establish what specific energy efficiency works have been undertaken to improve their non-traditional stock, the changes in thermal efficiency or fuel poverty risk as a result of these measures, and any issues associated with the works. If authorities had transferred their stock then the study contacted the ALMO (Arms Length Management Organisation) or housing association that is now responsible for the stock.

Key findings and conclusions

England

The 2001 EHCS estimated that of the total stock of 20.5 million occupied dwellings, some 1.2 million or nearly 6% were of non-masonry construction. In addition, some 230,000 or 1% of the stock are 'non-traditional' dwellings built with masonry cross-walls. Around 710,000 thousand non-masonry dwellings are houses or flats in blocks of less than 3 storeys, while the remaining 480,000 are medium or high rise flats or maisonettes. Of these non-masonry dwellings, 530,000 are of insitu concrete, 230,000 are pre-cast concrete, 360,000 are timber frame (including some 41,000 old traditional timber frame dwellings) and 70,000 have metal frames or panels.

In general, low-rise non-traditional housing is more energy efficient than traditional masonry dwellings with solid walls, but less so than traditional cavity wall housing. Of the main types of construction, non-traditional, medium and high-rise flats have the highest average SAP ratings. The very lowest SAP ratings are to be found in both low and high rise non-traditional housing as well as in traditional dwellings with solid walls. Some individual proprietary systems provide mean SAP ratings that are significantly lower than the average for traditional solid walled housing.

Excluding the oldest traditional timber frame houses and cottages (SAP 30), metal frame dwellings (45) and those built with pre-cast concrete frames (49 / 50) have the lowest average SAP rating. More modern timber frame and concrete cross-wall systems are generally the most energy efficient (i.e. 56 and 57 respectively).

Of the total of 1.72 million households in fuel poverty in 2001 on the full income definition, some 132,000 or nearly 8% were living in non-traditional dwellings, including masonry cross-wall housing. Levels of fuel poverty are higher in both low-rise (11%) and high-rise (9%) non-masonry dwellings than in masonry cavity (7%) or cross-wall housing (5%). However, the proportion of households in all fuel poverty and severe fuel poverty is highest (13% and 2%) in traditionally built (box-wall) dwellings with solid masonry walls.

Using the basic income definition substantially changes the distribution of fuel poverty across the main constructional types.[2] By this definition, fuel poverty is

[2] To define basic income, any housing benefit or income support for mortgage interest (ISMI) is excluded from the household's full income.

highest in non-traditional medium and high-rise dwellings (19%) and in non-masonry low-rise housing (16%). Traditional (box-wall) housing with solid masonry walls now comes third (15%), but still has the highest incidence of severe fuel poverty (3%). Also the lowest proportions of fuel poor households are no longer found in the masonry cross-wall systems, but in traditional housing with masonry cavity walls.

Using the residual income definition of fuel poverty, excluding housing costs, further changes its distribution across the different constructional systems. By this definition, fuel poverty remains highest in non-traditional medium and high-rise dwellings (28%), but the problem is now marginally greater in traditional solid wall housing (20%) than in low-rise non-traditional houses and flats. As with the basic income definition, fuel poverty remains least likely in traditional cavity wall housing, but the number and proportion of household defined as in fuel poverty (13%) now significantly increase, here as elsewhere.

In non-traditional and non-masonry housing, the proportion of households in fuel poverty, when measured on the full income definition, are higher in the public sector than in private housing. By this definition, around half of all fuel poor households in non-traditional housing rent from a local authority or registered social landlord.

The basic income definition shifts the problem to the public sector in all forms of housing construction, with 71% of all households in fuel poverty in non-traditional housing renting socially. For the residual income definition, rates of fuel poverty in publicly owned non-masonry low-rise housing are very similar to those for traditional masonry housing with solid walls (around 30%). The exclusion of housing costs increases rates of fuel poverty in the private sector substantially, but in non-traditional housing, these rates are still typically half of those found in the public sector.

Non-masonry low-rise dwellings house a particularly high proportion of vulnerable households (72%) and after traditional solid wall housing, have the highest proportion of such households in fuel poverty - 13%on the full income definition. With the exception of masonry cross-wall and non-traditional medium or high-rise flats, the incidence of fuel poverty in each type of construction is generally greater amongst vulnerable than non-vulnerable households.

By the basic income definition, 20% of vulnerable households in non-masonry low-rise housing are in fuel poverty. Only marginally lower rates are found amongst both vulnerable and non-vulnerable households in non-traditional medium and high-rise flats. Overall, of all the fuel poor households in non-traditional housing on the basic income definition, nearly 80% are vulnerable households.

Under the residual income definition, the risk of fuel poverty is substantially greater amongst vulnerable households than for those classed as non-vulnerable. This is true for all forms of construction with the notable exception of households in non-traditional medium and high-rise flats.

An analysis of causes of fuel poverty demonstrates that low incomes, poor energy efficiency, high fuel prices and under-occupation, often working in combination, are important causes of fuel poverty in both non-traditional and traditional housing. However, the property types that generally house the lowest income households (non-traditional medium and high-rise flats and masonry cross-wall systems) have the highest average SAP ratings. Conversely, the types with generally the highest incomes (traditional housing with solid walls) have the lowest average SAP ratings and highest proportion of particularly inefficient dwellings.

Wales

The 1998 WHCS estimated that Wales had a stock of some 64,000 non-traditional dwellings, accounting for 5.5% of the total stock of 1,157 thousand occupied dwellings. Only around 9,000 of the non-traditional dwellings are high rise blocks, but these have the highest average SAP ratings of all constructional types.

As in England, traditional solid wall masonry housing has the lowest average SAP rating (36) and one of the highest proportions of particularly inefficient properties (37%). Also as in England, non-traditional medium and high rise flats have the highest average rating (SAP 50) and the higher percentage of dwellings with SAP ratings of 65 or over (27%).

On the full income definition, the incidence of fuel poverty is highest amongst households living in non-traditional low-rise housing using metal frames or pre-cast concrete Over a half of all households are in fuel poverty in both of these system types, and in the former 11% are in severe fuel poverty. In addition, households in insitu concrete dwellings have the third highest level of fuel poverty (41%), but the largest number of fuel poor households living in non-traditional housing in Wales (over 8,000) Reflecting their relatively high energy efficiency, the non-traditional medium and high-rise flats show the lowest proportion of households in fuel poverty (23%).

Northern Ireland

In Northern Ireland, the 2001 NIHCS estimated that nearly 21,000 dwellings were of non-traditional construction. Of these under 2,000 are shown to be high rise dwellings, and although sample sizes are small these numbers are similar in magnitude to those provided by the NIHE e.g. 22,270 non-traditional properties.

Contrary to the situation in the other countries, the small NIHCS sample shows the lowest levels of energy efficiency to be amongst households in high rise concrete housing, with the highest levels occurring in the metal and timber framed housing.

In Northern Ireland, the level of fuel poverty in non-traditional housing is extremely high, 46% of all households living in such properties being fuel poor on the full income definition, including 12% in severe fuel poverty. No fewer than 87% of households in concrete high-rise blocks are shown as being fuel poor, but this figure is based on a very small sample. However, with a more significant sample, in-situ concrete low-rise houses and flats and other concrete low-rise systems also show over half of their households in fuel poverty and high levels of severe fuel poverty.

Using the basic income definition, has little affect on the already large proportion of households in concrete high rise flats recorded as being in fuel poverty, but does put nearly half of these into severe fuel poverty. However, fuel poverty levels increase in pre-cast concrete low-rise systems, putting these into the second position behind non-traditional high-rise blocks.

Unlike the situation in England and Wales, no fuel poverty variable or data on housing costs is available from the 2001 NIHCS to be able to estimate fuel poverty levels on the residual income definition.

Scotland

For Scotland, comparable estimates for the total number of non-traditional dwellings are not available. The 2002 SHCS sample is limited to a sample of 81 mainly low rise insitu and precast concrete and metal frame dwellings, representing just over 9,000 system-built homes.

The in-situ concrete systems have the lowest average SAP ratings (49) and highest proportion of particularly inefficient dwellings (22%), these figures being similar to those found in England., The pre-cast concrete systems have a slightly higher average (SAP 52) and again this is broadly comparable with the averages found in similar dwellings in England, although in Scotland having a lower proportion of inefficient dwellings – and based on a much smaller sample.

Easily the most efficient properties are the metal framed systems with an average SAP rating of 71, no dwellings below 35 and 83% with ratings over 65. These are substantially better than the equivalent dwellings in England and, despite the small sample, suggest that they have been subject to a comprehensive improvement programme.

Reflecting their energy efficiency, the highest levels of fuel poverty are recorded in the in-situ concrete and pre-cast concrete housing, with no fuel poor households appearing in the small Scottish sample of metal frame dwelling. However, only one Scottish fuel poverty variable is currently available to the project team.

Identification of potential case studies

The survey of potential authorities demonstrated that non-traditional property data were not exclusive to a single job role, meaning that enquiries were often passed through several positions and departments. Respondents that were unable to contribute to the project identified a number of reasons for this e.g. a lack of people resources, limited or no knowledge of storage methods for historical data, and the time constraints faced when accessing data that pre-dates electronic storage.

Significant levels of improvement works have been and continue to be carried out on all non-traditional stock, with typical measures including; external wall insulation or new replacement brick cavity walls, loft insulation, central heating and new kitchens and bathrooms. Findings suggest that good practice would require stock owners to thermally improve the walls through external cladding or replacement, insulate roof or loft spaces and replace inefficient central heating.

An average cost of £10,000 provides a good indication of expenditure required per property for the works described above. However, the responses have shown that costs can be significantly higher when structural work is required to improve or replace walls.

The study would recommend that future case study research only contact those local authorities that provided details of measures implemented and SAP improvements. The team feels that future research to develop case studies for non-traditional housing should also utilise the data contained in the HCSs. This research should produce HCS case studies for the most prevalent proprietary systems with the high incidences of fuel poverty.

FUEL POVERTY AND NON-TRADITIONAL CONSTRUCTIONS

1 INTRODUCTION

Non-traditional properties are generally referred to as system built or pre-fabricated. These systems fall into four broad categories which refer to their wall construction, i.e. in-situ concrete (concrete poured on site but normally using pre-fabricated shuttering), precast concrete (precast panels and/or frames assembled on site), metal frame (sometimes using concrete or brick cladding) and timber frame (sometimes using concrete or brick cladding).

Although there are earlier examples of system built housing, its use was pioneered after World War I. This was due to the need for quick building and replacement of housing and led to the development and use of pre-fabricated systems. However, the majority of non-traditional housing was built between the end of the World War II and the early 1970s.

The end of WWII led to an even larger demand for the rapid construction of new dwellings. In addition to the need to rebuild homes damaged during the war, the Government had set out objectives in a 1945 White Paper to provide a separate dwelling for any family that wanted one, and to finish the slum clearance programme that had started before WWII.

This study aims to investigate the prevalence of fuel poverty in non-traditional properties and the issues faced in improving these dwellings. The thermal efficiency of these properties varies significantly by design, and as such one may assume that the most inefficient properties were improved first.

Some systems were designated as potentially defective under the 1984 Housing Defects Legislation, which was subsequently incorporated into the Housing Act of 1985. Appendix I lists those non-traditional properties designated under the Act. In practice, the majority of investment has occurred in these properties. Therefore the study methodology has ensured that those local authorities contacted were asked for information concerning both non-traditional housing in general and designated properties.

In the concrete systems, the majority of problems occur because of either the carbonation of concrete or the presence of chlorides in the concrete. This often results in the corrosion of steel reinforcement and subsequent cracking and spalling of the concrete. The issue of carbonation is exacerbated in many of these systems by the slenderness of many of the components, which offers comparatively little cover to the reinforcement.

Following the Acts introduction, the Government introduced Defective Housing grants to remediate those properties designated defective. These grants were available until 1999, but in reality many local authorities are still performing work on these properties.

Although those designated as potentially defective are not necessarily the most thermally inefficient, their performance is poor and often regarded as amongst the worst displayed by system built housing. Concrete has an extremely low thermal resisitivity, and therefore both defective and non-defective dwellings with concrete wall construction have poor U-values. The poor thermal performance of concrete and often non-cavity design of walls results in low SAP values and high running costs.

The UK has considerable experience of prefabrication for house construction with around 1 million dwellings constructed by such methods. The range of systems and construction techniques used has been extremely varied. The Building Research Establishment (BRE) has listed over 500 systems built between 1919 and 1976, excluding Rationalised Traditional Systems or post 1976 timber frame.

Table 1.1: Number of Non-traditional Dwellings constructed[3]

System	**Approx number built**	**Length of time in production**
Wimpey No-fines (cast in-situ concrete)	300,000	30
Easiform (cast insitu concrete)	90,000	50 – 60
The BISF (steel framed) units over 6 yrs	35,000	6
B1 Aluminium bungalows	55,000	4
B2 Aluminium bungalows	14,000	4
Cornish Units (pre-cast concrete) Types 1 & 2	30,000	20
Airey (pre-cast concrete)	26,000	20
Reema Hollow Panel (pre-cast concrete)	17,600	20
Wates (pre-cast concrete)	22,000	10
Trusteel Mk II steel framed houses	20,000	20
Trusteel 3M steel framed houses	17,000	10
Unity (pre-cast concrete) - Types 1 and 2	19,000	10
Frameform (timber frame)	13,000	10
Quickbuild (timber frame)	12,000	10

Although originally largely built for local authorities, the determination of the prevalence and distribution of non-traditional properties has been complicated by the introduction of ‘Right to Buy’ legislation and voluntary stock transfer. This has resulted in large numbers of non-traditional houses being now privately owned or managed by a third party.

2. AIMS AND OBJECTIVES

The Hard-to-Treat Sub-Group of the Energy Efficiency Partnership for Homes (EEPfH) has commissioned this research to investigate how many non-traditionally constructed homes still exist in the UK, and the risk of fuel poverty within them. Although non-traditional housing only represents around 5% to 6% of the UK’s stock, a clearer picture of their distribution and thermal efficiency is essential as a basis for future research.

The group hopes that the results will also help identify best practice and develop case studies for local authorities, registered social landlords and home owners.

[3] Non-traditional housing in the UK – A brief review, BRE & of Council Mortgage Lenders 2002

In particular the study aims to:

- Provide average SAP ratings (where data exists) for each non-traditionally constructed dwelling type.
- Report on the risk of fuel poverty in each non-traditionally constructed dwelling type.
- Identify those local authorities with the highest prevalence of non-traditional housing in the UK, and investigate the energy efficiency measures that have typically been installed.
- Identify best practice examples of how the energy efficiency performance of these dwellings has been improved and highlight examples for future case studies.

Multi-storey dwellings were not specifically covered as part of this research; however, the report includes analysis for medium and high-rise flats. The Association for the Conservation of Energy (ACE) are currently conducting a pan-European study examining fuel poverty in high rise properties. The results of this study are to be published in May 2005 and will help provide a broader evidence base for future research.

3 METHODOLOGY

The tender submitted by CSE proposed a slight adaptation to the original methodology set out in the Request for Quotation. The methodology proposed by CSE has utilised published datasets to identify local authorities with both high proportions and numbers of non-traditional houses. The study team felt that this represented better value for money than contacting all UK local authorities routinely.

If the study had requested data from all local authorities there would have been no guarantee that the data had been collated in a standardized way, with many simply recording the total number of non-traditional homes (irrespective of type).It is likely, therefore, that the resulting data would have been inconsistent (in terms of local survey methodologies and different categorisations applied). While some local authorities will undoubtedly be able to provide relevant detailed information, the team felt that this approach would not provide much better data overall than the existing Housing Investment Programme (HIP) returns. These already provide details of the number of Housing Defect Act designated dwellings broken down by tenure, and for the local authority’s own stock, the number of all non-traditional dwellings broken by age, property type (i.e. houses or flats) and storey height.

The study has utilised the following existing databases and reports to model and map energy efficiency and fuel poverty in non-traditional housing.

- the latest available EHCS, SHCS, WHCS and NIHCS datasets;
- the Housing Investment Programme (HIP) returns;
- local house condition surveys data supplied by case study authorities;
- reports on the refurbishment of non-traditional housing;
- the BRE programme on non-traditional housing; and
- answers in Hansard on the number of dwellings of each proprietary type.

The study has used the data from all four UK HCSs in the UK (HCS) and most of these provide reasonably large samples of non-traditional housing. These datasets have been used to breakdown non-traditional housing by type, and provide SAP ratings and fuel poverty estimates for each type.

Although the samples are often only sufficiently large enough to provide estimates at national level, the EHCS data can be used in conjunction with the HIP returns and other data to model estimates for each local authority area. The Welsh, Scottish and Northern Ireland House Condition Surveys already provide some estimates for non-traditional housing in each local authority area.

3.1. Compilation of data covering the type and number of non-traditional homes

CSE has compiled a database of non-traditional housing in the UK based on a combination of data drawn from English HIP returns, existing ODPM and BRE studies, the English House Condition Survey (EHCS), and the equivalent Welsh, Scottish and Northern Ireland House Condition Surveys

The database provides total numbers of non-traditional properties, total households and where possible the numbers and proportions of those non-traditional properties designated as potentially defective. The original survey methodology planned to identify numbers of non-traditional properties by sub-category. These main categories match those classifications used in the EHCS and NIHCS:

- Concrete/Boxwall/In-situ
- Concrete/Boxwall/Precast <1m
- Concrete/Boxwall/Precast >1m
- Concrete/Crosswall/In-situ
- Concrete/Crosswall/Precast panel
- Concrete/Frame/In-situ
- Concrete/Frame/Precast
- Timber/Frame/Post 1919
- Metal/Frame

Unfortunately the sample size achieved has not been sufficient to allow the survey team to produce total numbers of non-traditional properties by sub-category at a local authority level. However, the HCS datasets have enabled the team to examine fuel poverty levels within sub-category and region.

The survey team originally planned to use a previous study performed by the DTI and the BRE in the 1980s which detailed numbers on non-traditional properties by type. The team could have used these numbers as a baseline and then updated them for each authority based on HCSs, numbers provided by case study authorities and national trends, i.e. where HCS and authority data was unavailable.

However, despite several requests the survey team was unable to obtain this data set from the ODPM. The team was disappointed by the failure of the ODPM to provide this information.

The survey employed individual methodologies to produce the datasets for each country and these have been summarised separately. Although the study has commented on fuel poverty in medium and high rise properties, the focus is on fuel poverty in low rise non-traditional dwellings. Thus the completed datasets give numbers for all non-traditional houses and flats with 1 to 2 floors.

English Authorities

The survey team downloaded a copy of the 2000 Housing Investment Programme returns for England from the ODPM website. The team requested a more up to date version from the ODPM, as a number of properties would have changed tenure through demolition, 'Right to Buy' or stock transfer since 2000. However, the ODPM were unwilling to provide a more up to date version.

As stated previously the HIP returns for English authorities provide total numbers of defective properties by tenure and local authority non-traditional properties by age band[4] and built form i.e. house, flat 1 to 2 floors and flat 3 to 5 floors. The HIP data provides relatively complete coverage for authorities, with only 5% of authorities failing to provide numbers of defective properties and 10% failing to provide numbers of non-traditional properties.

Welsh Authorities

Unfortunately the team has not been able to obtain a comparable database for Wales to that produced by the ODPM from Housing Investment Programme returns. The survey team used the 1997/98 WHCS to calculate the number and proportion of non-traditional homes for each of the 22 unitary authorities in Wales.

The WHCS categorises the building method as 'traditional; probably traditional; probably non-traditional; and non-traditional'. The team recoded these four categories into traditional / probably traditional; and non-traditional / probably non-traditional. The category concerning non-traditional dwellings was then split into purpose built non-traditional flats of 3 storeys and above and all other non-traditional dwellings. The WHCS contained 674 cases where the property was listed as non-traditional and a further 20 that were probably non-traditional.

For the purpose of the study the team has assumed that the Welsh data for all other non-traditional dwellings and low rise flats is broadly compatible with the numbers and percentages provided by the 2000 HIP dataset for English authorities.

[4] Age Bands - pre 1945, 1945-1964, 1965-1974 and post 1974

Scottish Authorities

The team has not been able to obtain a database of non-traditional properties by authority for Scotland. Thus total figures for non-traditional properties have been calculated from the 2002 SHCS data supplied by Communities Scotland.

Unfortunately, the Scottish totals do not include numbers for timber framed non-traditional properties. The SHCS does not ask surveyors to identify a property as traditional or non-traditional, with the subsequent response for non-traditional split by category. However, the Scottish data does ask surveyors to identify wall type as timber framed, metal framed, concrete, solid or other.

In order to identify non-traditional properties in Scotland the team requested photographs of all properties listed by the surveyor as constructed using metal frame or concrete. The inclusion of timber frame would have required Communities Scotland to provide thousands of pictures of properties which on 99% of occasions would have been traditional.

The SHCS sample used by the survey team to produce total numbers of non-traditional houses by authorities contained only 81 records. The data sample did not provide enough records to produce estimates of total numbers of non-traditional properties for all authorities, and those estimates do not include timber framed proprietary systems. The numbers calculated are based on the SHCS data and the ‘pweights’ and ‘sweights’ grossing fractions for the physical and social surveys.

The sample size for Scotland is small due to the survey methodology which does not allow users to easily select those that may be non-traditional. The failure of the HCS to ask surveyors if a system is traditional or non-traditional, means that wall type is the only potential method of selecting non-traditional housing.

Northern Ireland

Northern Ireland’s property stock is managed by the Northern Ireland Housing Executive (NIHE). The study team contacted the NIHE who were able to supply total numbers of non-traditional properties by main constructional types. The executive is currently reviewing total numbers of non-traditional properties, and plans to begin examining the state of these dwellings in terms of repair and thermal efficiency. The NIHE may therefore be a potential partner for future research.

3.2. Assessment of the risk of fuel poverty in each category of non-traditional dwelling

As stated previously, the HCS sample sizes were insufficient to calculate numbers of non-traditional properties by type for each authority. However, the HCS data has enabled the team to examine representative SAP ratings and fuel poverty for the most common proprietary systems.

In order to examine SAP and fuel poverty characteristics the team had to investigate the HCS data in more depth. The team had to examine each country's HCS to classify records by sub-category and where possible proprietary system. The following methodology details the process for each country.

Data Collection

England

The survey team visited the ODPM's offices in order to obtain data from the 2001 EHCS. The project team queried the EHCS to identify all records where the surveyor had answered 'yes' or 'unsure' when asked if the dwelling was a proprietary system. The team also included those records where a non-masonry wall type had been specified but the proprietary system question was left blank.

The team then spent four days examining each record's survey form and photographs to identify the property as traditional or non-traditional, and, for the majority of cases name the system. The BRE book and CD 'Identifying non-traditional houses in the UK 1918-75' (BRE 2005) was used to identify properties. Although this exercise went beyond the original scope of the proposed methodology, the increased sample set produced allowed the team to produce SAP and fuel poverty estimates for a much broader range of systems.

The 2001 EHCS asks surveyors to identify ten generic types of non-masonry housing, to say whether a proprietary system was used and to name the system where known. The surveyors identified nearly 1,300 of the sample addresses as non-masonry construction, recorded 423 as proprietary systems (being unsure about a further 518), but only named just over 300 cases that typically referred to common or easily identifiable systems e.g.. Wimpey No Fines, Cornish Units or BISF Steel Framed. None of these names had yet been coded by the EHCS team.

The in depth review of EHCS data identified 490 dwellings constructed in 76 different named systems, 143 non-traditional properties that are non-proprietary, 168 low rise flats (3 to 5 floors) and 200 high rise flats. The data for all non-traditional properties that are non-proprietary has been classified and analysed by sub-category i.e. Steel Framed, Concrete/Boxwall/In-situ etc.

The in-depth analysis of the EHCS data also allowed the study team to identify the measures that had been applied to non-traditional properties. For example, the images were studied to identify if; walls had been re-rendered; walls had been replaced with a brick cavity; windows had been double glazed; extensions had been added; porches had been added; a new roof had been added; or the walls had been over clad externally. This information has been used in conjunction with the original survey data on heating systems and insulation standards, to determine whether each sample dwelling was 'un-modernised' or 'modernised'.

Where the proprietary system sample size is sufficient, the identification of improvements made has enabled the project team to investigate their effects upon SAP ratings and fuel poverty levels. These findings are of particular importance for the identification of best practice for the improvement of non-traditional properties.

Scotland

During the process of reviewing the SHCS survey photographs to identify numbers of non-traditional houses the team classified the records by proprietary system and sub-category. As with the analysis of EHCS data, the review identified improvements made to enable the investigation of their effects on thermal efficiency and affordable warmth.

Wales

Unfortunately the 1997/98 WHCS did not hold sufficient survey documentation to allow the team to identify individual proprietary system. The WHCS survey does not specifically ask surveyors to name the system, and any photographs taken are not accessible electronically. However, the WHCS data on the material used for the wall structure has been used in conjunction with the one specific question on traditional/non-tradition construction to categorise the stock. The data has then been analysed at sub-category level to produce national SAP and fuel poverty estimates.

Northern Ireland

The NIHCS team reviewed their own data to identify non-traditional properties and where possible name proprietary systems. The NIHCS is similar to the EHCS in that the survey questionnaire asks surveyors if the property is traditional or non-traditional, to classify it by sub-category and to name the proprietary system if possible.

3.3 SAP Ratings

The energy efficiency of a house or flat is normally indicated by giving it an 'energy rating' and for the national house condition surveys, the rating system used is the Government's Standard Assessment Procedure (SAP). The SAP rating is a measurement of the annual unit cost of heating a home to a standard heating regime and depends on two main factors:

- the rate of heat loss due to the dwelling form, thermal properties of the building fabric, standard of insulation and level of ventilation; and
- the cost of supplying the lost heat resulting from the inefficiency of the heating system, the price of the particular fuel used and any solar gain.

The SAP rating is measured on a logarithmic scale and, in the 2001 version, normally runs from 1 for highly inefficient homes to 120 for highly efficient ones. However, the calculations which derive the rating can, in extreme cases, result in ratings outside this range. Applied to the EHCS sample, this produces a significant number of homes with SAP ratings below 1. In practice, when issuing SAP ratings, such values would be reset to the scale limits. However, in this Report, as in the EHCS Energy Reports, all values below 1 (or any above 120) have been retained so as not to distort the SAP averages and distribution profiles.

The national house condition surveys provide accurate estimates of the distribution of SAP ratings of non-traditional housing and these estimates have been used to calculate a typical range of SAP calculations for each proprietary system. The ranges presented distinguish between un-modernised and modernised dwellings. In order to produce these ratings, the team made a standard set of assumptions relating to the level of modernisation and based particularly on the efficiency of the heating system and level of applied wall insulation.

Where sample sizes are sufficient, the data has been grossed to the national household totals. This process excludes a significant number of vacant dwellings, but as some of these will be awaiting demolition or refurbishment, and fuel poverty estimates are, by definition, only available for occupied homes, it was decided – in a report focussing on fuel poverty - to confine all estimates to household numbers. The only exceptions to this are the tables giving SAP estimates for all propriety systems where the total un-grossed samples are used, including vacant dwellings.

The 2001 EHCS sample has enabled the team to provide reasonably representative SAP ratings for eight individual systems which, with their household sample sizes in brackets are; Wimpey nofines (142); Easiform (25); Airey (21); Cornish Unit (49); Reema (21); Unity (17); Wates (23); and B.I.S.F. (27).

The next largest household sample size was for Orlit houses with 10 cases, however, the team felt this insufficient to produce representative results. The results for proprietary systems with small sample sizes have been grouped by generic type and used in the calculation of an overall range of ratings by sub-category i.e. unimproved and improved.

The study has captured 76 different proprietary systems for England, comprising 14 insitu concrete, 32 precast concrete, 17 timber frame and 14 metal frame systems. In addition, the Scottish sample provides 14 named systems, 6 insitu-concrete, 2 pre-cast concrete and 6 metal frame systems, the latter including four systems not in the England sample. Thus, in total, 80 proprietary systems have been identified and the SAP ratings are provided for each system.

Although these are not necessarily representative of the stock of such dwellings, they do provide an indication of the possible SAP ratings for each system. The survey has not calculated SAP ratings for all 500 known proprietary systems; however, these 76 systems cover all of the most common systems identified by both the BRE and CML report (BRE and CML 2002) and ‘Non-traditional houses’ (BRE 2005).

3.4. Assess the risk of fuel poverty in each category of non-traditional dwelling

Once a typical range of SAP ratings was established for each sub-category of non-traditional dwelling, the total fuel costs required to heat, light and power each dwelling type to an adequate standard (based on standard assumptions for different heating regimes used in the calculation of fuel poverty) was analysed. This assumed average lighting and power loads, and based on BREDEM-12, corrected for the higher heating load associated with a northerly exposed location.

An assessment of fuel poverty risk was then made using comprehensive data on income, housing benefits and housing costs collected by the HCS. The range of variables and assumptions associated with the calculation of fuel poverty risk is wide. However, as with the SAP ratings, the fuel poverty estimates should, subject to the warnings given with respect to sample sizes, be at least as reliable as the official estimates of fuel poverty numbers (i.e. those produced using the national HCS).

Definitions of Fuel Poverty

The first two definitions of fuel poverty used in the analysis are the same as those used for England in the UK Fuel Poverty Strategy. A household is deemed to be in fuel poverty if, in order to maintain a satisfactory heating regime and cover other normal fuel costs, it would be required to spend more than 10% of its net income on fuel:

1. including housing benefit (the ‘full’ income definition) [5] ; and
2. excluding housing benefit (the ‘basic’ income definition).

In addition, estimates for fuel poverty are given for residual income, calculated as full net income minus housing costs. Fuel poverty, unlike general poverty, is specific to a household’s existing home, therefore this definition better reflects the amount of disposable income that households actually have to spend on fuel. However, none of these specified incomes have been equivalised to compensate for household size and composition.

Under each definition, households are considered to be in ‘moderate’ fuel poverty if their fuel costs exceed 10% but not 15% of their income, in ‘serious’ fuel poverty if these costs exceed 15% but not 20%, and in ‘severe’ fuel poverty if their fuel costs are more than 20% of household income.

[5] In England, Income Support for Mortgage Interest is also included but for Wales is ignored in the definitions, the number of such payments being extremely small.

3.5. Research the energy efficiency solutions that have been applied and identify best practice examples

Previous Research

The project team performed a desk based study to identify and collate existing case studies, guidance and best practice examples of energy efficiency solutions for different non-traditional dwelling types (e.g. existing Energy Efficiency Best Practice Publications, BRE literature and published articles in energy / technical journals).

The research review demonstrated that the information published to date details the physical construction methodology employed, system defects and the possible remedial work required as a result of these defects. The BRE has published over 80 reports covering the identification and structural condition of different proprietary systems.

These reports were commissioned by the government in the 1980's and were instrumental in the identification of those houses to be designated as potentially defective. Although publicly funded, the project team had to purchase a CD containing these reports at considerable cost.

Best Practice and Potential Case Studies

The study contacted local authorities to identify the energy efficiency measures that have been applied to non-traditional properties, and highlight potential best practice examples and case studies. The team used the database of non-traditional housing in the UK to identify 52 local authorities who have high levels of non-traditional properties. The number of authorities selected from each country is based on the proportions of total houses in each nation.

The study used prevalence of defective housing to select those English authorities to be surveyed, as authorities are more likely to hold information concerning these properties i.e. they have or had (pre-stock transfer) an obligation to improve them. The study selected 40 authorities based on sheer quantity of defective stock and also by proportion to ensure smaller and more rural authorities were represented.

Unfortunately, the Welsh and Scottish datasets only provide total numbers of non-traditional housing. The study therefore selected 4 Welsh and 7 Scottish authorities based on quantity and proportion of non-traditional stock. Northern Ireland has a single housing authority and therefore the study contacted the housing executive.

Local Authorities Selected

England	Leicester	Wolverhampton	Mid Devon	Hull
	North Hertfordshire	Wakefield	Ellesmere Port and Neston	Harlow
	North East Derbyshire	Southampton	Runnymede	Birmingham
	Bristol	Carrick	Tamworth	Oxford
	Worcester	Leeds	Darlington	Blackburn with Darwen
	Herefordshire	Reading	Cannock Chase	Newcastle upon Tyne
	Restormel	Barnsley	Chesterfield	Nuneaton and Bedworth
	Salisbury	North Cornwall	South Gloucestershire	Bradford
	Taunton Deane	Slough	Telford & Wrekin	Nottingham City
	Plymouth	Liverpool	Sheffield	Rugby
Wales	Newport	Torfaen	Caerphilly	Bridgend
Scotland	Highland	Falkirk	Midlothian	Moray
	West Lothian	Dumfries & Galloway	East Lothian	

The team contacted the HECA and Housing teams of each authority to establish what specific energy efficiency works have been undertaken to improve their non-traditional stock and any issues associated with the works. If authorities had transferred their stock then the study contacted the ALMO (Arms Length Management Organisation) or housing association that is now responsible for the stock.

The team asked authorities to provide information regarding:

- approximate total numbers of non-traditional properties for private sector and local authority / stock transfer housing (preferably by type e.g. Airey, Cornish Units, Unity, Wimpey no-fines).
- the proportion of these have been improved, and what (if any) the plans are for improving those still unimproved (how long this will take etc).
- τhe energy efficiency works that have been undertaken to improve them.
- if known, the average SAP or NHER rating before and after these works.
- τhe average cost of these works per unit and any issues associated with these works.

The team used BRE's records (BRE 2005) to provide authorities with a list of those proprietary systems built in their area, and those systems designated as defective. The team felt that the identification of systems present would help surveyed authorities collate data.

4 RESULTS

The original methodology planned to amalgamate the national HCS to create a larger dataset for analysis. However, this has not been possible due to the nature of the devolved administrations fuel poverty and housing policies, and resulting differences in the definitions of fuel poverty and incompatibility of the data collected. For example, the separate HCS use different SAP methodologies, England (SAP 2001), Wales (SAP 1998), Scotland (SAP 1998) and Northern Ireland a modified version of SAP 2001 designed to account for higher prevalence of solid fuel heating.

Compared to SAP 1998, SAP 2001 gives smaller dwellings a higher SAP rating and larger dwellings a lower rating. SAP 2001 also has a standard range of 1 to 120, compared to the 1 to 100 normally used in SAP 1998. These and other differences, including the use of different fuel prices, produce significantly different average SAP rating. For example, the same one bedroom dwellings surveyed in both the 1996 and 2001 EHCS had an average rating of 40.5 in 1996 using SAP 1998, but 51.2 in 1996 using SAP 2001.

The datasets collated for Wales, Northern Ireland and Scotland are also significantly smaller than that produced for England. This is in part due to the smaller size of these studies, and in Scotland's case the survey methodology. The study has therefore analysed the findings from the national HCS separately, with a more in depth examination for the larger and more detailed EHCS sample.

4.1.1 The EHCS non-traditional housing stock

For the analysis of non-traditional housing, four main variables are used that provide increasing amounts of detail. The first variable provides a comparison between all non-traditional and all traditionally constructed housing. Here, the non-masonry systems have been categorised into just two types, (1) low rise housing comprising all houses and flat blocks below three storeys, which includes the older proprietary systems, and (2) medium and high rise flats in blocks of 3 storeys or more. These are then compared with three categories of masonry construction, traditional housing with either (3) solid or (4) cavity walls, and 'non-traditional' housing built with (5) masonry cross-walls.

The second variable categorises all non-masonry systems into ten generic types. As well as giving the main wall material used – concrete, timber or metal - this variable categorises the predominant concrete systems into three main types:

- box-wall construction, where all external and party walls are structural
- cross wall construction where just the party and flank walls are structural, the front and rear external walls often being of lighter materials; and
- frame construction, where the walls between the frames are non-structural.

The concrete systems are also sub-divided between in-situ concrete and pre-cast concrete construction, while the timber frame systems are categorised by age to distinguish the more modern systems from old 'traditional' timber framed houses and cottages.

The third and fourth non-traditional housing variables cover the 76 proprietary non-traditional housing systems and types recorded in the 2001 EHCS sample. In the third variable, the eight named systems with the largest sample sizes are listed separately, while the proprietary systems with small samples, often in single figures, are grouped by generic type. Some systems, such as Cornish Unit, include more than one version, but all versions have been combined in this variable to increase sample sizes. In the fourth variable, however, the named systems including their various versions are listed separately for all 13 in-situ concrete, 32 pre-cast concrete, 17 timber frame and 14 metal frame proprietary systems recorded in the 2001 EHCS.

Numbers and distribution

In 2001, the English House Condition Survey (EHCS) estimated that of the total stock of 20.5 million dwellings in England, over 1.4 million were of 'non-traditional' construction. Of these, the walls or frame was constructed of insitu-concrete in nearly 530,000 cases and of pre-cast concrete in a further 230,000 dwellings. Timber frame housing accounted for over 360,000 of the total, although these included some 41,000 traditional timber frame houses built before 1919, while the remaining 70,000 had metal walls or frames. In addition to these non-masonry dwellings, there were over 230,000 'non-traditional' dwellings built with masonry cross-walls.

Regional Distribution

As shown in Table 4.1, the number and distribution of the main types varies significantly by region. The South West has the highest proportion of low-rise non-masonry systems (6%), but the South East comes second and with its larger total stock has a greater number of such dwellings (174,000). By contrast, London has the lowest proportion of such systems, but both the highest proportion (8%) and number (251,000) of non-masonry high-rise dwellings and masonry cross-wall systems (3% & 87,000).

Table 4.1: Main types of construction by Government Office Region

Row percentages/thousand households

Government regions	Non-masonry		masonry	masonry box-wall		Thous.
	low rise	**hi rise**	**crosswall**	**solid**	**cavity**	**hholds**
North East	2.7	0.9	1.4	11.9	83.1	1,036
Yorkshire & Humberside	2.8	1.2	1.1	25.4	69.5	2,118
North West & Merseyside	2.3	1.0	0.7	21.9	74.1	2,800
East Midlands	3.5	0.7	0.5	26.3	68.9	1,789
West Midlands	3.5	2.2	1.2	27.7	65.3	2,088
South West	6.2	1.0	0.4	23.8	68.6	2,062
Eastern	4.0	1.1	0.9	20.7	73.3	2,280
South East	5.2	1.8	0.8	17.2	74.9	3,343
London	1.2	8.4	2.9	51.6	35.9	2,993
All occupied dwellings	**3.5**	**2.3**	**1.1**	**26.4**	**66.7**	**20,510**

Dwelling types

Table 4.2 provides a more detailed breakdown of the constructional types by type of dwelling. As in the previous table, low and high rise is used here to denote flat blocks of less than three and of three or more storeys to indicate the proprietary systems.

The Table shows that the concrete box-wall systems and particularly, the timber frame and metal systems have been used predominantly in the construction of houses, a substantial proportion of the latter two groups being detached houses and bungalows. In contrast, in-situ concrete frame construction and the concrete cross-wall systems, both in-situ and pre-cast, have been used mainly in the construction of medium and high rise flats.

Table 4.2: Main types of masonry and non-masonry construction by dwelling type

Construction Type	Terraced house	Semi-detach	Detached house	low-rise flat	hi-rise flat	Thous. hholds
Masonry/Boxwall/Solid	46.3	23.9	13.0	5.3	11.4	5,411
Masonry/Boxwall/Cavity	23.5	35.7	24.8	9.1	6.9	13,672
Masonry/Crosswall	36.9	12.5	3.2	3.6	43.9	234
Concrete/Boxwall/In-situ	32.3	26.9		8.1	32.7	186
Concrete/Boxwall/Precast <1m	23.4	38.9	6.3	15.1	16.3	63
Concrete/Boxwall/Precast >1m	36.7	23.6	3.2	2.8	33.7	69
Concrete/Crosswall/In-situ	14.2	3.2		2.6	80.0	97
Concrete/Croswall/PC panel	9.4	18.5		5.1	67.0	46
Concrete/Frame/In-situ	4.9	2.3		3.3	89.5	245
Concrete/Frame/Precast	19.9	23.7		9.1	47.2	54
Timber/Frame/Pre 1919	14.9	9.7	71.9	3.5		41
Timber/Frame/Post 1919	33.6	10.7	45.0	4.0	6.7	321
Metal/Frame	8.0	39.7	38.0		14.2	72
All occupied dwellings	**29.6**	**31.2**	**21.0**	**7.8**	**10.4**	**20,510**

Dwelling Age

Table 4.4 shows there are significant differences in the age distribution of the housing between the different forms of non-masonry and non-traditional construction. Excluding the traditional timber-framed houses, the oldest non-masonry systems are generally the in-situ concrete box-wall systems and the pre-cast concrete systems using smaller panels (under 1 metre wide). Around 70% of these types were built before 1965, with a significant proportion dating from the inter-war years. Around 63% of the pre-cast concrete frame systems and metal systems were also built before 1965. In contrast, 71% of the masonry cross-wall systems, 63% of the insitu-concrete cross-wall types and no fewer than 91% of the post 1919 timber framed dwellings were built after 1964, nearly 60% of the latter being post 1980.

Table 4.3: Age of main types of masonry and non-masonry construction

Construction Type	Pre 1919	1919-1944	1945-1964	1965-1980	Post 1980	Thous. hholds
Masonry/Boxwall/Solid	66.3	27.6	4.7	0.8	0.6	5,411
Masonry/Boxwall/Cavity	4.2	15.3	26.6	28.1	25.8	13,672
Masonry/Crosswall		1.0	27.6	66.5	4.9	234
Concrete/Boxwall/In-situ	1.5	8.6	57.1	28.6	4.1	186
Concrete/Boxwall/Precast <1m		5.4	67.1	27.5		63
Concrete/Boxwall/Precast >1m		3.5	46.2	49.8	0.6	69
Concrete/Crosswall/In-situ			37.4	55.3	7.3	97
Concrete/Croswall/PC panel		1.7	55.6	42.7		46
Concrete/Frame/In-situ		1.9	44.0	45.6	8.5	245
Concrete/Frame/Precast		6.9	55.7	37.4		54
Timber/Frame/Pre 1919	100.0					41
Timber/Frame/Post 1919		3.2	6.1	31.1	59.6	321
Metal/Frame	0.9	9.3	52.6	12.5	24.7	72
All occupied dwellings	**20.5**	**17.8**	**21.4**	**21.8**	**18.6**	20,510

Tenure

With the exception of modern timber-framed construction and to a lesser extent masonry cross-wall building, non-traditional construction was generally much more commonly used in public sector house-building than by private house builders. However, following the 'Right to Buy' programme, a significant proportion of non-traditional housing is now privately owned. Of the non-masonry systems, over half the stock of metal framed housing (48%) is now in private ownership, as is some 45% of in-situ concrete box-wall housing. In contrast, three quarters or more of dwellings built using pre-cast concrete frame and large-panels (precast >1m) remain in the public sector. (Table 4.4)

Table 4.4: Age of main types of masonry and non-masonry construction

Construction Type	Owner occupied	Private rented	Local authority	Rg. social landlord	Thous. hholds
Masonry/Boxwall/Solid	73.5	18.3	4.9	3.3	5,411
Masonry/Boxwall/Cavity	72.1	6.7	13.8	7.5	13,672
Masonry/Crosswall	48.6	12.2	31.6	7.6	234
Concrete/Boxwall/In-situ	45.2	2.1	41.9	10.8	186
Concrete/Boxwall/Precast <1m	30.2	5.0	49.9	14.8	63
Concrete/Boxwall/Precast >1m	18.2	7.0	66.6	8.1	69
Concrete/Crosswall/In-situ	25.0	4.8	61.5	8.7	97
Concrete/Croswall/PC panel	22.9	4.7	66.2	6.2	46
Concrete/Frame/In-situ	27.7	8.4	55.4	8.6	245
Concrete/Frame/Precast	22.3	0.7	66.5	10.5	54
Timber/Frame/Pre 1919	78.5	20.2		1.3	41
Timber/Frame/Post 1919	75.1	8.1	7.5	9.3	321
Metal/Frame	47.6	6.5	35.7	10.2	72
All occupied dwellings	**70.6**	**9.8**	**13.1**	**6.5**	**20,510**

The 2001 EHCS estimates that of the 1.2 million non-masonry built dwellings, over 400,000 are proprietary (excluding the systems used on medium and high-rise housing). Of these, over 110,000 were built using the Wimpey no-fines system and around 40,000 using other similar no-fines concrete systems. However, with the possible exception of the precast concrete houses built in the Cornish Unit system, where well over 32,000 dwellings are recorded nationally, none of the other proprietary systems have a sufficiently large EHCS sample to provide accurate individual estimates of prevalence.

4.1.2 Energy efficiency of non-traditional housing

This section analyses the energy efficiency of the English non-traditional housing stock and has four parts. The first part compares the main types of non-traditional housing, categorised as non-masonry low rise housing and medium to high rise flats and masonry cross-wall systems with the majority of traditional housing built with either solid or cavity masonry walls. The second part examines the various generic types of non-masonry construction, while the third and fourth parts look specifically at the main proprietary systems.

In each of these three parts the average and distribution of SAP ratings is given, the generally lowest and highest ratings are examined and the extent of modernisation and its effect on the SAP ratings is discussed. The final part in the section lists all of the named proprietary system surveyed by the 2001 EHCS and gives the SAP ratings of un-modernised and modernised dwellings found in each system.

SAP Ratings of the Main Constructional Types

With much of the non-traditional stock remaining in the public sector, a large proportion of houses and flats have already been improved to varying degrees. Consequently, low-rise non-masonry housing has a higher average SAP rating (49) than that of traditionally built brick and stone housing with solid walls (42). It also has a lower incidence of very inefficient dwellings (19% compared to nearly 26%), but is still less energy efficient than cavity wall masonry dwellings (54). In turn, the latter are, on average, slightly less energy efficient than medium and high-rise non-traditional flats (56), although such flats have the third highest proportion (13%) of very inefficient dwellings. More recently built housing with masonry cross-walls is marginally the most efficient of all main types with a mean SAP of 58 and under 8% of dwellings rated under SAP 35 (Table 4.5).

Table 4.5: SAP ratings by main types of construction

All types of construction	**Mean SAP**	**Percentage distribution of SAP ratings**					**Thous. hholds**
		less 35	**35-45**	**45-55**	**55-65**	**65 plus**	
Masonry solid box-wall	42.2	25.6	26.2	29.8	15.4	3.1	5,411
Masonry cavity box-wall	53.8	8.8	14.2	28.2	28.3	20.5	13,672
Masonry cross-wall	57.8	7.6	8.4	26.4	24.0	33.6	234
Non-traditional low rise	49.3	19.1	17.0	23.8	19.6	20.5	714
Non-trad. medium/high rise	56.2	12.9	8.8	20.7	23.3	34.4	479
All occupied housing	**50.7**	**13.6**	**17.2**	**28.3**	**24.4**	**16.4**	**20,510**

Table 4.6 indicates the full range of SAP ratings for each of the main constructional types. However, to show both the typically worse and typically best of each type, any outliers or otherwise extreme ratings have been excluded by omitting the lowest and highest 1% in each case. The table also shows the percentage of un-modernised and modernised dwellings. For the purpose of this latter analysis, a dwelling is considered to be modernised if it has an

efficient central heating system and/or has external or full cavity wall insulation or passes the heating criteria of the Decent Home Standard.

The least efficient dwellings, with negative SAP ratings, are to be found in solid wall dwellings and in both low and higher rise non-masonry dwellings. By comparison, the worst dwellings in masonry cavity and masonry cross-wall housing, although still extremely inefficient, are better with SAP ratings of 8 and 10. The most efficient dwellings, with 2001 SAP ratings of 90 or above are the best masonry cross-wall or non-masonry medium and high rise flats. The highest ratings amongst non-masonry low-rise dwellings and, particularly, traditional solid wall dwellings are generally significantly lower with ratings under 83 and 69 respectively.

In line with their better efficiency, masonry cavity and cross-wall dwellings have the fewest 'un-modernised' dwellings falling short of the set improvement level (both 16%). Despite their poorer energy efficiency, solid wall dwellings have the next lowest proportion of such dwellings (under 22%). However, low rise non-masonry dwellings are only marginally worse in this respect, with 23% of their stock un-modernised, but non-traditional medium and high rise dwellings are significantly worse with 31% of dwellings not originally built or subsequently modernised to this level. (Table 4.6)

Table 4.6: Lowest, median and highest SAP ratings of main types of construction

Main constructional types	**Low, median & high ratings**			**unmod-ernised percent**	**mod-ernised percent**	**Total Hseholds 1000s**
	1% ntile	**Median SAP**	**99% ntile**			
Masonry solid box-wall	-4.5	44.4	69.3	21.9	78.1	5,411
Masonry cavity box-wall	7.9	54.6	86.8	16.4	83.6	13,672
Masonry cross-wall	10.0	57.8	91.3	16.0	84.0	234
Non-masonry low rise	-3.8	49.4	82.6	22.5	77.5	714
Non-masonry medium/high rise	-1.7	58.5	89.9	31.3	68.7	479
All occupied housing	**2.2**	**51.7**	**85.5**	**18.4**	**81.6**	**20,510**

Table 4.7 looks separately at the SAP ratings of the un-modernised and modernised stock in each constructional type. This shows the mean SAP rating for all un-modernised and modernised dwellings in each category. However, to also show where the bulk of each type of housing lies, the lowest and highest 20% of SAP ratings have been excluded from each range.

Despite the very low ratings shown in the previous table, the bulk of the un-modernised non-traditional housing stock has higher SAP ratings than that of traditional masonry housing. Thus, both non-masonry types and masonry cross-wall housing has SAP ratings typically ranging between 19/25 to 50/54, with mean ratings of around 35, compared to ratings of between 11 to 40 and means of around 25 for the bulk of un-modernised traditional masonry housing.

Table 4.7: SAP ratings of main constructional types before & after modernisation

All types of construction	**Unmodernised**			**Modernised**			**Thous. hholds**
	20% ntile	**Mean SAP**	**80% ntile**	**20% ntile**	**Mean SAP**	**80% ntile**	
Masonry solid box-wall	10.6	25.6	39.0	38.3	46.8	55.8	5,411
Masonry cavity box-wall	11.6	25.2	41.4	45.7	56.4	67.9	13,672
Masonry cross-wall	25.3	35.0	54.1	45.0	54.7	65.7	234
Non-masonry low rise	24.3	37.5	52.8	47.1	57.0	66.5	714
Non-masonry medium/high rise	19.3	34.2	50.0	51.1	62.3	74.1	479
All occupied housing	**15.2**	**31.5**	**46.7**	**44.0**	**54.1**	**64.5**	**20,510**

The majority of modernised or newly built non-masonry medium or high rise flats have the highest energy efficiency, with SAP ratings ranging between 51 and 74 and a mean of 62. The ratings for the bulk of modernised non-traditional housing is significantly lower, SAP ratings ranging from around 45/47 to 66/68 and a mean of around 55. However, traditional solid wall housing shows easily the lowest ratings after modernisation, the bulk of this stock ranging from 38 to 56 and having a mean SAP rating of only 47. (Table 4.6)

SAP Ratings of Non-Masonry Construction

Although with the smallest EHCS sample of only 27 households, the oldest pre 1919 traditionally built timber framed houses appear the least energy efficient of all the non-masonry types, having an average SAP rating of under 30 and no examples with ratings over 55. Of the remaining non-traditional types, all of which have significant sample sizes, the housing built with metal walls or frames has the lowest average SAP rating (45) and nearly 1 in 4 dwellings with ratings under 35. The housing built with pre-cast concrete frames is almost equally poor, having a mean SAP rating of under 47 and well over 1 in 5 dwellings with ratings under 35.

All the concrete box-wall systems, whether built in-situ or pre-cast, have mean SAP ratings which are only a little below that for the total housing stock, and also a relatively average distribution of ratings. Being mostly of later construction, the concrete cross-wall systems and post 1919 timber frame houses are generally of above average energy efficiency, having average SAP ratings of between 55 and 60.

Table 4.8: SAP ratings by main types of non-masonry construction

All types of construction	**Mean SAP**	**Percentage distribution of SAP ratings**					**Thous. hholds**
		less 35	**35-45**	**45-55**	**55-65**	**65 plus**	
Concrete/Boxwall/In-situ	49.1	17.7	15.0	30.1	17.9	19.3	186
Concrete/Boxwall/Precast <1m	49.8	14.5	18.4	35.2	12.5	19.4	63
Concrete/Boxwall/Precast >1m	49.0	17.7	14.1	31.3	19.8	17.1	69
Concrete/Crosswall/In-situ	59.6	7.5	9.6	15.4	29.2	38.4	97
Concrete/Croswall/PC panel	55.0	15.8	4.6	13.1	30.9	35.6	46
Concrete/Frame/In-situ	53.7	14.3	12.6	21.8	22.5	28.8	245
Concrete/Frame/Precast	46.5	22.0	21.6	21.5	23.9	10.9	54
Timber/Frame/Pre 1919	29.7	54.1	41.2	4.7	0	0	41
Timber/Frame/Post 1919	56.3	13.6	7.4	20.2	22.4	36.4	321
Metal/Frame	44.8	23.3	27.0	23.0	20.6	6.1	72
All occupied housing	**50.7**	**17.7**	**15.0**	**30.1**	**17.9**	**19.3**	**20510**

Looking at the different non-masonry types, the least efficient housing can be found amongst in-situ concrete cross-wall (SAP –8) and metal framed dwellings (SAP –9), although some of the sample of timber framed dwellings and in-situ concrete box-wall housing also have negative values. Conversely, post 1919 timber frame housing, those with a pre-cast concrete frame and the large-panel concrete systems demonstrate dwellings with the highest SAP ratings, all having ratings above 90. Nearly half of pre-1919 traditional timber framed housing is un-modernised on the set standard and the large-panel systems and both pre-cast and in-situ concrete framed housings also have a large proportion of dwellings in this category (29%, 31% and 36% respectively).

Table 4.9: Lowest, median and highest *SAP ratings of non-masonry types*

Main non-masonry types	**Low, median & high ratings**			**unmod-ernised** *percent*	**mod-ernised** *percent*	**Total Hseholds** thousands
	1% ntile	**Median *SAP***	**99% ntile**			
Concrete/Boxwall/In-situ	-4.5	44.4	69.3	23.4	76.6	186
Concrete/Boxwall/Precast <1m	7.9	54.6	86.8	24.9	75.1	63
Concrete/Boxwall/Precast >1m	10.0	57.8	91.3	29.3	70.7	69
Concrete/Crosswall/In-situ	-7.8	50.3	86.6	27.2	72.8	97
Concrete/Croswall/PC panel	12.6	49.1	78.0	20.9	79.1	46
Concrete/Frame/In-situ	10.2	51.7	81.5	30.7	69.3	245
Concrete/Frame/Precast	9.3	61.5	92.2	35.9	64.1	54
Timber/Frame/Pre 1919	-2.4	61.4	82.9	48.0	52.0	41
Timber/Frame/Post 1919	-3.9	56.6	93.8	20.5	79.5	321
Metal/Frame	-8.8	47.7	84.1	20.6	79.4	72
All occupied housing	**2.2**	**51.7**	**85.5**	**18.4**	**81.6**	**20,510**

In an un-modernised state, both in-situ concrete box-wall and cross-wall dwellings have the lowest average energy efficiency ratings, with mean SAP values in the mid 20s (see table 4.10). Pre-cast concrete frame systems have the highest mean both before and after modernisation, with mean SAPs of 43 and 66. Small panel pre-cast concrete box-wall housing also has a relatively high SAP average when un-modernised (38), while after modernisation, large panel pre-cast concrete systems, and both ages of timber framed housing reach SAP averages of around 62. The lowest average for modernised dwellings (47) is given by the in-situ concrete box-wall systems.

Table 4.10: SAP ratings of non-masonry construction before & after modernisation

All types of construction	**Unmodernised**			**Modernised**			**Thous. hholds**
	20% ntile	**Mean SAP**	**80% ntile**	**20% ntile**	**Mean SAP**	**80% ntile**	
Concrete/Boxwall/In-situ	10.6	25.6	39.0	38.3	46.8	55.8	186
Concrete/Boxwall/Precast <1m	24.3	37.5	52.8	47.1	57.0	66.5	63
Concrete/Boxwall/Precast >1m	19.3	34.2	50.0	51.1	62.3	74.1	69
Concrete/Crosswall/In-situ	11.6	25.2	41.4	45.7	56.4	67.9	97
Concrete/Croswall/PC panel	25.3	35.0	54.1	45.0	54.7	65.7	46
Concrete/Frame/In-situ	13.4	34.8	53.5	46.0	54.9	65.4	245
Concrete/Frame/Precast	28.9	43.2	58.1	53.7	65.7	75.2	54
Timber/Frame/Pre 1919	3.6	27.7	46.7	58.3	62.3	69.5	41
Timber/Frame/Post 1919	15.4	33.6	48.2	51.7	62.6	74.6	321
Metal/Frame	17.9	29.9	43.3	44.6	55.9	64.9	72
All occupied housing	**15.2**	**31.5**	**46.7**	**44.0**	**54.1**	**64.5**	**20,510**

SAP Ratings of the Proprietary Systems

The next table shows the average SAP ratings and their distribution for the main proprietary non-traditional housing systems in the 2001 EHCS sample. With the exception of the sample for Wimpey no-fines dwellings, the sample sizes, even sometimes when grouped, are very small and, consequently, the results need to be treated with considerable caution. The actual household sample sizes are shown in brackets in the final column, after the number of homes in the stock (in thousand) which each sample represents.

Of the individual systems, the housing built using the Wates system show the lowest average SAP rating (42) and highest proportion of particularly inefficient properties (31%). Based on a similar small sample, the average for Airey houses is only marginally better, but this type shows fewer very inefficient homes (23%). Easiform insitu concrete dwellings, the British Iron and Steel Federation houses (B.I.S.F), and Unity systems also generally have lower than average SAP ratings, Easiform having the second highest proportion of very inefficient properties (28%). By comparison, Wimpey no-fines, Reema and Cornish Unit dwellings have mean SAP ratings closer to the average for the housing stock as a whole, the latter system being slightly higher than average.

Of the other grouped systems, the metal framed housing has the lowest average SAP rating (43), although the pre-cast concrete systems are only slightly better (45). In contrast, the other in-situ concrete systems and, particularly, the generally more recent timber frame systems show average SAP ratings higher than that of the national stock.

Table 4.11: SAP ratings of main proprietary types in 2001 EHCS sample

Proprietary systems	**Mean**	**% distribution of SAP ratings**			**Thous.**
in 2001 EHCS sample	**SAP**	**less 35**	**35-65**	**65 plus**	**hholds**
Wimpey Nofines (Insitu concrete)	49.2	13.9	70.3	15.8	114 (142)
Easiform (In-situ concrete)	44.1	27.9	55.5	16.5	20 (25)
Airey (Pre-cast concrete)	42.3	23.1	56.8	20.1	14 (21)
Cornish Unit (Pre-cast concrete)	51.8	12.8	73.8	13.5	32 (49)
Reema (Pre-cast concrete)	49.2	14.4	75.8	9.8	16 (21)
Unity (Pre-cast concrete)	45.7	14.9	84.8	0.3	10 (17)
Wates (Pre-cast concrete)	42.0	30.9	61.5	7.6	16 (23)
B.I.S.F. (Metal.frame)	45.1	11.0	81.6	7.4	19 (27)
Other in-situ concrete systems	51.2	18.8	52.7	28.5	46 (45)
Other pre-cast concrete systems	44.6	24.9	66.6	8.5	48 (62)
Timber frame systems	52.9	13.8	59.9	26.3	42 (46)
Other metal frame systems	42.7	21.9	68.1	10.0	22 (22)
All occupied housing	50.7	13.6	70.0	16.4	20,510

Looking at the proprietary systems, the very lowest SAP ratings are recorded by the two named in-situ concrete systems, Easiform and Wimpey Nofines, and the collective group of other in-situ concrete systems, these all including negative SAP ratings. Although their sample sizes are quite small, three systems -Cornish Unit, Unity and B.I.S.F. - appear to have few examples of particularly inefficient dwellings, with less than 1% of dwellings rated below SAP 20.

As well as including the lowest SAP ratings, the in-situ concrete proprietary systems also have some of the highest SAP ratings, having 99% percentile values ranging from 82 for the group of other insitu systems to 87 for Wimpey No-fines housing (see table 4.12). Unity and Wates are the only systems showing less than 1% of dwellings with SAP ratings of 66 or over, although the former has a particularly small sample (17 addresses).

Table 4.12: Lowest, median and highest SAP ratings for main proprietary systems

Proprietary systems in 2001 EHCS sample	**Low, median & high ratings**			**unmod-ernised**	**mod-ernised**	**Total Hseholds**
	1% ntile	**Median SAP**	**99% ntile**	**percent**	**percent**	**thousands**
Wimpey Nofines (Insitu concrete)	-7.8	49.5	86.6	17.9	82.1	114 (142)
Easiform (In-situ concrete)	-3.5	46.1	84.7	30.6	69.4	20 (25)
Airey (Pre-cast concrete)	-8.8	43.9	65.7	34.1	65.9	14 (21)
Cornish Unit (Pre-cast concrete)	22.6	51.9	78.6	21.6	78.4	32 (49)
Reema (Pre-cast concrete)	11.7	52.1	74.5	27.7	72.3	16 (21)
Unity (Pre-cast concrete)	20.5	49.3	63.5	10.1	89.9	10 (17)
Wates (Pre-cast concrete)	7.9	47.3	66.0	36.6	63.4	16 (23)
B.I.S.F. (Metal.frame)	21.9	45.5	75.6	15.0	85.0	19 (27)
Other in-situ concrete systems	-3.8	52.8	82.6	29.1	70.9	46 (45)
Other pre-cast concrete systems	-0.9	47.8	72.6	33.5	66.5	48 (62)
Timber frame systems	0.5	58.6	77.0	12.8	87.2	42 (46)
Other metal frame systems	12.0	40.5	71.8	9.1	90.9	22 (22)
All occupied housing	**2.2**	**51.7**	**85.5**	**18.4**	**81.6**	**20,510**

In keeping with showing the lowest SAP ratings, the two named in-situ concrete systems - Easiform and Wimpey No-fines - also have the lowest average SAP ratings (both around 22) for un-modernised dwellings. Conversely, with relatively few really inefficient dwellings, Cornish Unit, Reema and the group of other metal frame systems appear generally the most energy efficient before modernisation, all having mean SAP ratings of around 36 to 37 (see table 4.13).

Table 4.13 shows that amongst modernised proprietary systems, the group of other in-situ concrete systems has the highest average SAP rating (61), followed by the group of timber framed systems (SAP 57). None of the eight named systems appear particularly energy efficient after modernisation, the best being the Cornish Unit and Wimpey No-fines houses with average SAP ratings of 56 and 55 respectively and the worst being the Unity system and the B.I.S.F housing, both with SAP averages of 48.

Table 4.13: SAP ratings of main proprietary systems before & after modernisation

Proprietary systems in 2001 EHCS sample	**Unmodernised 20% ntile**	**Unmodernised Mean SAP**	**Unmodernised 80% ntile**	**Modernised 20% ntile**	**Modernised Mean SAP**	**Modernised 80% ntile**	**Thous. hholds**
Wimpey Nofines (Insitu concrete)	6.3	22.4	42.4	45.1	55.1	62.8	114 (142)
Easiform (In-situ concrete)	-2.0	21.5	33.1	44.0	54.1	65.6	20 (25)
Airey (Pre-cast concrete)	17.9	24.5	38.3	43.4	51.5	65.7	14 (21)
Cornish Unit (Pre-cast concrete)	26.6	35.7	44.5	47.2	56.2	64.2	32 (49)
Reema (Pre-cast concrete)	13.4	36.6	56.3	51.7	54.1	58.7	16 (21)
Unity (Pre-cast concrete)	20.5	26.1	33.3	40.3	47.9	53.7	10 (17)
Wates (Pre-cast concrete)	10.2	26.1	29.2	46.8	51.1	59.5	16 (23)
B.I.S.F. (Metal.frame)	21.9	29.4	36.8	43.2	47.9	48.5	19 (27)
Other in-situ concrete systems	23.4	27.5	38.3	48.6	60.9	72.4	46 (45)
Other pre-cast concrete systems	12.6	28.5	45.7	40.5	52.7	63.5	48 (62)
Timber frame systems	2.5	24.5	39.0	48.7	57.1	67.4	42 (46)
Other metal frame systems	12.0	36.6	63.9	37.2	43.3	56.5	22 (22)
All occupied housing	**15.2**	**31.5**	**46.7**	**44.0**	**54.1**	**64.5**	**20,510**

SAP Ratings of all the Proprietary Systems in 2001 EHCS

The next four tables provide the average SAP ratings for each of the 76 individual proprietary systems surveyed in the 2001 EHCS. These include different versions of the same system, which in the previous tables were combined. Each table provides the name of the system, the version if any, and its BRE code, followed by the average SAP rating for all un-modernised and modernised cases and for the total sample of each type. The relevant sample sizes for each group are then given.

To boost sample sizes these SAP tables include some vacant dwellings, excluded in the previous tables. Nevertheless, in many cases this represents one or a handful of survey addresses for each proprietary system. Consequently, the mean SAP ratings, which in these particular tables are un-grossed, cannot be taken as representative of the whole stock of such dwellings. At best they may be considered to be typical ratings found in the different systems when un-modernised or modernised.

The In-situ concrete systems

Table 4.14 lists the 13 in-situ concrete systems identified from the EHCS survey. Here, for the un-modernised stock, the average SAP ratings range from under 4 for Easiform Type 1 dwellings (from a total sample of 10) to a SAP of nearly 43 in the case of the single example of a dwelling thought to be built in the Miller No-fines system. Modernised dwellings range from a SAP of 44 for a Boswell dwelling to 65 in the case of one built on the Mowlem system, the total sample sizes for these systems being 2 and 5 respectively. .

Table 4.14: SAP ratings in un-modernised and modernisation in-situ concrete systems

In-situ concrete systems in 2001 EHCS sample	BRE code	Unmod. Mean SAP	Mod. Mean SAP	Total Mean SAP	Sample sizes Unmod no.	Mod. no.	Total no.
Boswell	S007	20.1	44.1	32.1	1	1	2
Boyd Gibbons No-Fines	S008	.	55.6	55.6	0	1	1
Diatomite	S019	.	47.3	47.3	0	1	1
Duo-Slab	S022	15.8	.	15.8	1	0	1
Easiform Type I	S023	3.5	49.7	37.1	3	8	11
Easiform Type II	S024	24.3	59.4	50.1	4	11	15
Incast	S033	23.4	.	23.4	1	0	1
Miller No-Fines	S038	42.5	.	42.5	1	0	1
Mowlem	S043	30.7	64.9	51.2	2	3	5
Parkwall	S045	.	61.6	61.6	0	1	1
Wakefield Special	S058	.	44.6	44.6	0	1	1
Whatling	S061	36.2	.	36.2	1	0	1
Wimpey No-Fines	S062	25.1	54.9	49.3	28	122	150

The pre-cast concrete systems

Table 4.15 shows the 32 pre-cast concrete proprietary systems captured by the 2001 survey. In this case, the lowest average SAP for un-modernised dwellings, (below 9) comes from a total sample of five properties built in the Newland's system. The highest SAP rating (54) for an un-modernised dwelling comes from one of the two examples of the Bryant Low Rise system, the other example providing the second highest SAP ratings (73) for modernised pre-cast concrete dwellings, after two examples of the MFC system (mean SAP 75), Conversely, the lowest SAP rating (under 31) for a 'modernised' dwelling of this form of construction is given by the only example of the Taylor-Woodrow Anglian system.

Table 4.15: SAP ratings in un-modernised and modernisation pre-cast concrete systems

Pre-cast concrete systems in 2001 EHCS sample	**BRE code**	**Unmod. Mean SAP**	**Mod. Mean SAP**	**Total Mean SAP**	**Sample sizes Unmod no.**	**Mod. no.**	**Total no.**
Airey	P003	27.0	47.5	40.7	7	14	21
Anglia Type A	P006	.	64.9	64.9	0	1	1
Bison Crosswall	P020	13.4	61.7	45.6	1	2	3
Boot Pier and Panel	P026	35.3	50.0	38.2	4	1	5
Bryant Low Rise	P029	54.1	72.6	63.3	1	1	2
Cornish Unit Type I	P039	38.5	56.9	53.4	9	38	47
Cornish Unit Type II	P040	22.6	44.8	33.7	1	1	2
Fram	P052	.	66.3	66.3	0	2	2
Glasgow Foamed Slag	P053	.	50.8	50.8	0	1	1
Gregory	P055	.	49.7	49.7	0	1	1
Kenkast	P068	.	38.8	38.8	0	1	1
Lecaplan	P072/73	.	48.7	48.7	0	1	1
MFC	P082	19.3	74.7	47.0	2	2	4
Myton	P087	12.6	45.7	40.2	1	5	6
Newland	P090	8.7	44.9	23.2	3	2	5
Orlit Type I	P091	.	51.1	51.1	0	3	3
Orlit Type II	P092	29.4	52.8	49.9	1	7	8
Reema Conclad	P099	.	62.2	62.2	0	3	3
Reema Contrad	P100	15.6	41.7	33.0	2	4	6
Reema Hollow Panel	P101	42.6	57.5	53.8	4	12	16
Skarne	P106	.	39.7	39.7	0	1	1
Smith	P107	39.3	.	39.3	3	0	3
Spacemaker	P109	.	56.0	56.0	0	5	5
Stent	P110	.	56.8	56.8	0	2	2
Tarran Temporary Bungalow	P115	.	43.3	43.3	0	5	5
Taylor Woodrow-Anglian	P116	.	30.9	30.9	0	1	1
Unity Type I	P127	.	40.9	40.9	0	4	4
Unity Type II	P128	26.9	51.4	47.6	2	11	13
Wates	P130	24.3	51.1	41.8	8	15	23
Wessex	P132	39.6	52.4	46.0	1	1	2
Woolaway	P138	.	48.7	48.7	0	1	1
Woolaways Bungalow	P139	10.2	44.6	36.0	1	3	4

The timber frame systems

Amongst the 17 timber-framed systems in the survey, there are far fewer examples of un-modernised dwellings, many of these generally more recent systems probably reaching the threshold standard when built. However, the sole example of the relatively early Yorkshire Development Group system (YDG) has a SAP rating of under 1. Marginally, the best of the three remaining un-modernised systems, with an average SAP of nearly 30, comes for a total sample of 7 addresses built in the Frameform system. The worst example of a modernised dwelling is the single example of the Anchor 12 M system, this having a rating of only 12. The best SAP for a modernised timber-frame dwelling, a rating of nearly 72, is also from the sole example of its type, namely from a system named ‘Purpose Built Type 1’.

Table 4.16: SAP ratings in un-modernised and modernisation timber-frame systems

Timber frame systems in 2001 EHCS sample	**BRE code**	**Unmod. Mean SAP**	**Mod. Mean SAP**	**Total Mean SAP**	**Sample sizes Unmod no.**	**Mod. no.**	**Total no.**
Anchor 12M	T002	.	12.2	12.2	0	1	1
Barratt	AT008	.	58.2	58.2	0	1	1
Caspon	T023	28.2	63.0	45.6	1	1	2
Cedar Homes	T024	.	67.4	67.4	0	1	1
Celtic Homes	T026	.	58.2	58.2	0	2	2
Frameform	T044	29.6	54.7	43.9	3	4	7
Guildway	T051	.	60.4	60.4	0	5	5
Hallam Mk I & Mk II	T053	.	56.7	56.7	0	4	4
Hallam Mk III	T054	.	54.1	54.1	0	1	1
Lovell	T074	.	66.2	66.2	0	1	1
MeTraTim	T083	.	66.9	66.9	0	6	6
MHC	T085	.	60.7	60.7	0	4	4
Purpose Built Type I	T098	.	71.5	71.5	0	1	1
Quikbild	T101	.	69.3	69.3	0	2	2
Spooner	T122	.	47.9	47.9	0	1	1
Swedish Timber	T125	28.6	53.4	32.8	5	1	6
YDG	T139	0.5	.	0.5	1	0	1

The metal frame systems

Including the four different versions of the British Iron and Steel Federation houses (B.I.S.F) a total of 14 metal frame systems are covered by the 2001 EHCS. Un-modernised dwellings range from a SAP rating of 12 for the single example of an AIROH temporary bungalow to averages of just under SAP 32 provided by both the sample (5 addresses) of Aluminium bungalows and sample (7 addresses) of dwellings built in the Trusteel 3M system. The later Trusteel Mk II system provides the best SAP rating (64) for a modernised metal frame dwelling, while the poorest such dwelling has a SAP rating of 42 and is built in the Cussins system.

Table 4.17: SAP ratings in un-modernised and modernisation metal-frame systems

Metal frame systems in 2001 EHCS sample	BRE code	Unmod. Mean SAP	Mod. Mean SAP	Total Mean SAP	Sample sizes Unmod no.	Mod. no.	Total no.
AIROH Temp. Bungalow	M002	12.0	.	12.0	1	0	1
Aluminium Bungalow	M003	31.8	39.6	38.0	1	4	5
BISF Type A	M016	.	43.5	43.5	0	2	2
BISF Type A1	M017	25.0	47.9	44.7	3	18	21
BISF Type B	M018	.	47.1	47.1	0	1	1
BISF Type C	M019	.	52.0	52.0	0	4	4
Cussins	M032	.	42.2	42.2	0	1	1
Hawthorn Leslie	M045	.	50.1	50.1	0	1	1
Howard Type B	M051	.	37.2	37.2	0	1	1
Livett-Cartwright	M059	.	39.7	39.7	0	1	1
MOHLG 5M	M064	.	46.0	46.0	0	2	2
New Georgian	M067	.	46.6	46.6	0	1	1
Trusteel 3M	M096	31.8	53.6	50.5	1	6	7
Trusteel Mk II	M097	20.3	63.9	42.1	1	1	2

4.1.3 The distribution of SAP ratings in non-traditional housing

This section examines the distribution of energy efficiency by housing sector (public or private) and by household vulnerability. The analysis compares SAP ratings in the main forms of non-traditional construction (low-rise housing or medium and high rise flats) and the main types of masonry construction (solid wall, cavity wall and cross-wall housing). More detailed analyses disaggregating traditional housing into its separate non-masonry types or proprietary systems have not been attempted as the sample sizes are generally insufficient to give representative estimates from such three-way cross-tabulations.

Tenure

As already mentioned, non-traditional housing, particularly flats in medium and high rise blocks, has a significantly lower proportion of private owners than traditionally built housing. Despite this difference, the distribution of energy efficiency in the private sector follows a very similar pattern to that of the stock as a whole. Traditional masonry housing with solid walls has the lowest average SAP rating (42) followed by non-masonry low rise housing (49), both having high proportions of particularly inefficient properties. Conversely, non-traditional medium and high rise and masonry cross-wall housing are generally the most energy efficient types, both having average SAP ratings of around 57, with 31% or more of their stock with ratings of SAP 65 or over.

Table 4.18: SAP ratings in main constructional types in private sector

Main constructional types	Mean SAP	% distribution of ratings			All private sector	
		<SAP 35	35-65	65 plus	1000s	percent
Masonry solid box-wall	41.7	26.5	70.7	2.7	4971	91.9
Masonry cavity box-wall	52.8	8.5	74.5	17.0	10,769	78.8
Masonry cross-wall	56.8	6.9	62.2	30.8	142	60.8
Non-masonry low rise	49.0	21.3	58.0	20.7	459	64.3
Non-masonry medium/high rise	57.3	9.6	56.0	34.4	157	32.7
All occupied housing	**49.4**	**14.3**	**72.6**	**13.1**	**16,498**	**80.4**

Masonry housing, whether solid, cavity or cross-wall, is generally more energy efficient when in the public than in the private sector. However, this is not the case for non-masonry housing. As such low-rise housing has a very similar average SAP rating, albeit with somewhat fewer particularly inefficient properties, while non-traditional medium and high rise flats have a lower average and more inefficient properties than the equivalent housing in the private sector. In the public sector, both forms of non-masonry housing are, on average, less energy efficient than traditional cavity walled housing, having a significantly higher proportion of homes with SAP ratings below 35.

Table 4.19: SAP ratings in main constructional types in public sector

Main constructional types	Mean SAP	% distribution of ratings			All public sector	
		<SAP 35	35-65	65 plus	1000s	percent
Masonry solid box-wall	48.1	14.8	77.5	7.6	440	8.1
Masonry cavity box-wall	57.5	9.6	56.9	33.5	2,904	21.2
Masonry cross-wall	59.4	8.7	53.5	37.8	91	39.2
Non-masonry low rise	49.7	15.2	64.6	20.1	255	35.7
Non-masonry medium/high rise	55.7	14.5	51.1	34.4	322	67.3
All occupied housing	**55.9**	**10.9**	**59.1**	**30.0**	**4,012**	**19.6**

Vulnerable Households

In England, the Government aims to seek an end to fuel poverty for vulnerable households "as far as reasonably practicable" by 2010 and for other households to similarly eliminate fuel poverty by 2016. For these targets, a vulnerable household is defined as one containing dependant children or those who are elderly, disabled or long-term sick.

For non-vulnerable households, the pattern of energy efficiency is again similar to that for all households. Traditional masonry solid wall housing is generally the least energy efficient. This is followed by non-masonry low-rise housing, although this includes a much higher proportion of efficient properties. Non-vulnerable households living in non-traditional housing built with masonry cross-walls or medium or low-rise flats have the most efficient homes.

Table 4.20: SAP ratings in homes of non-vulnerable households

Main constructional types	Mean SAP	% distribution of ratings <SAP 35	35-65	65 plus	All non-vulnerable 1000s	percent
Masonry solid box-wall	43.8	22.4	73.8	3.8	1,956	36.1
Masonry cavity box-wall	54.2	8.5	70.5	21.0	3,822	28.0
Masonry cross-wall	56.6	8.9	56.6	34.5	68	29.2
Non-masonry low rise	51.0	17.0	61.4	21.6	202	28.2
Non-masonry medium/high rise	59.0	9.6	53.7	36.7	161	33.7
All occupied housing	**51.0**	**13.2**	**70.6**	**16.2**	**6,209**	**30.3**

With the exception of those living in masonry cross-wall housing, the homes of vulnerable households are less energy efficient than the equivalent homes of the non-vulnerable. This is particularly true in traditional masonry housing with solid walls, but also in non-masonry housing and especially non-traditional medium and high-rise flats. Here, there are significantly more properties with SAP ratings below 35 (15%), although still less than found in non-masonry low-rise dwellings (20%) and traditional solid wall housing (27%) occupied by vulnerable households.

Table 4.21: SAP ratings in homes of vulnerable households

Main constructional types	Mean SAP	% distribution of ratings <SAP 35	35-65	65 plus	All vulnerable 1000s	percent
Masonry solid box-wall	41.3	27.4	69.8	2.7	3455	63.9
Masonry cavity box-wall	53.6	8.9	70.9	20.3	9851	72.0
Masonry cross-wall	58.3	7.1	59.7	33.2	165	70.8
Non-masonry low rise	48.6	20.0	60.0	20.0	512	71.8
Non-masonry medium/high rise	54.8	14.5	52.2	33.2	317	66.3
All occupied housing	50.5	13.8	69.7	16.5	14301	69.7

4.1.3 Fuel poverty in non-traditional housing

Main Constructional Types

On the full income definition, the distribution of fuel poverty across the main types of traditional and non-traditional construction follows the same pattern as the proportion of particularly inefficient properties in the stock (see tables 4.5 in section 4.1.2). The proportion of households in all fuel poverty and severe fuel poverty is highest (13% and 2%) in traditionally built (box-wall) dwellings with solid masonry walls. However, low rise non-masonry houses and flats have the second highest percentage of fuel poor households (11%) and fuel poverty is also higher than average in non-traditional medium and high rise flats (9%). The more recently built and generally more energy efficient masonry cross-wall housing has both the lowest number and proportion (5%) of households in fuel poverty.

Table 4.22: Fuel poverty in main constructional types - Full income definition

Main constructional types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
			mod.	serious	severe	
	1000s	percent	percent	percent	percent	thousands
Masonry solid box-wall	680	12.6	8.0	2.6	2.0	5,411
Masonry cavity box-wall	910	6.7	4.9	1.3	0.5	13,672
Masonry cross-wall	11	4.8	3.4	0.5	0.9	234
Non-masonry low rise	77	10.8	8.4	1.6	0.8	714
Non-masonry medium/high rise	44	9.1	6.3	1.5	1.3	479
All occupied housing	**1722**	**8.4**	**5.8**	**1.6**	**0.9**	**20,510**

Using the basic income definition substantially changes the distribution of fuel poverty across the main constructional types. To define basic income, any housing benefit or income support for mortgage interest (ISMI) is excluded from the household's full income. However, as very few households receive ISMI, in practice this has the effect of increasing fuel poverty in the rented sectors while having little effect on the owner occupied stock. With generally much higher levels of social renting in non-traditional housings than in traditional (box-wall) masonry properties, this consequently tends to increase fuel poverty in the former.

On this definition, fuel poverty is highest in non-traditional medium and high-rise dwellings (19%) and in non-masonry low-rise housing (16%). Traditional (box-wall) housing with solid masonry walls now comes third (15%), but still has the highest incidence of severe fuel poverty (3%). Also the lowest proportions of fuel poor households are no longer found in the masonry cross-wall systems, but in traditional (box-wall) housing with masonry cavity walls.

Table 4.23: Fuel poverty in main constructional types - Basic income definition

Main constructional types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
			mod.	serious	severe	
	1000s	percent	percent	percent	percent	thousands
Masonry solid box-wall	819	15.1	8.8	3.2	3.1	5,411
Masonry cavity box-wall	1306	9.6	6.5	2.0	1.0	13,672
Masonry cross-wall	27	11.5	7.6	2.2	1.7	234
Non-masonry low rise	111	15.5	11.3	2.5	1.6	714
Non-masonry medium/high rise	90	18.9	10.9	5.3	2.6	479
All occupied housing	**2352**	**11.5**	**7.4**	**2.4**	**1.6**	**20,510**

Using the residual income definition of fuel poverty, excluding housing costs, further changes its distribution across the different constructional systems. In this case, the extent of fuel poverty amongst households in receipt of full housing benefit (HB) will not change from that recorded using the basic income definition. However, assuming the same 10% threshold, levels of fuel poverty will now generally increase amongst owner occupiers with mortgages and for public and private tenants not in receipt of HB or not on full housing benefit.

On this definition, fuel poverty remains highest in non-traditional medium and high-rise dwellings (28%), but the problem is now marginally greater in traditional solid wall housing (20%) than in low-rise non-traditional houses and flats. As with the basic income definition, fuel poverty remains least likely in traditional cavity wall housing, but the number and proportion of household defined as in fuel poverty (13%) now significantly increase, here as elsewhere.

Table 4.24: Fuel poverty in main constructional types - Residual income definition

Main constructional types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
	1000s	percent	mod. percent	serious percent	severe percent	thousands
Masonry solid box-wall	1,068	20.1	10.0	4.0	6.1	5,411
Masonry cavity box-wall	1,779	13.3	8.3	2.5	2.5	13,672
Masonry cross-wall	38	16.2	9.4	2.9	4.0	234
Non-masonry low rise	137	19.4	12.6	3.2	3.6	714
Non-masonry medium/high rise	134	28.1	14.3	6.3	7.5	479
All occupied housing	**3,155**	**15.7**	**9.0**	**3.0**	**3.6**	**20,510**

Main Non-Masonry Types

Reflecting its poor energy efficiency, the proportion of households in fuel poverty is greatest in the oldest traditional timber framed dwellings (20%). The percentage of fuel poor households is also significant in metal framed dwellings (15%) and in small-panel precast concrete system-built housing (14%). However, neither of these systems have particularly large stocks and the greatest number of fuel poor households (nearly 26,000) are to be found in those dwellings, mainly in medium and high rise flats, built with an in-situ concrete frame. Also largely because of the size of their stocks, there are a significant number of fuel poor in more modern timber framed housing (over 23,000) and in the insitu concrete box-wall systems (nearly 23,000), where 12% of households are fuel poor.

Table 4.25: Fuel poverty in non-masonry types - Full income definition

Main non-masonry types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
	1000s	percent	mod. percent	serious percent	severe percent	thousands
Concrete/Boxwall/In-situ	22.7	*12.2*	*8.0*	*1.7*	*2.5*	186
Concrete/Boxwall/Precast <1m	8.6	*13.7*	*10.6*	*3.1*		63
Concrete/Boxwall/Precast >1m	7.6	*11.0*	*10.1*	*0.9*		69
Concrete/Crosswall/In-situ	4.4	*4.5*	*2.2*	*2.3*		97
Concrete/Croswall/PC panel	4.4	*9.7*	*9.7*			46
Concrete/Frame/In-situ	25.5	*10.4*	*6.4*	*1.9*	*2.2*	245
Concrete/Frame/Precast	5.8	*10.7*	*9.2*	*1.5*		54
Timber/Frame/Pre 1919	8.0	*19.5*	*12.3*	*7.2*		41
Timber/Frame/Post 1919	23.2	*7.2*	*6.0*	*0.6*	*0.7*	321
Metal/Frame	10.9	*15.2*	*14.4*	*0.8*		72
All occupied housing	**1,722**	***8.4***	***5.8***	***1.6***	***0.9***	**20,510**

Under the basic income definition, there is no change in fuel poverty in the oldest timber framed dwellings, these being predominantly private owned (see Table 4.25 above). However, four of the non-traditional systems, metal frame (25%), insitu concrete frame (24%) and both large and small panel precast concrete box wall systems (24% and 23% respectively) now have higher proportions of their households in fuel poverty.

As with the previous definition, the largest number of fuel poor households are to be found in buildings constructed with an insitu concrete frame (58,000), in in-situ concrete boxwall housing (nearly 29,000) and in timber framed dwellings built since 1919 (over 29,000), despite the latter having the lowest proportion of fuel poor households (9%).

Table 4.26: Fuel poverty in non-masonry types - Basic income definition

Main non-masonry types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
			mod.	serious	severe	
	1000s	percent	percent	percent	percent	thousands
Concrete/Boxwall/In-situ	28.7	15.4	9.3	3.4	2.7	186
Concrete/Boxwall/Precast <1m	14.2	22.8	14.3	6.0	2.5	63
Concrete/Boxwall/Precast >1m	16.9	24.3	19.0	3.8	1.6	69
Concrete/Crosswall/In-situ	12.7	13.1	7.6	3.3	2.2	97
Concrete/Croswall/PC panel	7.0	15.3	7.6	7.7		46
Concrete/Frame/In-situ	57.8	23.6	14.4	5.5	3.8	245
Concrete/Frame/Precast	8.8	16.2	6.7	8.3	1.2	54
Timber/Frame/Pre 1919	8.0	19.5	12.3	7.2		41
Timber/Frame/Post 1919	29.2	9.1	7.5	0.9	0.7	321
Metal/Frame	17.9	25.0	21.2	0.7	3.1	72
All occupied housing	**2,352**	**11.5**	**7.4**	**2.4**	**1.6**	**20,510**

The residual income definition, excluding housing costs, again changes the distribution somewhat. As with the previous definition, metal frame dwellings (28%), insitu concrete frame (33%) and both large and small panel precast concrete box wall systems (26% and 31% respectively) are still included in the worst five systems, albeit in a somewhat different order. However, the early timber framed dwellings are now replaced by insitu concrete cross-wall housing (where 26% of the households are in fuel poverty under the new definition).

The largest number of fuel poor households still live in insitu concrete frame built dwellings (80,000), in in-situ concrete boxwall housing (nearly 38,000) and in more modern timber framed dwellings (over 42,000), the latter still retaining the lowest proportion of fuel poor households (13%).

Table 4.27: Fuel poverty in main non-masonry types - Residual income definition

Main non-masonry types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
	1000s	percent	mod. percent	serious percent	severe percent	thousands
Concrete/Boxwall/In-situ	38.2	20.5	11.6	2.2	6.7	186
Concrete/Boxwall/Precast <1m	18.1	31.1	18.3	9.3	3.5	63
Concrete/Boxwall/Precast >1m	17.7	25.5	13.6	7.0	4.9	69
Concrete/Crosswall/In-situ	25.3	26.2	15.1	3.4	7.6	97
Concrete/Croswall/PC panel	8.8	19.2	4.0	9.9	5.3	46
Concrete/Frame/In-situ	80.4	32.9	18.1	8.1	6.6	245
Concrete/Frame/Precast	11.8	23.0	9.2	7.0	6.8	54
Timber/Frame/Pre 1919	8.0	19.5	12.3	3.5	3.7	41
Timber/Frame/Post 1919	42.3	13.4	10.0	1.0	2.3	321
Metal/Frame	20.4	28.4	18.6	3.0	6.8	72
All occupied housing	**3,155**	**15.7**	**9.0**	**3.0**	**3.6**	**20,510**

Proprietary systems

Table 4.28 shows the extent of fuel poverty on the full income definition in the proprietary systems in the 2001 EHCS sample. However, as in the previous section, these results need to be treated with caution because of the small individual samples for all of the systems – apart from that for Wimpey No fines houses and flats. Under 11% of the households living in Wimpey No-fines housing are in fuel poverty but because of the large stock of such dwellings these house the greatest number of fuel poor of any specific proprietary system (12,100 households).

Although based on a much smaller sample, the incidence of fuel poverty appears greater in Wates precast concrete dwellings, where nearly 25% of households are estimated to be fuel poor, including 6% in severe fuel poverty. This reflects their particular poor energy efficiency as shown in Table 4.11. The Airey and Cornish Unit systems also show a high incidence of fuel poverty (some 15% and 14% respectively), the latter system housing the second highest number of fuel poor households (some 4,500). In contrast, the Unity and Reema systems house both the lowest number and smallest proportion of households in fuel poverty (with under 5% and 4% respectively.

In the other grouped categories, the other metal frame systems show easily the largest proportion of households in fuel poverty (27%) and the other in-situ concrete systems the least, albeit still with over 12%. However, the greatest numbers of fuel poor households are to be found in the other pre-cast concrete systems (7,400) and in timber framed housing (6,900).

Table 4.28: Fuel poverty in main proprietary systems - Full income definition

Proprietary systems in 2001 EHCS sample	**All households in fuel poverty 1000s**	**percent**	**Degree of fuel poverty mod. percent**	**serious percent**	**severe percent**	**Total Hseholds 1000s**
Wimpey Nofines (Insitu concrete)	12.1	10.6	5.0	1.9	3.7	114 (142)
Easiform (In-situ concrete)	2.1	10.1	4.2	3.7	2.3	20 (25)
Airey (Pre-cast concrete)	2.1	14.9	14.9			14 (21)
Cornish Unit (Pre-cast concrete)	4.5	13.8	13.8			32 (49)
Reema (Pre-cast concrete)	0.6	3.8		3.8		16 (21)
Unity (Pre-cast concrete)	0.5	4.8	4.8			10 (17)
Wates (Pre-cast concrete)	3.9	24.5	18.8		5.7	16 (23)
B.I.S.F. (Metal.frame)	2.0	10.4	7.3	3.1		19 (27)
Other in-situ concrete systems	5.5	12.2	12.2			46 (45)
Other pre-cast concrete systems	7.4	15.3	11.3	4.0		48 (62)
Timber frame systems	6.9	16.5	12.1	4.4		42 (46)
Other metal frame systems	5.8	26.8	26.8			22 (22)
All occupied housing	1722	8.4	5.8	1.6	0.9	**20,510**

Under the basic income definition, the Wates system still records the highest proportion of households in fuel poverty (35%), although the B.I.S.F. metal framed houses follow close behind with 33% or some 6,300 of their households in fuel poverty. Although with only the third highest percentage of the individual systems, Cornish Unit dwellings have the second largest number of households in fuel poverty (6,900) after the 19,700 in the much large stock of Wimpey no-fines dwellings. Easiform insitu-concrete houses now show the highest proportion of households in severe fuel poverty (6%).

Table 4.29: Fuel poverty in main proprietary systems - Basic income definition

Proprietary systems in 2001 EHCS sample	**All households in fuel poverty 1000s**	**percent**	**Degree of fuel poverty mod. percent**	**serious percent**	**severe percent**	**Total Hseholds thousands**
Wimpey Nofines (Insitu concrete)	19.7	17.3	7.7	6.0	3.7	114 (142)
Easiform (In-situ concrete)	3.9	19.0	13.1		6.0	20 (25)
Airey (Pre-cast concrete)	2.6	18.4	7.0	11.4		14 (21)
Cornish Unit (Pre-cast concrete)	6.9	21.4	20.1	1.3		32 (49)
Reema (Pre-cast concrete)	2.6	16.5	5.7	10.8		16 (21)
Unity (Pre-cast concrete)	1.4	13.5	8.7	4.8		10 (17)
Wates (Pre-cast concrete)	5.5	34.8	29.1		5.7	16 (23)
B.I.S.F. (Metal.frame)	6.3	33.4	30.4		3.1	19 (27)
Other in-situ concrete systems	7.2	16.2	14.3	1.9		46 (45)
Other pre-cast concrete systems	10.5	21.7	10.8	7.9	2.9	48 (62)
Timber frame systems	9.8	23.2	16.5	6.7		42 (46)
Other metal frame systems	6.5	30.1	30.1			22 (22)
All occupied housing	**2,352**	**11.5**	**7.4**	**2.4**	**1.6**	**20,510**

Using the residual income definition, after housing costs, B.I.S.F. metal framed housing overtakes the Wates system as the type with the highest level of fuel poverty, 41% of households being fuel poor compared to 35% in the latter. Under this definition, these two types also have by far the highest proportions of households in severe fuel poverty (both around 14%).

Table 4.30: Fuel poverty in main proprietary systems - Residual income definition

Proprietary systems in 2001 EHCS sample	**All households in fuel poverty**		**Degree of fuel poverty**			**Total**
			mod.	**serious**	**severe**	**Hseholds**
	1000s	**percent**	**percent**	**percent**	**percent**	**thousands**
Wimpey Nofines (Insitu concrete)	22.9	20.3	9.7	4.7	5.9	114 (142)
Easiform (In-situ concrete)	4.4	21.7	14.1	1.6	6.0	20 (25)
Airey (Pre-cast concrete)	2.7	19.1	4.2	11.4	3.5	14 (21)
Cornish Unit (Pre-cast concrete)	8.7	27.0	15.0	8.9	3.1	32 (49)
Reema (Pre-cast concrete)	4.8	30.5	19.7	7.1	3.8	16 (21)
Unity (Pre-cast concrete)	3.0	28.9	24.2	4.8		10 (17)
Wates (Pre-cast concrete)	5.5	34.8	16.9	4.0	13.9	16 (23)
B.I.S.F. (Metal.frame)	7.7	40.7	26.6		14.1	19 (27)
Other in-situ concrete systems	7.8	19.2	17.1	2.1		46 (45)
Other pre-cast concrete systems	13.6	28.6	11.8	12.7	4.1	48 (62)
Timber frame systems	12.6	29.9	21.9	3.6	4.4	42 (46)
Other metal frame systems	6.5	33.4	24.9	8.5		22 (22)
All occupied housing	**3,155**	**15.7**	**9.0**	**3.0**	**3.6**	**20,510**

Fuel Poverty in each of the Proprietary Systems in the 2001 EHCS

The last four tables in this section looks at fuel poverty in all of the proprietary systems for which there is data in the 2001 EHCS. As in the analysis of the energy efficiency of these systems, this analysis used un-grossed numbers and is not designed to provide representative estimates as are other parts of the analysis. With very small, often single figure samples for the majority of systems, the tables, at best, show typical conditions in the various concrete, timber and metal systems.

The In-situ concrete systems

On the full income definition, 22 of the household sample living in the 180 cases of insitu concrete propriety housing are in fuel poverty. Some 14 of these are in un-modernised dwellings and 8 in modernised dwellings meeting the set standard. Of all those in fuel poverty, just eight are in serious or severe fuel poverty on this definition. However, using the residual income definition after housing costs, more than doubles the number of households in the sample in fuel poverty to 50. Of these, the majority (31) are in dwellings which show signs of being modernised. In addition, a large proportion of the sample (23 households) are now in serious or severe fuel poverty, having required fuel costs of over 15% of their income.

Table 4.31: Fuel poverty in in-situ concrete systems – Full & (residual) income definition

Metal frame systems in 2001 EHCS sample	In Fuel Poverty Not FP Hholds	Yes FP Hholds	FP in un-mod. Hholds	FP in mod. Hholds	Degree of FP mod Hholds	serious Hholds	Total Hhold sample
Boswell	1 (0)	(1)	(1)		(1)		1
Boyd Gibbons No-Fines	1 (1)						1
Diatomite	1 (0)	(1)		(1)		(1)	1
Duo-Slab	1 (1)						1
Easiform Type I	7 (5)	3 (5)	2 (2)	1 (3)	1 (2)	2 (3)	10
Easiform Type II	14 (10)	1 (5)	1 (2)	(3)	(5)		15
Incast	1 (1)						1
Miller No-Fines	1 (1)						1
Mowlem	4 (4)	1 (1)		1 (1)	1 (1)		5
Parkwall	1 (1)						1
Wakefield Special	1 (1)						1
Whatling	1 (1)						1
Wimpey No-Fines	125 (104)	17 (37)	11 (14)	6 (23)	10 (18)	7 (19)	142

Using residual rather than full income, tips a number of the sole sample cases, such as the Boswell and Diatomite systems into fuel poverty. However, the proportion of the sample in fuel poverty also increases substantially in homes constructed in the more common Easiform and Wimpey nofines systems. Over the two types of Easiform dwellings, the sample of households in fuel poverty increases from 4 to 10, while in the much larger sample of Wimpey no-fines houses the equivalent increase is from 17 to 37 households. In both systems, most of the increase occurs in modernised dwellings. On the new definition, the majority of fuel poor households in Wimpey no-fines dwellings (19) are in serious or severe fuel poverty.

The Pre-cast concrete systems

Of the 2001 EHCS sample of some 190 households living in pre-cast concrete proprietary systems, 26 are in fuel poverty on the full income definition. Of these, the majority (14) are living in un-modernised dwellings, but only four are in serious or severe fuel poverty. Using the residual income definition increases the sample of fuel poor households to 58, of which the majority (35) are in modernised dwellings.

With many of the households previously in only moderate fuel poverty becoming seriously or severely fuel poor, the total number of households in these categories increases from only 4 to 26 under the new definition.

The exclusion of net housing costs brings many households in systems with small samples and no previous examples of fuel poverty into fuel poverty. For example, this occurs in the case of the less common Cornish Unit Type II, Orlit Type I, Reema Contrad, Tarran Temporary Bungalow, Unity Type II and Wessex systems. However, the numbers of fuel poor are also increased in many of the more common systems, such as Airey, Cornish Unit Type I and Wates.

Table 4.32: Fuel poverty in metal framed systems – Full & (residual) income definitions

Pre-cast concrete systems in 2001 EHCS sample	In Fuel Poverty		FP in	FP in	Degree of FP		Total
	Not FP Hholds	Yes FP Hholds	un-mod. Hholds	mod. Hholds	mod. Hholds	serious Hholds	Hholds no.
Airey	17 (15)	4 (6)	2 (3)	2 (3)	4 (2)	(4)	21
Anglia Type A	1 (1)						1
Bison Crosswall	3 (3)						3
Boot Pier and Panel	3 (2)	2 (3)	1 (3)	1 (1)	1 (1)	1 (2)	5
Bryant Low Rise	2 (2)						2
Cornish Unit Type I	42 (34)	5 (13)	2 (2)	3 (11)	5 (7)	(6)	47
Cornish Unit Type II	2 (1)	(1)	(1)		(1)		2
Fram	1 (1)						1
Glasgow Foamed Slag	1 (0)	(1)		(1)	(1)	0	1
Gregory	1 (1)						1
Kenkast		1 (1)		1 (1)	1	(1)	1
Lecaplan	1 (1)						1
MFC	2 (1)	(1)	(1)		(1)		2
Myton	4 (4)	2 (2)	1 (1)	1 (1)	1	1 (2)	6
Newland	3 (1)	2 (4)	1 (3)	1 (1)	2 (3)	(1)	5
Orlit Type I	2 (1)	(1)		(1)		(1)	2
Orlit Type II	7 (7)	1 (1)		1 (1)	1	(1)	8
Reema Conclad	2 (2)						2
Reema Contrad	5 (2)	(3)	(1)	(2)	(3)		5
Reema Hollow Panel	10 (10)	1 (1)	1 (1)			1 (1)	11
Skarne	1 (1)						1
Smith	3 (3)						3
Spacemaker	5 (4)	(1)		(1)	(1)		5
Stent	2 (1)	(1)		(1)		(1)	2
Tarran Temporary Bungalow	5 (3)	(2)		(2)	(2)		5
Taylor Woodrow-Anglian	1 (1)						1
Unity Type I	3 (1)	1 (3)		1 (3)	1 (2)	(1)	4
Unity Type II	13 (10)	(3)	(1)	(2)	(3)		13
Wates	17 (15)	6 (8)	5 (6)	1 (2)	5 (4)	1 (4)	23
Wessex	2 (0)	(2)	(1)	(1)	(2)		2
Woolaway	1 (1)						1
Woolaways Bungalow	3 (3)	1 (1)	1 (1)		1	(1)	4

The Timber framed systems

Of the 45 households in the 2001 EHCS sample who inhabit timber-framed proprietary system dwellings, just 5 are in fuel poverty on the full income definition. Of these, three live in un-modernised dwellings and two in the modernised stock. On this definition, only one household is in serious or severe fuel poverty. Based on the residual income definition, however, the incidence of fuel poverty almost trebles to give 14 households in fuel poverty, of whom four are in serious or severe fuel poverty. Five of these households live in un-modernised housing and nine in modernised dwellings or those originally built to, at least, the specified standard. Although each adding no more than a couple of additional fuel poor households, the main increases come from the Frameform, MeTraTim and Swedish Timber systems.

Table 4.33: Fuel poverty in timber framed systems – Full & (residual) income definitions.

Metal frame systems in 2001 EHCS sample	**In Fuel Poverty**		**FP in**	**FP in**	**Degree of FP**		**Total**
	Not FP Hholds	**Yes FP Hholds**	**un-mod. Hholds**	**mod. Hholds**	**mod. Hholds**	**serious Hholds**	**Hholds no.**
Anchor 12M		1 (1)		1 (1)	0	1 (1)	1
Barratt	1 (1)						1
Caspon		1 (1)	1 (1)		1	(1)	1
Cedar Homes	1 (1)						1
Celtic Homes	2 (2)						2
Frameform	7 (5)	(2)		(2)	(2)		7
Guildway	4 (3)	1 (2)		1 (2)	1 (2)		5
Hallam Mk I & Mk II	4 (3)	(1)		(1)	(1)		4
Hallam Mk III	1 (1)						1
Lovell	1 (1)						1
MeTraTim	6 (4)	(2)		(2)	(2)		6
MHC	4 (4)						4
Purpose Built Type I	1 (0)	(1)		(1)	(1)		1
Quikbild	2 (2)						2
Spooner	1 (1)						1
Swedish Timber	5 (3)	1 (3)	1 (3)		1 (1)	(2)	6
YDG	0	1 (1)	1 (1)		1 (1)		1

The metal framed systems

In the 49 metal frame proprietary dwellings there are just 6 cases of fuel poverty on the full income definition, including one case of serious or severe fuel poverty, all of these cases occurring in the modernised stock. However, on the residual income definition, this number almost trebles to 17 households, of which 5 are in serious or severe fuel poverty. However, only three of the new cases occur in un-modernised dwellings. A particularly large increase occurs in the sample of twenty B.I.S.F. Type A1 dwellings, these having no cases of fuel poverty on the full income definition but six cases on the residual income definition, with five of these occurring in modernised dwellings.

Table 4.34: Fuel poverty in metal framed systems – Full & (Residual) income definitions

Metal frame systems in 2001 EHCS sample	In Fuel Poverty		FP in	FP in	Degree of FP		Total
	Not FP Hholds	Yes FP Hholds	un-mod. Hholds	mod. Hholds	mod. Hholds	serious Hholds	Hholds no.
AIROH Temp. Bungalow	1 (1)						1
Aluminium Bungalow	4 (3)	1 (2)	(1)	1 (1)	1 (1)	(1)	5
BISF Type A	1 (1)	1 (1)		1 (1)		1 (1)	2
BISF Type A1	20 (14)	(6)	(1)	(5)	(6)		20
BISF Type B	1 (1)						1
BISF Type C	3 (1)	1 (3)		1 (3)	1 (1)	(2)	4
Cussins		1 (1)		1 (1)	1	(1)	1
Hawthorn Leslie	1 (1)						1
Howard Type B	1 (1)						1
Livett-Cartwright	1 (1)						1
MOHLG 5M	2 (1)	(1)		(1)	(1)		2
New Georgian	1 (1)						1
Trusteel 3M	6 (5)	1 (2)	(1)	1 (1)	1 (1)		7
Trusteel Mk II	1 (1)	1 (1)		1 (1)	1 (1)		2

4.1.4 The distribution of fuel poverty in non-traditional housing

This section examines the distribution of fuel poverty on the three main definitions by tenure (public or private) and by household vulnerability. For these variables, the analysis provides a comparison between the main forms of non-traditional construction (low-rise housing or medium and high rise flats) and the main types of masonry construction (solid wall, cavity wall and cross-wall housing). Sample sizes are generally insufficient to give representative estimates for more detailed three-way cross-tabulations showing individual non-masonry types or proprietary systems.

Tenure

With the exception of traditional masonry housing with solid walls, levels of fuel poverty when measured on the full income definition are higher in the public sector than in private housing. This appears particularly true of households in ‘non-traditional’ masonry cross-wall dwellings, although the sample of these in the public sector is quite small (96 addresses). By this definition, around a half of all fuel poor household in non-traditional housing rent from a local authority or registered social landlord.

Table 4.35: Fuel poverty by sector - Full income definition

Main constructional types	**All households in fuel poverty**				**All private sector households**	
	Private sector		**Public sector**			
	1000s	**percent**	**1000s**	**percent**	**1000s**	**percent**
Masonry solid box-wall	636	12.8	44	10.0	4,971	91.9
Masonry cavity box-wall	686	6.4	224	7.7	10,769	78.8
Masonry cross-wall	3	2.0	8	9.2	142	60.8
Non-masonry low rise	48	10.3	30	11.7	459	64.3
Non-masonry medium/high rise	13	8.6	30	9.4	157	32.7
All occupied housing	**1,386**	**8.4**	**336**	**8.4**	**16,498**	**80.4**

The basic income definition shifts the problem to the public sector for all forms of housing construction. By this definition, some 71% of all households in fuel poverty in non-traditional housing come from the public sector. A quarter or just under a quarter of tenants living in the three main forms of non-traditional housing are in fuel poverty, as are those living in traditional solid wall housing in the public sector. With the private sector dominated by owner-occupiers and few of these receiving ISMI, levels of fuel poverty in the private sector are only slightly above those recorded for the full income definition. Consequently, these are now substantially lower than the rates recorded for public sector tenants. (Table 4.36)

Table 4.36: Fuel poverty by sector - Basic income definition

Main constructional types	**All households in fuel poverty**				**All public sector households**	
	Private sector		**Public sector**			
	1000s	**percent**	**1000s**	**percent**	**1000s**	**percent**
Masonry solid box-wall	712	14.3	106	24.2	440	8.1
Masonry cavity box-wall	752	7.0	554	19.1	2904	21.2
Masonry cross-wall	4	2.7	23	25.1	91	39.2
Non-masonry low rise	50	10.8	61	24.0	255	35.7
Non-masonry medium/high rise	13	8.6	77	23.9	322	67.3
All occupied housing	**1531**	**9.3**	**821**	**20.5**	**4012**	**19.6**

A similar picture is produced using the more meaningful residual income definition, excluding housing costs. The percentage of all households in fuel poverty in non-traditional housing stays at around 70%. However, nearly a third of tenants living in public sector non-traditional medium/high rise flats and in masonry cross-wall housing are now in fuel poverty. Also in the public sector, rates of fuel poverty in non-masonry low rise housing are very similar to those in traditional masonry housing with solid walls (at 31%). Although the exclusion of housing costs increases rates of fuel poverty in the private sector substantially, in the non-traditional housing, these rates are still typically half of those found in the public sector.

Table 4.37: Fuel poverty by sector - Residual income definition

Main constructional types	All households in fuel poverty				All public sector households	
	Private sector		Public sector			
	1000s	percent	1000s	percent	1000s	percent
Masonry solid box-wall	930	19.1	138	31.3	440	8.1
Masonry cavity box-wall	1,031	9.8	747	25.7	2,904	21.2
Masonry cross-wall	8	5.5	30	32.6	91	39.2
Non-masonry low rise	58	12.9	79	30.8	255	35.7
Non-masonry medium/high rise	26	16.8	108	33.6	322	67.3
All occupied housing	**2,053**	**12.7**	**1,102**	**27.5**	**4,012**	**19.6**

Vulnerable households

Although with a much smaller number, non-masonry low-rise dwellings share the highest proportion of vulnerable households (72%) with traditional masonry cavity wall dwellings. Traditional solid wall dwellings house the lowest proportion of vulnerable households (64%), but have the highest proportion of such households in fuel poverty (16%) on the full income definition. Non-masonry low-rise homes have the second highest proportion of vulnerable households in fuel poverty with a similar percentage i.e. 13%. Masonry cross-wall housing has easily the lowest rate of fuel poverty with less than 5%.

With the exception of masonry cross-wall and non-traditional medium or high rise flats, the incidence of fuel poverty is generally greater amongst vulnerable households than non-vulnerable households. However, non-vulnerable households living in the latter such flats have the third highest proportion of households in fuel poverty (11%). Due to this, the overall proportion of vulnerable to non-vulnerable fuel poor is slightly lower in non-traditional housing (76%) than in the stock as a whole (82%) on the full income definition.

Table 4.38: Fuel poverty by vulnerable household - Full income definition

Main constructional types	All households in fuel poverty				All vulnerable Households	
	Non-vulnerable		Vulnerable			
	1000s	percent	1000s	percent	1000s	percent
Masonry solid box-wall	136	7.0	544	15.7	3,455	63.9
Masonry cavity box-wall	137	3.6	773	7.8	9,851	72.0
Masonry cross-wall	4	5.8	7	4.4	165	70.8
Non-masonry low rise	10	4.8	68	13.2	512	71.8
Non-masonry medium/high rise	18	10.9	26	8.2	317	66.3
All occupied housing	**304**	**4.9**	**1,418**	**9.9**	**14,301**	**69.7**

By the basic income definition, 1 in 5 vulnerable households in non-masonry low-rise housing are in fuel poverty (see table 4.39). Rates amongst vulnerable households are also high in non-traditional medium and high rise flats and in traditional masonry housing with solid walls, both having 19% of households in fuel poverty. A similar rate is also recorded by non-vulnerable households in non-traditional medium and high rise housing. Overall, of all the fuel poor households in non-traditional housing on the basic income definition, some 78% are now vulnerable households.

Table 4.39: Fuel poverty by vulnerable household - Basic income definition

Main constructional types	All households in fuel poverty				All vulnerable Households	
	Non-vulnerable		Vulnerable			
	1000s	percent	1000s	percent	1000s	percent
Masonry solid box-wall	162	8.3	657	19.0	3,455	63.9
Masonry cavity box-wall	199	5.2	1107	11.2	9,851	72.0
Masonry cross-wall	7	10.3	20	11.9	165	70.8
Non-masonry low rise	11	5.4	100	19.5	512	71.8
Non-masonry medium/high rise	31	19.3	59	18.7	317	66.3
All occupied housing	**410**	**6.6**	**1,943**	**13.6**	**14,301**	**69.7**

Under the residual income definition, vulnerable households in non-traditional housing again have the highest rates of fuel poverty. Rates are particularly high in non-traditional medium and high rise flats, 31% of non-vulnerable households and 27% of vulnerable households being fuel poor. However, the risk is also high for vulnerable households in non-masonry low rise housing and in traditional solid wall housing, the percentage of such households suffering fuel poverty being 24% and 23% respectively. Apart from the situation in medium/high rise non-traditional flats, in all forms of construction, the risk of fuel poverty is substantially greater amongst vulnerable households than for those who are classed as non-vulnerable.

Table 4.40: Fuel poverty by vulnerable household - Residual income definition

Main constructional types	All households in fuel poverty				All non-vulnerable Households	
	Non-vulnerable		Vulnerable			
	1000s	percent	1000s	percent	1000s	percent
Masonry solid box-wall	291	15.2	777	22.9	1,956	36.1
Masonry cavity box-wall	344	9.2	1,435	14.8	3,822	28.0
Masonry cross-wall	9	13.9	28	17.2	68	29.2
Non-masonry low rise	15	7.5	122	24.0	202	28.2
Non-masonry medium/high rise	49	30.8	85	26.8	161	33.7
All occupied housing	**708**	**11.7**	**2,447**	**17.4**	**6,209**	**30.3**

4.1.5. The causes of fuel poverty in non-traditional housing

The four main causes of fuel poverty are low household income, poor energy efficiency, high fuel prices and under-occupation. This section analyses the extent to which the differences in the levels of fuel poverty between the main non-traditional and traditional types of housing can be explained by these main causal factors.

Causal Factors in the Main Constructional Types

Table 4.41 shows the average household income for each of the three income definition used in fuel poverty. In each case, the percentage of households with incomes of less than £7,665 is also shown, some 15% of all households in England having full incomes below this amount, exactly 20% basic incomes and some 25% with residual incomes, after housing costs, at this level in 2001. The table also shows the percentage of households in each constructional type in receipt of housing benefit.

On all three definitions, households living in non-traditional medium and high rise housing have both the lowest average incomes and greatest proportion of households with incomes below £7,665. In each case, this proportion is nearly twice that for the national household population. Some 40% of these households are in receipt of housing benefit. On all definitions, households living in masonry cross-wall dwellings generally have the second lowest incomes, and also have the second highest proportion of households in receipt of housing benefit.

Again on all definitions, the highest average incomes belong to households living in traditional masonry housing with solid walls, but the second highest averages are to be found in non-masonry low-rise housing. However, depending on the income definition, these have an equal or greater proportion of low income households than households living in traditional masonry housing with cavity walls. They also have a significantly higher proportion of households in receipt of housing benefit (22%) than households in traditional masonry housing.

Table 4.41: Household incomes in main constructional types

All types of construction	Full income Mean £	% < £7665	Basic income Mean £	% < £7665	Residual AHC Mean £	% < £7665	Has % < %
Masonry solid box-wall	22,257	13.5	21,921	17.1	19,132	22.6	9.6
Masonry cavity box-wall	19,252	15.4	18,878	20.2	16,562	25.4	14.4
Masonry cross-wall	17,642	17.4	16,758	26.4	14,022	32.3	28.9
Non-masonry low rise	20,033	15.4	19,477	22.4	17,515	28.5	21.5
Non-trad med/high rise	12,918	27.5	11,857	39.4	9,890	49.5	40.2
All occupied housing	19,906	15.2	19,514	20.0	17,086	25.4	14.1

The energy efficiency of each constructional type has been described in detail above. But it should be noted here that the types that generally house the lowest income households, non-traditional medium and high-rise flats and masonry cross-wall systems have the highest average SAP ratings. Conversely, the type with generally the highest incomes - traditional housing with solid walls – has the lowest average SAP rating and highest proportion of particularly inefficient dwellings.

Although largely determined by the energy efficiency of the dwelling, the distribution of unit fuel costs does not follow the pattern of energy efficiency exactly, due to other compounding factors such as the different heating regimes required and different requirements for non-heating fuels. Nevertheless, on average, the least efficient construction type – masonry solid wall housing -does have the highest average unit fuel costs and percentage of particularly high unit costs (in the highest 20% nationally). However, although with a lower average, non-masonry low-rise housing has only a marginally lower proportion of dwellings (30%) with particularly high unit fuel costs. Largely reflecting their better energy efficiency, both masonry cross-wall and cavity wall dwellings have easily the lowest average unit fuel costs and proportion of dwellings with particularly high costs.

The final factor affecting the total fuel costs is the size of the dwelling. Not surprisingly, the non-traditional medium and high rise flats, followed by the masonry cross-wall systems, have the lowest average total floor area and proportion of dwellings in the largest 20% of homes nationally. Traditional masonry dwellings with solid walls have easily the largest total floor areas and percentage of particularly large dwellings, but non-masonry low-rise dwellings appear, in general, only slightly smaller than traditional housing with cavity walls.

Table 4.42: Factors determining total fuel costs in main constructional types

All types of construction	E. efficiency		Unit fuel costs		Size of dwelling		House holds
	Meann SAP	% < SAP 35	Mean £/m2	% < £9.6 m2	Mean sq m	% < 107 m2	x1000
Masonry solid box-wall	42.2	25.6	9.3	31.4	94.7	24.7	5,411
Masonry cavity box-wall	53.8	8.8	7.7	14.7	85.4	19.1	13,672
Masonry cross-wall	57.8	7.6	7.9	13.1	74.9	9.1	234
Non-masonry low rise	49.3	19.1	8.8	31.1	82.8	15.2	714
Non-trad med/high rise	56.2	12.9	9.0	28.3	60.5	4.1	479
All occupied housing	50.7	13.6	8.2	20.0	87.1	20.0	20,510

As well as the size of the dwelling, the number of occupants also determines the required total fuel costs. Consequently, the first part of the third table in this set shows the average number of occupants and the proportion of dwellings that are under-occupied on the specific definition of under-occupation used in the calculation of fuel poverty. With an average of 1.9 persons per dwelling, occupancy levels are lowest in non-traditional medium and high rise flats, but these smaller dwellings also have the lowest level of under-occupation.

The highest occupancy levels (2.5 persons) are to be found in traditional masonry solid wall housing and in the non-masonry low rise systems, although the former have a substantially higher level of under-occupation (26% compared to 18%). However, average occupancy levels are only marginally lower (2.4 persons per dwelling) in traditional cavity wall housing and in the masonry cross-wall systems, both these types having more average levels of under-occupation (with 24 to 20% of households under-occupying respectively).

Resulting from the factors discussed above, the second part of the table shows the total required fuel costs in each of the main constructional types. Largely as a result of their smaller floor areas and, in the case of the flats, lower occupancy levels, non-traditional medium and high-rise flats and masonry cross-wall systems, have the lowest total fuel costs. With their larger size, high occupancy rates and higher unit fuel costs reflecting poorer energy efficiency, traditional solid wall housing followed by non-traditional low-rise housing has the highest average total fuel costs and largest proportion of housing with the highest 20% of fuel costs nationally.

Table 4.43: Factors determining fuel poverty in main constructional types

All types of of construction	Occupancy Mean pers.	% under-occupy	Total fuel costs Mean £	> £811	TFC/income Mean %	% < 10%	House house x1000
Masonry solid box-wall	2.5	26.4	777	33.4	5.6	12.6	5,411
Masonry cavity box-wall	2.4	23.5	613	15.3	4.6	6.7	13,672
Masonry cross-wall	2.4	20.1	540	10.7	4.6	4.8	234
Non-masonry low rise	2.5	18.4	662	18.6	5.2	10.8	714
Non-trad med/high rise	1.9	11.7	504	7.6	5.3	9.1	479
All occupied housing	**2.4**	**23.8**	**655**	**20.0**	**4.9**	**8.4**	**20,510**

The final section of the table expresses the total fuel costs as a percentage of full income to give the level of fuel poverty. In the case of the solid wall dwellings, higher average incomes are often not sufficient to offset the substantially higher total fuel costs. Consequently, the average percentage of income required for fuel is highest here (5.6%) as is the proportion of all household (12.6%) needing to spend more than 10% of their income on fuel and thus in fuel poverty.

Many households in non-masonry low-rise housing are in a similar position, their generally relatively high incomes not being sufficient to offset the higher total fuel costs. Conversely, while the total heating costs are on average much lower in non-traditional medium and high-rise flats, they are in many cases not sufficiently low to compensate for the low incomes generally found in this type of housing. In contrast, in masonry cross-wall systems, the incomes although still generally below the national average are better matched to the significantly lower than average total fuel costs, resulting in lower levels of fuel poverty.

The next tables examine the extent to which the main causal factors are a greater problem amongst households in fuel poverty than for the general household population in each of the main constructional types. First, Table 4.44 looks at the respective average incomes of all households and fuel poor households on each of the income definitions.

On the full income definition, the average income of households in fuel poverty is generally around a third of that for all households, except in the case of non-traditional medium and high rise non-traditional housing were it is nearer a half. For basic incomes, the divergence is greater, households in fuel poverty having an average income of less than a third of the general population, apart from in the non-traditional flats were it is again higher and in masonry cross-wall housing were it is only a quarter. On the residual income definition, the divergence is similar or slightly less than with basic incomes.

Table 4.44: Mean household incomes of all households and those in fuel poverty

All types of construction	Full income Mean £	In FP Mean	Basic income Mean £	In FP Mean	Residual AHC Mean £	In FP Mean
Masonry solid box-wall	22,257	7,589	21,921	6,830	19,132	5,850
Masonry cavity box-wall	19,252	6,459	18,878	5,638	16,562	5,016
Masonry cross-wall	17,642	5,653	16,758	4,261	14,022	3,958
Non-masonry low rise	20,033	6,998	19,477	6,145	17,515	5,622
Non-trad med/high rise	12,918	5,751	11,857	4,402	9,890	3,869
All occupied housing	**19,906**	**6,906**	**19,514**	**6,014**	**17,086**	**5,263**

The next table compares the averages for all households and those in fuel poverty on the full income definition for each of the factors determining the fuel costs. In all constructional types, the average SAP rating of the homes occupied by those in fuel poverty is substantially lower than the average for all dwellings of that type. The unit fuel costs are also significantly higher, and this is particularly the case for medium and high-rise non-traditional housing. Fuel poor households also generally have larger dwellings than the general population, with the notable exception of non-masonry low-rise housing where they are smaller.

Table 4.45: Factors determining total fuel costs for all households and those in fuel poverty.

All types of construction	E. efficiency Mean SAP	In FP Mean	Unit fuel costs Mean £/m2	In FP Mean	Size of dwelling Mean sq m	In FP Mean	House holds x1000
Masonry solid box-wall	42.2	28.0	9.3	12.9	94.7	110.4	5,411
Masonry cavity box-wall	53.8	37.1	7.7	10.3	85.4	95.4	13,672
Masonry cross-wall	57.8	43.6	7.9	11.2	74.9	81.0	234
Non-masonry low rise	49.3	26.5	8.8	14.0	82.8	77.7	714
Non-trad med/high rise	56.2	33.7	9.0	14.5	60.5	74.6	479
All occupied housing	**50.7**	**33.0**	**8.2**	**11.6**	**87.1**	**99.9**	**20,510**

The proportion of household’s under-occupying their home is also substantially higher amongst fuel poor households, being twice as high in the case of both types of non-masonry housing and traditional housing with cavity walls. Overall, the average total fuel costs of households in fuel poverty are around 40% higher than for all households, but this rises to 60% in the case of non-traditional medium and high-rise flats. These significantly higher fuel costs combined with the substantially lower incomes shown in Table 4.44 above, result in average fuel cost to income ratios that are typically around three times greater than those of the total household population.

Table 4.46: Factors determining fuel poverty for all households and those in fuel poverty

All types of of construction	Under-occupancy Total %	In FP %	Total fuel costs Mean £	In FP Mean	TFC/income Mean fuel %	In FP fuel %	In FP Hholds x1000
Masonry solid box-wall	26.4	45.8	777	1103	5.6	15.3	680
Masonry cavity box-wall	23.5	50.5	613	861	4.6	13.8	910
Masonry cross-wall	20.1	28.0	540	750	4.6	14.5	11
Non-masonry low rise	18.4	36.0	662	951	5.2	13.8	77
Non-trad med/high rise	11.7	24.5	504	815	5.3	14.8	44
All occupied housing	**23.8**	**47.2**	**655**	**959**	**4.9**	**14.4**	**1,722**

4.2 Wales, Northern Ireland and Scotland HCS

4.2.1 Non-Traditional Housing in Wales

The 1998 Welsh House Condition Survey identified some 62,700 non-traditional dwellings and a further 1,200 dwellings that were “probably non-traditional” making a likely non-traditional stock in Wales of just under 64,000 dwellings. Although having only one specific question on non-traditional construction, it is possible from other data in the survey to determine the wall material and storey height of those buildings identified as non-traditional or probably non-traditional and to compare the energy efficiency and fuel poverty levels in different types with that for the two main forms of traditional masonry construction.

Energy Efficiency

Table 4.47 shows the mean and distribution of SAP ratings in the Welsh housing stock, based on the 1998 version of SAP. Total numbers for each type of construction are also shown (with sample sizes in brackets). As in England, traditional solid wall masonry housing has the lowest average SAP rating (36) and one of the highest proportions of particularly inefficient properties (37%). Also as in England, non-traditional medium and high rise flats have the highest average rating (SAP 50) and easily the higher percentage of dwellings with SAP ratings of 65 or over (27%).

Lying between these extremes, in-situ concrete and pre-cast concrete low-rise housing is on a par with that for traditional masonry cavity wall housing, all having an average SAP of 43. However, as in England, pre-cast concrete and timber low-rise housing , which will include the oldest ‘traditional’ timber framed housing, has lower average ratings (39) and a large proportion of particularly inefficient housing (32% and 44% respectively).

Table 4.47: SAP ratings by main constructional types

Main construction types from 1998 WHCS	Mean SAP	% distribution of SAP ratings			Thous. hholds
		less 35	35-65	65 plus	
Traditional masonry solid wall	35.5	37.2	60.9	1.9	347 (4585)
Traditional masonry cavity wall	42.7	23.4	67.5	9.1	747 (6758)
Non-trad medium & high rise flats	49.9	26.3	46.4	27.3	9 (97)
Insitu concrete etc low rise	42.8	24.8	64.2	11.0	22 (230)
Pre-cast concrete low rise	38.6	32.0	63.6	4.5	12 (162)
Timber low rise housing	38.7	43.9	45.8	10.4	9 (82)
Metal/other low rise housing	42.5	25.4	68.2	6.4	12 (123)
All occupied dwellings	**40.5**	**27.8**	**65.1**	**7.0**	**1,157**

Fuel Poverty

Revised fuel poverty estimates for Wales for the 1997/98 WHCS, show high levels of fuel poverty arising from a combination of factors. These include generally low incomes and poor energy efficiency, but also high fuel prices some but not all of which can be attributed to the earlier date of the survey.

On the full income definition, the incidence of fuel poverty is highest amongst households living in non-traditional low-rise housing using metal frames or pre-cast concrete Over a half of all households are in fuel poverty in both of these system types, and in the former 11% are in severe fuel poverty. In addition, households in insitu concrete dwellings have the third highest level of fuel poverty (41%), but the largest number of fuel poor households living in non-traditional housing in Wales (over 8,000). Reflecting their relatively high energy efficiency, the non-traditional medium and high-rise flats show the lowest proportion of households in fuel poverty (23%).

Table 4.48: Fuel poverty by main constructional types - Full income definition

Main non-masonry types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
	1000s	percent	mod. percent	serious percent	severe percent	1000s
Traditional masonry solid wall	122.1	36.1	18.6	8.8	8.6	347
Traditional masonry cavity wall	213.0	28.1	16.7	6.4	5.0	747
Non-trad medium & high rise flats	2.0	22.9	14.1	2.4	6.4	9
Insitu concrete etc low rise	8.3	41.0	25.3	10.3	5.4	22
Pre-cast concrete low rise	6.6	50.1	26.8	14.0	9.3	12
Timber low rise housing	2.8	33.2	18.5	7.3	7.4	9
Metal/other low rise housing	5.8	53.1	30.1	12.2	10.8	12
All occupied dwellings	**360.5**	**31.1**	**17.7**	**7.3**	**6.2**	**1,157**

Based on the basic income definition, the metal frame, pre-cast concrete and in-situ concrete low rise housing, in that order, continue to show the highest incidence of fuel poverty, but now with a significantly higher proportion of households in severe fuel poverty. However, with the exclusion of household benefit from income, non-traditional medium and high-rise flats no longer show the least proportion of households in fuel poverty, this position now being taken by households in traditional cavity wall dwellings – albeit still with easily the highest number of fuel poor.

Table 4.49: Fuel poverty by main constructional types – Basic income definition

Main non-masonry types	**All households in fuel poverty**		**Degree of fuel poverty**			**Total Hseholds**
	1000s	**percent**	**mod. percent**	**serious percent**	**severe percent**	**1000s**
Traditional masonry solid wall	126	37.3	18.0	8.5	10.8	347
Traditional masonry cavity wall	239	31.5	15.5	6.7	9.3	747
Non-trad medium & high rise flats	3	34.2	15.2	5.8	13.2	9
Insitu concrete etc low rise	9	46.0	21.4	10.6	14.0	22
Pre-cast concrete low rise	7	55.9	19.0	14.6	22.3	12
Timber low rise housing	3	37.5	16.0	8.9	12.6	9
Metal/other low rise housing	6	57.5	20.5	14.4	22.6	12
All occupied dwellings	**394**	**34.0**	**16.4**	**7.5**	**10.2**	**1,157**

The data on residual incomes from the WHCS is equivalised i.e. is corrected for household size and composition. Using the equivalised residual income definition, as well as further increasing the number of fuel poor changes the distribution slightly. Pre-cast concrete housing now shows the highest levels of fuel poverty (64%), followed by the households living in metal frame and insitu-concrete low-rise dwellings (with 59% and 57% respectively). However, under this definition, non-traditional medium and high-rise flats regain the position of having the least proportion of fuel poor households of any building type (34%).

Table 4.50: Fuel poverty by main constructional types – Residual income definition

Main non-masonry types	**All households in fuel poverty**		**Degree of fuel poverty**			**Total Hseholds**
	1000s	**%**	**mod. percent**	**serious percent**	**severe percent**	**1000s**
Traditional masonry solid wall	164	48.5	19.9	10.6	18.0	347
Traditional masonry cavity wall	313	41.3	18.0	9.1	14.2	747
Non-trad medium & high rise flats	3	34.1	18.8	5.5	9.8	9
Insitu concrete etc low rise	12	57.0	18.9	9.9	28.3	22
Pre-cast concrete low rise	8	63.7	20.5	15.1	28.0	12
Timber low rise housing	4	47.7	21.7	11.9	14.2	9
Metal/other low rise housing	6	59.3	22.0	11.6	25.7	12
All occupied dwellings	**510**	**44.1**	**18.7**	**9.6**	**15.8**	**1,157**

4.2.2 Non-Traditional Housing in Northern Ireland

The 2001 Northern Ireland House Condition Survey (NIHCS) provides a sample of just 185 non-traditional dwellings representing a total of about 20,700 such homes in the national stock. The NIHCS classifies non-traditional housing into generic types in the same way as the EHCS, distinguishing the material used, concrete, timber or metal and in the case of the former the type of construction, box-wall or cross-wall, and whether poured in-situ or pre-cast. However, because of the small sample sizes, all concrete systems other than the more common in-situ concrete systems have been grouped into just hi-rise and low-rise dwellings. Even with this grouping, some of the sample sizes remain very small and, therefore, the grossed estimates need to be treated with considerable caution.

Energy Efficiency

Although based on a very small sample, concrete high-rise housing appears to have the lowest average SAP rating (43) and the highest proportion of particularly inefficient dwellings, this contrasting with the situation elsewhere in the UK. Both in-situ and pre-cast concrete low rise houses and flats also have lower than average SAP ratings, although the former has significantly larger proportion of inefficient properties than the latter. Metal and timber framed dwellings are generally the most energy efficient, with the latter having easily the highest proportion of dwellings with SAP ratings of 65 or above (43%).

Table 4.51: SAP ratings by main non-masonry types

Main construction types from 2001 NIHCS	**Mean SAP**	**% distribution of SAP ratings**			**Thous. hholds**
		less 35	**35-65**	**65 plus**	
Concrete high-rise	43.4	32.1	54.2	13.7	1.6 (11)
In-situ concrete low rise	53.0	17.1	59.4	23.5	5.1 (49)
Other concrete low-rise systems	51.4	8.5	70.8	20.7	2.2 (17)
Timber frame	57.8	10.2	46.6	43.2	11.0 (97)
Metal frame	56.8	3.2	74.1	22.7	0.7 (11)
All non-masonry dwellings	54.8	13.2	53.9	32.9	20.7 (185)

Fuel Poverty

In Northern Ireland, the level of fuel poverty in non-traditional housing is extremely high, 46% of all households living in such properties being fuel poor on the full income definition, including 12% in severe fuel poverty. No fewer than 87% of households in concrete high rise blocks are shown as being fuel poor, but as this figure is based on a sample of only 11 dwellings it cannot necessarily be taken as representative. However, with a more significant sample, in-situ concrete low-rise houses and flats and other concrete low-rise systems also show over half of their households in fuel poverty and high levels of severe fuel poverty. By comparison, timber frame dwellings and, particularly, metal frame houses show significantly lower rates of fuel poverty (36% and 17% respectively) although the last estimate is again based on an extremely small sample.

Table 4.52: Fuel poverty by non-masonry types – Full income definition

Main non-masonry types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
	1000s	percent	mod. percent	serious percent	severe percent	1000s
Concrete high-rise	1.4	86.7	4.5	74.3	8.0	1.6
In-situ concrete low rise	2.9	56.9	32.1	14.0	10.9	5.1
Other concrete low-rise systems	1.1	50.6	5.2	2.0	43.4	2.2
Timber frame	4.0	36.4	15.9	13.9	6.6	11.0
Metal frame	0.1	16.6	16.6			0.7
All non-masonry dwellings	9.6	46.6	18.1	16.6	11.8	20.7

Using the basic income definition, has no affect on the already large proportion of households in concrete high rise flats recorded as bring in fuel poverty, but does put nearly half of these into severe fuel poverty. The change in definition also achieves a similar effect to the fuel poor households in in-situ concrete low rise housing. However, overall fuel poverty levels do increase in other concrete low-rise systems, putting these into the second position behind non-traditional high rise blocks. There is also an increase in timber frame housing in both the level of fuel poverty generally and particularly in the level of severe fuel poverty.

Table 4.53: Fuel poverty by non-masonry types – Basic income definition

Main non-masonry types	All households in fuel poverty		Degree of fuel poverty			Total Hseholds
	1000s	percent	mod. percent	serious percent	severe percent	1000s
Concrete high-rise	1.4	86.7		44.4	42.3	1.6
In-situ concrete low rise	2.9	56.9	20.4	19.4	17.1	5.1
Other concrete low-rise systems	1.3	57.3	11.9	2.0	43.4	2.2
Timber frame	4.5	40.9	10.2	13.6	17.0	11.0
Metal frame	0.1	16.6	16.6			0.7
All non-masonry dwellings	10.3	49.7	12.5	15.7	21.5	20.7

Unlike the situation in England and Wales, no fuel poverty variable or data on housing costs is available from the 2001 NIHCS to be able to estimate fuel poverty levels on the residual income definition. However as apart from the metal and timber frame housing, a high proportion of the households in this sector of the stock are socially renting and on full housing benefit, the estimates are unlikely to change substantially from those shown by the basic income definition.

4.2.3 Non-Traditional Housing in Scotland

As discussed in the introduction to the report, the data available on non-traditional housing from the 2002 Scottish House Condition Survey is limited to just 81 sample addresses covering some 36 in-situ concrete, 20 pre-cast concrete and 25 metal frame system-built dwellings. When grossed to the national stock these represent a total of some 9,200 occupied homes. Table 6.1 shows the mean and distribution of SAP ratings (1998 version) for the three constructional types. As well as the total households after grossing, the last column also provides the individual sample sizes. These are small and consequently the following estimates need to be treated with caution.

Energy Efficiency

The in-situ concrete systems have the lowest average SAP ratings (49) and highest proportion of particularly inefficient dwellings (22%). These ratings are similar to those found in England, where the most common in-situ concrete box-wall systems also have an average rating of 49 and 18% of their stock with ratings below 35 (see Table 4.8). In Scotland, the pre-cast concrete systems have a slightly higher average (SAP 52) and again this is broadly comparable with the averages found in pre-cast concrete dwellings in England, although in Scotland having a lower proportion of inefficient dwellings – and based on a much smaller sample.

Easily the most efficient properties are the metal framed systems with an average SAP rating of 71, no dwellings below 35 and 83% with ratings over 65. These are substantially better than the equivalent dwellings in England and, despite the small sample, suggest that they have been subject to a comprehensive improvement programme.

Table 4.54: SAP ratings by main types of non-masonry construction

Non-masonry systems in 2002 SHCS sample	Mean SAP	% distribution of SAP ratings			Thous. hholds
		less 35	35-65	65 plus	
Insitu concrete systems	49.4	22.3	62.4	15.3	4.3 (36)
Pre-cast concrete systems	51.5	6.9	77.9	15.2	2.6 (20)
Metal frame systems	71.2	0	17.5	82.5	2.3 (25)
All recorded systems	**55.5**	**12.3**	**55.3**	**32.4**	**9.2 (81)**

The project team identified 14 named proprietary systems in the 2002 SHCS sample, comprising six insitu concrete systems, two precast concrete systems and six metal frame systems. The latter include four types not covered by the 2001 EHCS sample, namely the Atholl 45, Atholl 51, Cruden and Dennis systems.

Table 4.55 shows the mean SAP rating and the distribution of SAP ratings for each of the types. (There was not the data available to the team to create the same modernisation variable as used with the EHCS sample). As with the EHCS sample of individual proprietary types, these un-grossed mean SAP ratings and their distribution should in no way be taken as necessarily representative of those for the systems in the Scottish housing stock.

The least energy efficient dwelling in this sample was provided by the sole example of the Duo-Slab system, this dwelling having a SAP rating of only 4. The highest average rating found amongst the remaining in-situ concrete systems was a mean SAP of 61 given by two examples of the Easiform Type I system. The two pre-cast concrete systems provided mean SAP ratings of around 50. The highest ratings are to be found amongst the metal frame systems, the two examples of the Cruden system producing an average SAP of 84 and all of the remaining systems apart from the sole example of the Trusteel Mark II system having individual or mean ratings of over SAP 70.

Table 4.55 SAP ratings of individual proprietary systems in 2002 SHCS sample

Proprietary systems in 2002 SHCS sample	**BRE code**	**Mean SAP**	**SAP distribution** < SAP 35	SAP 35-65	SAP 65 +	**Total sample size**
Duo-Slab	S022	4.0	1	0	0	1
Easiform Type 1	S023	60.5	0	2	0	2
Easiform Type 2	S024	46.5	1	0	1	2
Miller No-Fines	S038	33.0	1	0	0	1
Mowlem	S043	53.0	1	1	1	3
Wimpey No-fines	S062	49.0	4	12	2	18
MFC	P082	51.0	0	1	0	1
Orlit Type II	P092	48.3	0	3	0	3
Atholl 45	M011	72.4	0	3	14	17
Atholl 51	M012	71.0	0	0	1	1
BISF Type A1	M017	60.5	0	1	1	2
Cruden	M031	83.5	0	0	2	2
Dennis	M035	75.5	0	0	2	2
Trusteel Mk II	M097	53.0	0	1	0	1

Fuel Poverty

Unlike the equivalent variables for England, Wales and Northern Ireland, the fuel poverty variable from the 2002 SHCS does not distinguish between various levels of fuel poverty. Also no information is available from the Scottish survey to enable fuel poverty estimates to be determined using the basic and residual income definitions. However, on the full income definition, fuel poverty in the three main non-masonry types follows the pattern of energy efficiency, with the highest proportion (23%) living in the in-situ concrete housing and the second highest (17%) coming from the pre-cast concrete systems. With their particularly high energy efficiency, none of the households living in metal frame dwellings are in fuel poverty on this definition.

Table 4.56: Fuel poverty in non-masonry types - Full income definition

Non-masonry systems in 2002 SHCS sample	**Number & percentage in fuel poverty** Not in fuel poverty 1000s	percent	**In fuel poverty** 1000s	percent	**Hseholds & sample 1000s**
Insitu concrete systems	3.3	77.5	1.0	22.5	4.3 (36)
Pre-cast concrete systems	2.1	83.0	0.4	17.0	2.6 (20)
Metal frame systems	2.3	100.0	0.0	0.0	2.3 (25)
All occupied housing	**7.8**	**84.8**	**1.4**	**15.2**	**9.2 (81)**

includes 162 missiung cases distributed pro-rata.

The next table shows the number of households in fuel poverty in each of the identified proprietary systems in the SHCS sample. As with the SAP ratings these should not be taken as necessarily representative of fuel poverty in the total Scottish stock of these particular systems. As the Scottish data does not give an indication of the degree of fuel poverty, the number of households with incomes below or above £200 per week – roughly the mean for the sample - is provided instead.

Only two of these individual systems are recorded as having households in fuel poverty, these being two insitu concrete systems - Mowlem and Wimpey No-fines. Both of these systems show the high proportion of households on weekly incomes of under £200. Although by no means the lowest, these systems also have relatively low average SAP ratings. Finding no households in fuel poverty in the metal systems is not surprising; these having particularly high SAP ratings and also a relatively small proportion of very low income households.

Table 4.57 Fuel poverty in individual proprietary systems in 2002 SHCS sample

Proprietary systems in 2002 SHCS sample	BRE code	In Fuel Poverty: Not FP Hholds	In Fuel Poverty: In FP Hholds	Weekly income: < £200	Weekly income: >= £200	Total sample size
Duo-Slab	S022	1	0	0	1	1
Easiform Type 1	S023	2	0	1	1	2
Easiform Type 2	S024	2	0	1	1	2
Miller No-Fines	S038	1	0	1	0	1
Mowlem	S043	2	1	3	0	3
Wimpey No-fines	S062	12	6	13	5	18
MFC	P082	1	0	0	1	1
Orlit Type II	P092	3	0	2	1	3
Atholl 45	M011	17	0	4	13	17
Atholl 51	M012	1	0	0	1	1
BISF Type A1	M017	2	0	1	1	2
Cruden	M031	2	0	0	2	2
Dennis	M035	2	0	0	2	2
Trusteel Mk II	M097	1	0	1	0	1

4.3 Energy efficiency solutions that have been applied and best practice examples

4.3.1 Targeted Survey of Authorities and Housing Managers

The survey received responses from 19 of the 52 (36%) authorities contacted. The teams experienced a number of problems and issues when requesting information on non-traditional housing. These issues have been summarised in order to help inform future research methodologies.

Problems Experienced

The team found that access to non-traditional property data was not exclusive to a single job role. In most cases, the initial research telephone call and follow up email was passed on through several positions and departments in search of someone who may have access to the required data. This suggests that non-traditional property information is often not readily available, not often requested and more often than not, not known about.

Responses were received from those organisations that were quickly able to identify the relevant individual. In cases where councils or other organisations were unable to locate the correct contact and forwarded the email to another colleague, response rates were poor. The email may have lost its impact the further it was past around i.e. people saw the list of addresses it had already been to, and the recipient did not benefit from the personal explanation given during the accompanying telephone call.

The majority of local authorities were unable to provide any information about private sector stock in their area. Local Authorities had some idea about the proportion of their stock purchased under ‘Right to Buy’ (although no one was able to give approximate figures). The council staff that may have been able to provide an indication of the numbers of non-traditional housing prior to the introduction of ‘Right to Buy’ legislation had generally left the council or retired.

Reasons for not contributing to this project varied widely and included; lack of people resources; limited or no knowledge of storage methods for historical data; and the time constraints faced when accessing data that pre-dates electronic storage, e.g. in many cases the improvement of these properties began in the 1980s following the introduction of the 1985 Housing Act.

Additionally, in several cases, the one individual who had access to the required information was on annual leave or sick leave. Several councils stated they would send information and subsequently failed to respond. After following up enquiries, the study secured some additional responses. In many cases the emails continue to be passed on to different individuals, attempting to find the correct contact.

Those responses received generally provided basic numbers of non-traditional properties and details of measures installed and their cost. The majority of respondents were unable to provide details of SAP ratings before and after the installation of measures, or comment on the levels of fuel poverty experienced.

SAP 65

Where local authorities have provided SAP ratings it is worth considering if the improvements made raised SAP to 65. Analysis of the 2001 EHCS has demonstrated that a SAP of 65 is the point at which minimal risk of fuel poverty is achieved. Figures 4.1 and 4.2 demonstrate the relationship between fuel poverty and SAP ratings.

Figure 4.1: Percentage of households in fuel poverty (full income definition) by SAP rating - Source 2001 EHCS

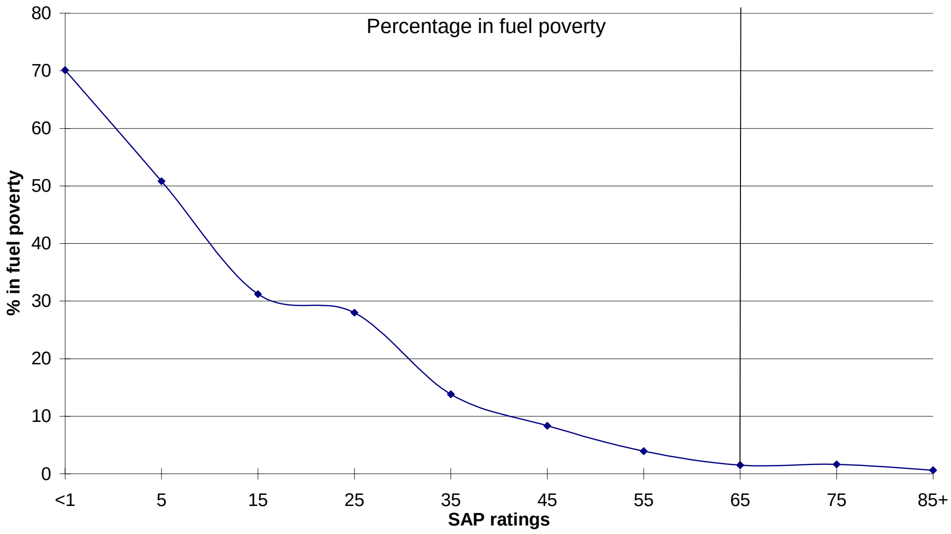
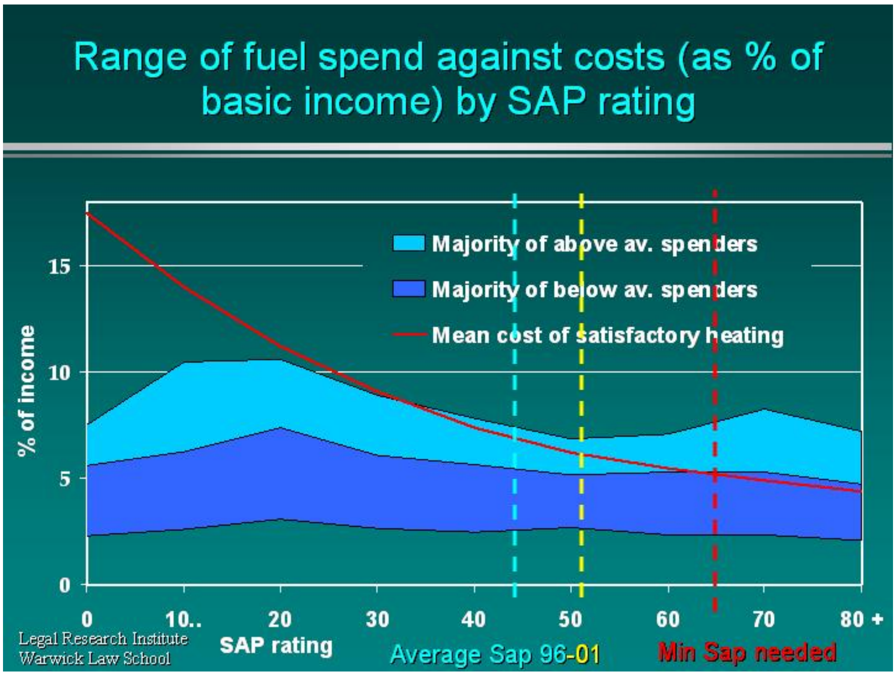


Figure 4.1 above shows that the percentage of households in fuel poverty progressively declines as SAP ratings increase but levels out after a rating of 65, the residual households in fuel poverty in higher rated dwellings probably being there due solely to exceptionally low incomes and/or severe under-occupation.

Figure 4.2 plots the bulk of actual fuel expenditure (blue bands) and the required total fuel spending for satisfactory heating (red line) against SAP ratings and shows that SAP 65 is the point at which average actual spending equates with average required fuel spending. The graph is based on 1996 EHCS data, the collection of actual fuel expenditure being dropped from the 2001 EHCS.

Figure 4.2: Actual fuel spending by % of income (blue bands, excluding lowest and highest 20%) against required fuel spending (red line) by SAP rating – Source 1996 EHCS.



4.3.2 Potential Non-traditional Case Studies

Responses

The responses received for all 19 local authorities are included in full in Appendix II. In total, 18 respondents (95%) were able to provide numbers of non-traditional houses either local authority owned or transferred stock. However, only 2 of these were able to provide numbers for the private sector. Estimates of the number of properties purchased under 'Right to Buy' varied significantly between respondents, ranging from 10 to 50%.

A total of 14 respondents were able to supply details of the improvements made to non-traditional properties, with 11 of these giving indicative figures for average work costs. Only 6 respondents had details changes in SAP ratings resulting from these works. Unfortunately, none of the 6 respondents that supplied SAP ratings were able to comment on the effects the improvements had on affordable warmth or fuel poverty.

Findings

The responses show that significant levels of improvement works have been carried out on all non-traditional stock, with typical measures including; external wall insulation or new replacement brick cavity walls, loft insulation, central heating and new kitchens and bathrooms. Although a certain amount of these works were carried out in the 1980s and 90s through defective housing grants, there is a significant amount of ongoing maintenance and improvement.

The implementation of the Decent Homes Standard and government targets for fuel poverty has no doubt resulted in the routine improvement of non-traditional stock. The cost of the works implemented demonstrates the commitment required to improve these homes. Indeed, the estimated cost of works varies significantly, i.e. from £3,000 to £80,000, depending on their scale and the system to be improved.

The stock owner must evaluate the cost of these improvements against the value of the property. For example, Rugby Borough Council identified a total cost of £80,000 to improve their Airey properties, which was equal to the cost of demolishing and rebuilding the properties to modern Part L building regulations. However, local authorities or housing managers in areas of high house prises i.e. the South East and South West may not be able to consider demolition. For example, an Airey house in Cornwall or Somerset may cost in excess of £150,000.

The responses show that those properties demolished have all been systems designated as defective, with the exception of the proposed demolition of Bison properties in Runnymede. This would suggest that stock owners are demolishing properties with inherent structural flaws, rather than thermally inefficient properties that require significant investment.

The table below shows the improvements, SAP changes and associated costs for those respondents that provided details of SAP ratings.

Table 4.58: Improvements made to non-traditional housing

Authority	Type	SAP before	SAP after	Cost	Improvements
Carrick	Cornish	11	78	£9,500	EI, CH, LI / RI
	Woolaway	11	78	£9,500	EI, CH, LI / RI
Runnymead	Cornish	39	65	£3,000	EI, CH, RI
	Orlit	24	76	£3,000	EI, CH, LI
	Stent	24	76	£3,000	EI, CH, LI
	BISF	24	76	£3,000	EI, CH, LI
Taunton	Reema HP	60	92	£9,000	EI, CH, DG, LI
	Woolaway	40	84	£9,000	EI, CH, DG, LI
	Airey	54	68	£17,500	EI, CH, DG, LI
	Cornish (Houses)	38	54	£5,000	EI, CH, DG, LI
	Cornish (Flats)	40	62	£5,000	EI, CH, DG, LI
Reading	Easiform	10	70	£13,000	EI, CH, LI, DG
	Wates	10	70	£14,000	EI, CH, LI, DG
	Bison	Unknown	60	unknown	EI
	Wimpey no fines	Unknown	80	unknown	EI, LI, DG
Sheffield	PRC (no CH)	34	68	unknown	CH & Insulation*
	PRC (with CH)	44	68	unknown	CH & Insulation*
	Wimpey no fines	43	68	£5,000	EI, DG
Ellesmere	Wates	42	80		NB, DP, DG**
	Airey		47		NB, DP, DG**
	Cornish		47		NB, DP, DG**
	BISF	50	-	-	No works performed
	Aluminium Bungalow	48	-	-	No works performed
	Kenfast	40	-	-	No works performed

** - insulation works were not specified*
*** - a combination of the works quoted has been installed in some or all of the identified systems*

Improvements;
EI – external wall insulation; CH – new central heating; DG – double glazing; LI – loft insulation, DP – draught proofing; and NB – replacement walls with filled brick cavity.

Table 4.58 shows that a comprehensive package of measures is required to raise SAP ratings to a target level of 65 or above. Thus good practice would require stock owners to thermally improve the walls through external cladding or replacement, insulate roof or loft spaces and replace inefficient central heating.

The choice to externally clad or replace walls with a new brick cavity could be identified as a key indicator for best practice. However, analysis of the 14 responses detailing improvements by proprietary system does not show a trend for any one system, Cornish Units and Airey houses have commonly been improved by both methods. Previous experience of both the survey team and several respondents suggests that the structural integrity of the wall determines the method of improvement employed, i.e. replacement brick cavity walls where walls are structurally defective.

The cost of measures installed in table 4.58 varies from £3,000 to £17,500, with an average cost of around £10,000 for a package including loft insulation, external wall insulation, central heating and in some cases double glazing. Although the average costs provided by Runnymede Council of £3,000 are low considering the work performed, an average cost of £10,000 provides a good indication of expenditure required per property. However, the survey responses have shown that costs can be significantly higher when structural work is required to improve or replace walls.

Table 4.13 details average SAP ratings for proprietary systems in both improved and unimproved condition as determined by the EHCS. Although the 4 example SAP ratings for Cornish units shown in table 4.58 vary significantly, those results provided by Runnymede, Taunton and Ellesmere all fall within the typical ranges produced by the EHCS i.e. 27 to 45 unimproved and 47 to 64 for improved examples. Although just within this range, the Cornish Units in Ellesmere demonstrate a low SAP rating (47) following improvement; however, the respondent identified a range of measures that could potentially have been installed without a specific break down by system, suggesting a lower specification of work was performed on Cornish Units.

The survey team obtained 2 examples of SAP ratings for Woolaway, Wates, and Airey houses. Of these, the EHCS was able to provide an indication of SAP for both Airey and Wates houses. The improved values of SAP for Airey properties in Taunton and Wates houses in Reading are higher than the averages shown in table 4.13; the much lower standard achieved for Airey dwellings in Ellesmere appearing to be more typical. The findings for the unimproved state are also either higher or lower than the EHCS average. The inequalities between ratings can not be evaluated in depth as the exact state of unimproved properties in table 4.58 is unknown.

Potential Case Study Areas

The study would recommend that future research to create case studies only contact those respondents that provided details of measures implemented and SAP improvements, i.e. Carrick, Runnymede, Taunton, Reading, Sheffield, and Ellesmere. Although none of these authorities have carried out any specific work to examine levels of fuel poverty, the available SAP data should allow a future research team to investigate fuel poverty status.

The study has also identified the HCS data as a potential source of future case studies (see section 4.3.3). Thus a future research study must compare the merits of further targeted research by area or examination of HCS data. The EHCS, particularly, provides a significant level of detail regarding the characteristics of the property and the owner. However, the study would need to produce a number of such case studies for each proprietary system which would be a lengthy process.

Although time consuming, the study team feels that the use of HCS to create detailed case studies would be more beneficial for future research projects. The team would recommend that a research project produce HCS case studies for the most prevalent proprietary systems with high incidences of fuel poverty.

4.3.3 EHCS Case Study

The following case study for a Cornish Unit House has been prepared using data contained in the 1996 and 2001 EHCS. The featured property appeared in both HCS, and as such the project team has been able to evaluate changes in fuel poverty as a result of improvements to the property.

The original proposal did not include the production of a case study using HCS data. However, the responses received from local authorities contained limited details of improvements to SAP ratings and changes in the levels of affordable warmth experienced by householders. The team felt that the exercise demonstrates that the HCSs could be used to produce more detailed results, and thus inform future research methodology.

The team has only produced one such case study as it requires the relevant information to be extracted from a number of files containing hundreds of variables for both EHCS surveys. Although, this process is time consuming the information extracted provides a valuable insight into the fuel poverty experienced by residents. A future study could produce case studies for a range of different proprietary systems and housing and social conditions.

Cornish Unit House - Energy Efficiency and Fuel Poverty in 1996 and 2001

Introduction

This case study is of a Cornish Unit dwelling located in mid Devon. The house was one of the sample addresses in both the 1991 and 1996 English House Condition Surveys and all of the following housing, energy and household information is provided by these two surveys.

In comparing the fuel poverty of the household in 2001 with that in 1996, however, it should be noted that there were a number of methodological changes made in the calculation of fuel costs between the two surveys. For example, in 1996, the non-heating fuel costs were based on the actual occupancy of the house, whereas in 2001 they were based on the 'standard' occupancy calculated from the total floor area. Also, in 1996, the fuel prices used are those actually paid by the household as recorded by the 1996 EHCS fuel survey, whereas in 2001 - when there was no such survey - fuel prices were based on the DTI regional averages for the type of payment method, i.e. direct debit, quarterly credit or pre-payment. These methodological changes mean that the 2001 fuel poverty estimates and not strictly comparable with those of 1996.

The house and household in 1996

The case study concerns a two-storey semi-detached house built for the local authority using the Cornish Unit proprietary system in the early post-war years. The house has three bedrooms and a total floor area of around 67 square metres and is located on a suburban estate of similar dwellings

In 1996, the house lacked any central or programmable heating, the main heating being provided by individual gas fires, then judged by the surveyor to be around 20 years old. Water heating was from a back boiler to the main gas fire, but was supplemented with an electric immersion heater with an off-peak supply. The hot water cylinder had a loose-fitting jacket, but there was no primary pipe-work insulation. The loft was insulated, but the insulation thickness was 50mm or under. The walls and sides of the mansard roof had no cavity insulation and were sources of particularly high heat loss, while the windows were still single-glazed. Using the 1998 version of SAP, the SAP rating of the house in 1996 was calculated as 21, this being equivalent to a rating of 24 using the 2001 version of the Standard Assessment Procedure.

In 1996, the tenants were a single parent family, comprising a 27 year old divorcee and her two sons of 11 and 6 years and daughter of 2 years. The family had been renting the house for less than 2 years. The mother was not in work, but was in receipt of income support, child benefit and housing benefit. She had no savings, but her total annual net income was calculated to be just under £9,178. Of this, nearly £2,000 (£38 per week) was required for rent.

The tenants heated the living room all day on both weekdays and at weekends, but with no fixed heating in the bedrooms, these remained unheated. The electric immersion heater was used in both summer and winter, but the off-peak supply accounted for only around 10% of total electricity consumption. However, the tenants used an all gas cooker, gas accounting for 81% of the household's total annual fuel consumption. This was above the 1996 average for 3 bedroom semi-detached local authority housing of 19,902 kWh, and amounted to 21,964 kWh per year. Similarly the actual annual fuel bills were above the average of £636 for the tenure, type and size of dwelling, totalling over £737 or just over 8% of household income. Of this, nearly £413 was for electricity and £325 for gas.

Despite the relatively high fuel bills, this actual spend was significantly less than that required to provide satisfactory 'all day' heating of 21.0^{O}C in the living room and 18.0^{O}C elsewhere for 16 hours. In 1996, this amounted to £1,059, of which £837 was required for space and water heating, including standing charges. As a consequence the house was cold.

It was not a particularly cold day when the1996 interview survey was conducted, the outside temperature reading 9.5^{O}C. However, both the living room and hall temperatures were below that normally regarded as comfortable and healthy, measuring some 17.4^{O}C and 17.0^{O}C respectively, despite the house having been occupied by the family for between 2 and 4 hours before the interview. However, the mother reported these room temperatures to be the same as usual, and said that she found the house a "little too cold". But she reported no problems with condensation or mould.

With total required fuel costs of £1,059 per year and a full annual income of only £9,178, including 100% housing benefit covering the rent of £1,976, the household was in fuel poverty on all three income definitions. On the full income definition, the fuel costs amounted to 11.5% of income. However, on both the basic and (unequivalised) residual income definition excluding housing costs, the household was in more serious fuel poverty, requiring 15.0% of income to cover their total fuel costs.

The house and household in 2001

Around 1998 the single parent family moved out of the house and the house was then substantially improved by the local authority. All of the external walls of the house were now fitted with external insulation and the sides of the mansard roof also fully insulated. The windows were changed to doube-glazed units throughout and the depth of the loft insulation was more than doubled. Despite the space and water heating remaining unchanged, this comprehensive upgrading of the insulation improved the energy efficiency of the house dramatically, increasing the SAP rating (2001 version) from 24 to 67. This improvement in energy efficiency was equivalent to a reduction in notional heating costs of some 60% from around £600 to some £240 per annum at 1996 prices, assuming that the dwelling is heated to the standard regime.

The new tenants benefiting from these lower fuel costs comprised a woman of 37 years – the head of household - who was cohabiting with a partner of 42 years. The woman had a teenage daughter, who was reported as being married to a teenager, also living in the house. The woman, her partner and male teenager were all unemployed, but each comprised a separate benefit unit, the woman and daughter comprising one of the three units. With income support and housing benefit, the total full net household income is recorded as £14,009. Of this, over £2,650 was required for rent, the latter having increased from £38 per week in 1996 to £51 per week in 2001.

Like the household in 1996, the new tenants reported using the heating all day in winter. Despite the much improved insulation, they reported both the space and water heating to be "not very effective", probably due to the fact that there remained only partial heating and that both the space and water heating systems were by then some 25 years old.

Although included in the EHCS since 1986, the fuel consumption and temperature surveys were dropped in the 2001 EHCS. Consequently, the extent to which the benefit of the improved energy efficiency was taken in higher temperatures rather than lower fuel costs cannot be determined. However, the low temperatures in 1996, the continued use of the heating all day and the fact that the new tenants reported finding the costs of running the home “fairly difficult”, suggests that most of the benefit was taken in increased warmth.

Unlike 1996, however, the tenants now complained of mould growth in the house. Mould on the walls and mildew on furnishings was reported in the living room, while the kitchen and bedrooms had either mould on the walls or on the window frames and the bathroom both of these problems. This was probably caused by the larger moisture load generated by the larger household; although the greater air-tightness of the dwelling combined with the remaining partial heating may have exacerbated the problem.

At 2001 prices, the total notional costs to achieve satisfactory heating and cover other fuel costs was calculated to be £449 – a reduction of nearly 58% from the 1996 annual total of £1,059. In addition to the fall in heating costs resulting from the improvement in energy efficiency, this calculation incorporates a number of other real changes occurring between 1996 and 2001.

After 1996, fuel prices, particularly those for the main metered fuels of gas and electricity, fell substantially as a result of price regulation on distribution charges, reductions in the Fossil Fuel Levy, the lowering of VAT on domestic fuel from 8 to 5% and increasing competition following liberalisation. By the first quarter of 2001, electricity prices were over 13% lower in cash terms than five years earlier, while gas prices fell by nearly 8% in cash terms over the same period[6].

With the change of tenants, the full household income had also increased from under £9,200 to over £14,000. With the required heating costs reduced to £449, this meant that the new household was not in fuel poverty on any of the income definitions. The new fuel costs amounted to only 3.2% of the full household income, although on the basic income definition excluding housing benefit for the three benefit units – calculated at £4,110 - the household required some 4.5% of total income to achieve satisfactory heating and cover other fuel costs. Assuming housing benefits to equal the total housing costs for all households, this proportion would again be the same for the residual income definition, excluding housing costs.

The second household were well away from being in fuel poverty, in part due to their higher total household income. However, with the substantially reduced fuel costs, even a household with the same full income in 2001 as the previous tenants had in 1996 (£9,179), would no longer have been in fuel poverty on any of the three income definitions. In this case, the new fuel costs would have amounted to 4.9% of full income, and 6.9% of both basic and residual income, assuming that the rent was still fully covered by housing benefit.

[6] DTI (2004), *Retail Prices Index, Fuel Components, Fuel price index numbers relative to the GDP deflator, Monthly figures*, January 1987 to December 2003.

5 SUMMARY AND CONCLUSIONS

5.1 The English Non-traditional housing stock

- The 2001 EHCS estimated that of the total stock of 20.5 million occupied dwellings, some 1.19 million or nearly 6% were of non-masonry construction. In addition, some 230,000 thousand or 1% of the stock are 'non-traditional' dwellings built with masonry cross-walls.

- Around 710,000 non-masonry dwellings are houses or flats in blocks of less than 3 storeys, while the remaining 480,000 thousand are medium or high rise flats or maisonettes.

- Of these non-masonry dwellings, 530,000 are of insitu concrete, 230,000 of pre-cast concrete, 360,000 in timber frame (including some 41,000 old traditional timber frame dwellings) while 70,000 have metal frames or panels.

- These types are not evenly distributed across the country. For example, the South West has nearly twice the national proportion of low-rise system dwellings and London well over three times its share of non-traditional medium and high rise flats.

- Concrete box-wall systems and particularly the timber frame and metal systems are predominantly associated with house building, while in-situ concrete frame and concrete cross-wall construction have been used mainly for flats.

- Despite being largely built by local authorities, around half of the metal and in-situ concrete system-built housing is now in private ownership. Conversely, three-quarters or more of dwellings built using pre-cast concrete frames or large-panels remain in the public sector.

Energy efficiency of non-traditional housing

- Overall, low-rise non-traditional housing is more energy efficient than traditional masonry dwellings with solid walls, but less so than traditional cavity wall housing.

- Of the main types of construction, non-traditional, medium and high rise flats have the highest average SAP ratings, despite a significant proportion of inefficient dwellings.

- The very lowest SAP ratings are to be found in both low and high rise non-traditional housing as well as in traditional dwellings with solid walls.

- Excluding the oldest traditional timber frame houses and cottages, metal frame dwellings and those built with pre-cast concrete frames have the lowest average SAP rating. More modern timber frame and concrete cross-wall systems are generally the most energy efficient.

- Dividing the stock between un-modernised and modernised dwellings, in-situ concrete box-wall systems tend to have the lowest average SAP ratings both before and after modernisation (26 and 47 respectively).

- Although some dwellings reach well into the SAP 70s in most of the non-masonry types, the average SAP ratings for modernised dwellings is often not significantly higher than the average for the total stock.

- Only the timber frame and pre-cast concrete frame and large panel systems have average ratings after modernisation that exceed or approach a target SAP of 65.

The distribution of SAP ratings in non-traditional housing

- Masonry housing is generally more energy efficient when in the public than in the private sector, but this is not the case for non-masonry housing.

- The energy efficiency of non-masonry low-rise dwellings is similar in both sectors. However, publicly owned non-traditional medium and high-rise flats have a lower average and more inefficient properties than the equivalent housing in the private sector.

- The homes of vulnerable households are generally less energy efficient than the equivalent homes of the non-vulnerable. This is particularly true in traditional masonry housing with solid walls, but also true of non-masonry housing and especially non-traditional medium and high-rise flats.

Fuel poverty in non-traditional housing

- Of the total of some 1,720 thousand households in fuel poverty in 2001 on the full income definition, some 132 thousand or nearly 8% were living in non-traditional dwellings, including masonry cross-wall housing.

- Levels of fuel poverty are generally higher in both low-rise and high-rise non-masonry dwellings than in other forms of construction, with the exception of traditional masonry dwellings with solid walls.

- Under the basic income definition, however, both categories of non-masonry housing overtake solid masonry wall dwellings as the worst form of housing with respect to fuel poverty.

- The use of the residual income definition, after housing costs, raises solid wall dwellings to second position, after non-traditional medium and high rise flats.

- After traditional timber framed dwellings, the highest proportion of households in fuel poverty on the full income definition are to be found in the metal framed, small panel concrete and in-situ concrete box-wall systems used mainly for low-rise housing.

- The use of the basic income definition increases the problem in the large panel concrete and insitu concrete frame systems associated more with high rise housing.

- The residual income definition re-addresses the balance somewhat with the highest levels of fuel poverty appearing in the in-situ concrete frame, small panel and metal frame systems, these all now showing nearly double the rate of fuel poverty as the national stock.

The distribution of fuel poverty in non-traditional housing

- In non-traditional and non-masonry housing, the proportion of households in fuel poverty, when measured on the full income definition, are higher in the public sector than in private housing.

- On this definition, around a half of all fuel poor households in non-traditional housing rent from a local authority or registered social landlord.

- The basic income definition shifts the problem to the public sector in all forms of housing construction. On this definition, some 71% of all households in fuel poverty in non-traditional housing are socially renting.

- On the residual income definition, rates of fuel poverty in publicly owned non-masonry low-rise housing is, at around 30%, very similar to that in traditional masonry housing with solid walls.

- The exclusion of housing costs increases rates of fuel poverty in the private sector substantially, but in non-traditional housing, these rates are still typically half of those found in the public sector.

- Non-masonry low-rise dwellings house a particularly high proportion of vulnerable households (72%) and after traditional solid wall housing, have the highest proportion of such households in fuel poverty (13%) on the full income definition.

- With the exception of masonry cross-wall and non-traditional medium or high rise flats, the incidence of fuel poverty in each type of construction is generally greater amongst vulnerable households than non-vulnerable households.

- On the basic income definition, 1 in 5 vulnerable households in non-masonry low-rise housing are in fuel poverty. Only marginally lower rates are found amongst both vulnerable and non-vulnerable households in non-traditional medium and high-rise flats.

- Overall, of all the fuel poor households in non-traditional housing on the basic income definition, nearly 80% are vulnerable households.

- Under the residual income definition, the risk of fuel poverty is substantially greater amongst vulnerable households than for those who are not classed as vulnerable. This is true for all forms of construction with the notable exception of households in non-traditional medium and high-rise flats.

Causes of Fuel Poverty in Non-traditional housing

- Low incomes, poor energy efficiency, high fuel prices and under-occupation, often working in combination, all appear as an important cause of fuel poverty in non-traditional housing as in traditional construction.

- In all constructional types, including flats, households in fuel poverty generally have larger dwellings than the household population, the notable exception being in low-rise non-traditional houses where the fuel-poor are generally in the smaller dwellings.

5.2 Non-traditional housing in Wales, Northern Ireland and Scotland

- The 1998 HCS estimates that Wales had a stock of some 64 thousand non-traditional dwellings, accounting for some 5.5% of the total stock of 1,157 thousand occupied dwellings.

- Only around 9,000 of the non-traditional dwellings are in high rise blocks, but these have the highest average SAP ratings of all constructional types.

- As in England, traditional masonry dwellings with solid walls are generally the least energy efficient, followed by timber frame (including the oldest traditional houses) and pre-cast concrete low rise dwellings.

- In Wales, the rate of fuel poverty is highest amongst households living in metal frame, pre-cast concrete low rise and, to a lesser extent, in in-situ concrete low rise housing.

- In Northern Ireland, the 2001 NIHCS estimated that nearly 21 thousand dwellings, were of non-masonry construction. Of these under 2 thousand are shown to be high rise dwellings, although sample sizes are small.

- Contrary to the situation in the other countries, the small NIHCS sample shows the lowest levels of energy efficiency to be amongst households in this high rise concrete housing, with the highest levels occurring in the metal and timber framed housing.

- The NIHCS also shows extremely high levels of fuel poverty in non-traditional housing, the highest levels occurring in high rise flats and in the in-situ concrete and other concrete low-rise systems.

- For Scotland, comparable estimates for the total number of non-traditional dwellings are not available. The 2002 SHCS sample is limited to a sample of 81 mainly low rise insitu and precast concrete and metal frame dwellings, representing just over 9 thousand system-built homes.

- Again based on small samples, these show the in-situ concrete and pre-cast concrete systems to have the lowest energy efficiency, with the metal framed dwellings being significantly better.

- Reflecting their energy efficiency, the highest levels of fuel poverty are recorded in the in-situ concrete and pre-cast concrete housing, with no fuel poor households appearing in the small Scottish sample of metal frame dwelling.

5.3 Identification of potential case studies

- Access to non-traditional property data was not exclusive to a single job role, meaning enquiries had to be passed through several positions and departments.

- The majority of local authorities were unable to provide any information about non-traditional housing in the private sector. Local Authorities had some idea about the proportion of their stock purchased under 'Right to Buy', but historical records were not available electronically and staff had changed since the schemes introduction.

- Reasons for not contributing to the project included; lack of people resources; limited or no knowledge of storage methods for historical data; and the time constraints faced when accessing data that pre-dates electronic storage, e.g. in many cases the improvement of these properties began in the 1980s.

- In total, 18 respondents (95%) were able to provide numbers of non-traditional houses in either local authority owned or transferred stock. However, only 2 of these were able to provide numbers for the private sector.

- A total of 14 respondents were able to supply details of the improvements made to non-traditional properties, 11 gave indicative figures for average work costs and 6 provided indications of SAP ratings before and after improvement.

- Significant levels of improvement works have been and continue to be carried out on all non-traditional stock, with typical measures including; external wall insulation or new replacement brick cavity walls, loft insulation, central heating and new kitchens and bathrooms.

- Findings suggest that good practice would require stock owners to thermally improve the walls through external cladding or replacement, insulate roof or loft spaces and replace inefficient central heating.

- An average cost of £10,000 provides a good indication of expenditure required per property for the works described above. However, the responses have shown that costs can be significantly higher when structural work is required to improve or replace walls.

- The results demonstrate that the choice to externally clad or replace walls with a new brick cavity is dependent on the structural integrity of the walls. Thus good practice may include either external cladding or wall replacement.

- The study team feels that future research to develop case studies for non-traditional housing should utilise the data contained in the HCSs. This research should produce HCS case studies for the most prevalent proprietary systems with the high incidences of fuel poverty.

APPENDIX I: HOUSES DESIGNATED DEFECT

The numbers built for proprietary systems have been taken from the BRE publication 'Non-traditional houses: Identifying non-traditional houses in the UK 1918 - 1975'.

DATABASE 3 (CHARACTERISTICS)		**DESIGNATED**	
Code	**Name**	**Des 1**	**Number Built**
P003	Airey	x	26,000
P010	Ayrshire County Council	x	750
P024	Blackburn Orlit	x	360
P025	Boot Beaucrete	x	2
P026	Boot Pier and Panel	x	8,200
S007	Boswell	x	4,000
P039	Cornish Unit Type I	x	30,000
P040	Cornish Unit Type II	x	(inc above)
P046	Dorran	x	600
P047	Dyke CCC	x	450
P055	Gregory	x	1,500
P078	Mac-Girling	x	?
P087	Myton	x	8,000*
P090	Newland	x	8,000*
P091	Orlit Type I	x	17,000
P092	Orlit Type II	x	(inc above)
P094	Parkinson	x	3,000
P101	Reema Hollow Panel	x	17,600
S049	Schindler	x	1,400
P107	Smith	x	4,500
P110	Stent	x	1,250
P113	Stonecrete	x	?
P115	Tarran Temporary Bungalow	x	8,000*
P117	Tee Beam	x	260
P122	Ulster Cottage	x	?
P123	Underdown	x	4,700**
P126	Unitroy	x	200
P127	Unity Type I	x	19,000
P128	Unity Type II	x	(inc above)
P129	Waller	x	?
P130	Wates	x	22,000
P132	Wessex	x	?
P134	Whitson-Fairhurst	x	3,400
P137	Winget	x	4,700**
P138	Woolaway	x	5,500

* - (inc Myton, Dorran, Newland & Tarran)
** - (inc Winget and Underdown)

APPENDIX II: RESPONSES RECEIVED FROM LOCAL AUTHORITIES

Carrick Council, Cornwall

Extent of non-traditional housing

Carrick Housing Ltd is responsible for the management of Carrick Council's housing stock. Carrick Housing Ltd has records of 600 non-traditional dwellings; accounting for 15% of the council's housing stock. Records show that this consists of mainly of 'Cornish Type I' properties (543 properties noted) with 11 'Cornish Unit Type II' and 46 'Woolaway' properties.

State of non-traditional housing / Improvements

The majority of improvements made to non-traditional properties in the area involve various forms of insulation work. In total 55% of these properties have been fully insulated i.e. external wall insulation and loft / mansard roof insulation[7]. Over the next 6 years, the remainder of these properties will be insulated under an on-going programme, subject to budget.

Additionally, properties have benefited from a central heating programme within the LA. Worcestor Green Star combi-condensing boilers have been installed in 70% of those mentioned above.

Work carried out has significantly improved the SAP ratings of the properties with an average increase from 11 before to 78 after completion of the works described above. The SAP of 78 is significantly higher than the widely excepted affordable warmth target of 65 i.e. where there is a minimal risk of fuel poverty.

Stock investment

Installation of the insulation and boiler features described above costs an average £9,500.

Notes

Properties listed by the BRE as defective in their area; Cornish Unit Type I & II II and Woolaway.

[7] Cornish Units have a mansard roof i.e. a roof that has two slopes on each of the four sides. The lower slope is steeper than the upper slope. Dormers are often set in the lower slope. The upper slope is usually not visible from the ground.

Worcester Council, Worcestershire

Extent of non-traditional housing

Worcester Community Housing Ltd manages Worcester Council's housing stock. In total 1055 (22%) of Worcester Community Housing Ltd's 4,871 properties are non-traditional, including:

Type	Number
BISF Steel Framed	44
MHC	263
Cornish Units Type I & II	39
Wates	701
Orlits	8

State of non-traditional housing / Improvements

All Parkinson houses (not listed at defect), Wates flats (listed as defect under Housing Defects Act) and Orlit properties (other than the 8 above, listed as defect) have been demolished.

Extensive refurbishment was carried out on all Cornish Units and Wates properties approximately 15 years ago. The Cornish Units concrete walls were replaced with brick cavities and as such they have received the equivalent of a PRC certificate i.e. are no longer classified defective. The Wates properties walls were over clad with external insulation and then rendered, which means that the Wates properties are still classified as defective.

Stock investment

Due to the fact that improvement work was carried out 15 years ago, costs for the renovations were not available.

Notes

Properties listed by the BRE as defective in their area; Cornish Unit Type I, & II, Orlit Type I & II, Parkinson, Tarran Temporary Bungalow, Unitroy and Wates.

Runnymede Council, Surrey

Extent of non-traditional housing

Runnymede has approximately 383 non-traditional units which represents (11%) of their 3,205 properties. The 'Right to Buy' process has reduce the council's stock from 5,400 to its current level, but its not known what proportion of these sales were non-traditional. Their current non-traditional stock consists of:

Type	Number
BISF Steel Framed	15
Bison Wall Frame	83
Cornish Units Type I & II	190
Stents	55
Orlits	40

State of non-traditional housing / Improvements

Various actions have been taken to deal with non-traditional properties in the area. The 83 Bison properties are to be demolished later in 2005. Of the 190 Cornish Units, 116 are flats and 74 houses. There are plans to demolish the flats; however the remaining houses have been treated through the installation of external wall and roof insulation and new central heating systems. These improvements have increased the SAP rating of Cornish housing units from 39 before work to 65 after installation.

The Orlit, Stent and BISF houses are located on the same estate. There are no plans to demolish these properties and investment has been made to improve the properties, again through the installation of insulation and new central heating systems. It is proposed that new kitchens and bathrooms will be introduced in the near future. Individual SAP rating improvements were not available; however an average increase from 24 before works to 76 after has been recorded.

Stock investment

The average cost of heating and insulation was approximately £3,000 per property, with a total cost of approximately £542,000.

Notes

Properties listed by the BRE as defective in their area; Cornish Unit Type I & II, Orlit Type I & II, Stent, and Unity Type I & II.

Darlington Council

Extent of non-traditional housing

Darlington has 530 non-traditional properties which represent (8%) of its total stock (6,275). Their non-traditional stock consists of; 302 Shephard Spacemakers; 226 Wimpey no fines and 2 Airey houses.

It is estimated that 12 Shepard Spacemakers and 3 Wimpey no fines have been sold under 'Right to Buy' over recent years. Additionally, based on local knowledge, it is thought that there are approximately 100 timber framed properties built by Yuills and Wimpey within the private sector. Unfortunately it was not possible to access information on improvements made to these properties.

State of non-traditional housing / Improvements

The properties have been improved through a combination of new central heating, rewiring, modernisation (kitchen and bathroom replacement) and loft insulation. The council has not externally insulated or replace the walls in any of their non-traditional properties. Unfortunately the council was unable to provide details of SAP ratings or fuel poverty estimates prior to or following the works.

- The 2 Airey properties were modernised and rewired in 1989, with replacement central heating in 1995.
- Although Shepherds Spacemaker units are not classified as defective the council has insulated the lofts to 250mm in 266 units, rewired and modernised 116 units, and replaced central heating in 290 properties (222 gas and 68 electrical).
- Wimpey no fines properties have also been improved between 2001 and 2004, with the insulation of 57 lofts to 250mm, rewiring and modernisation of 75 properties, and installation of new heating systems in all of their properties (180 gas and 46 electrical).

Stock investment

Based on 2005 figures, the approximate costs for the works listed above were:

- Central heating replacement – £2,500
- Kitchen and bathroom replacement – £5,750
- Rewiring – £2,100
- Loft insulation – £200

Notes

Properties listed by the BRE as defective in their area; Airey and Unity Type I & II.

Taunton Deane, Somerset

Extent of non-traditional housing

Taunton Deane council owned by 6,400 properties, of which 1,450 are non-traditional. Their current non-traditional stock consists of:

Type	Number
Pre 1945 Concrete Houses	69
Airey Houses	28
Cornish Units I & II	396
Reema HP	56
Woolaway Units	280
BISF Steel Framed	94
Easiform	451
Truesteel Bungalows	24

State of non-traditional housing / Improvements

Taunton Deane council has fitted external cladding, new central heating, double glazing and increased loft installation to 150mm to all of their non-traditional housing. Following a survey by Curtins Consultants last year, the council is proposing to more actively monitor the performance of all its dwellings. It is anticipated that the Woolaways may require new external walls or more extensive works between 2020 and 2030.

The table below shows the SAP and NHER rating for the non-traditional properties before and after any works carried out.

Type	SAP		NHER	
	Before	After	Before	After
Reema HP	60	92	6.2	7.4
Woolaway	40	84	5.0	8.0
Airey	54	68	6.4	7.2
Cornish Units (Houses)	38	54	4.8	7.0
Cornish Units (Flats)	40	62	5.0	7.2

Stock investment

Taunton Dean has estimated that the works carried out cost in the region of £9,000 for Reema HPs, £9,000 for Woolaways, £17,500 for Airey houses and £5,000 for Cornish Units.

Notes

Properties listed by the BRE as defective in their area; Airey, Cornish Unit Type I & II, Orlit Type I & II, Reema Hollow Panel, and Woolaway.

Plymouth City Council, Devon

Plymouth City Council owns a total of 16,008 properties, with approximately 5,000 of these being of non-traditional construction. Their current non-traditional stock consists of:

Type	Number
Easiform	1,963
Cornish Units	1,684
Timber framed*	518
BISF Steel Framed	407
Star	360
Orlits	81
Dorman Longs	49
Stonecrete	6

* - Non-traditional timber frame construction not specified

State of non-traditional housing / Improvements

- Plymouth CC has commissioned full structural reports on all of their Easiform properties, whose results will inform a future improvement programme.
- The walls of Cornish Units have had concrete remedial work, anti-carbonating coating, followed by the edition of an outer brick layer with filled cavity. The council has also replaced roofs and insulated loft spaces.
- Remidial works were carried out on Orlit properties in the 1980s. Periodic surveys have shown no significant further deterioration in the structural integrity of these dwellings.
- The walls of Star flats have been improved through the installation of external cladding or a new filled brick cavity. All of these properties have had new roofs and windows.
- The external walls of Dorman Longs have had an outer brick layer added with filled cavity.
- The BISF properties have had a roof replacement programme to replace asbestos roofs with lightweight metal sheeting, which is now nearing its completion with only 10 to complete. However, Plymouth CC is not able to carry out these works on seven properties, due to asbestos sheeting overlapping onto properties purchase under ‘Right to Buy’.

Plymouth CC did not supply ant SAP, NHER or cost information relating to the above properties and works.

Notes

Properties listed by the BRE as defective in their area; Airey, Cornish Unit Type I & II, Orlit Type I & II, Stonecrete and Wates.

Reading Borough Council

Reading Borough Council owns 7,800 properties, of which 985 are of non-traditional build. Their current non-traditional stock consists of:

Type	Number
Bison Crosswall	482
Wates	377
Easiform	110
Wimpey no fines	16

State of non-traditional housing / Improvements

- Improvements made to Easiform homes include energy efficiency works and modernisation, such as, 100mm wall insulation, 200mm loft, new doors, windows and central heating.
- Wates properties have had 100mm external insualtion, 200mm of loft insulation, condensing boilers, K glass windows, doors and central heating.
- Wimpy No- Fines has been insulated with 80mm of external permarock system, 150mm loft insulation. Also, double glazed and pitch roof were added to the properties.
- Bison properties were all insulated externally in the 90's.

The table below shows the SAP and NHER rating for the non-traditional properties before and after any works carried out.

Type	SAP	
	Before	After
Easiform	10	70
Wates	10	70
Bison	unknown	60
Wimpey no fines	Unknown	80

Stock investment

Reading CC has estimated costs at £12,000 to 14,000 for Easiform properties and approximately £14,000 for Wates. The council was unable to provide costs for the other works identified.

Notes

Properties listed by the BRE as defective in their area; Airey, Orlit Type I & II, Unity Type I & II and Wates.

North Cornwall

The North Cornwall District Council own 3,500 properties, of which 311 (9%) are Cornish units. The council's had a small number of Airey units which were either improved or demolished.

The council could not identify how many units there are in the private sector. A number of units were sold under 'right to buy', but the MoD also owned a large number of units in North Cornwall that were subsequently been sold, e.g. Padstow.

State of non-traditional housing / Improvements

The council has improved the majority of its Cornish units by either replacing the concrete panels with brick cavity walls or replacing the walls and insulating the Mansard roofs. Unfortunately the council was not able to provide SAP or NHER ratings.

Stock investment

The work to replace concrete walls with brick cavity walls took place 8 years ago under the Defective Housing Grants with average costs of £22,000 per property. Current work to replace walls and insulate Mansard roof cost approximately £25,000 to £30,000 per property. The council noted that the cost of insulating the Cornish Unit's large mansard roof was a significant factor in the high improvement costs.

Notes

Properties listed by the BRE as defective in their area; Airey and Cornish Unit Type I & II.

Slough Borough Council

Slough has 696 non-traditional properties which represents 9% of the total 7,500 council stock. Their current non-traditional stock consists of:

Type	Number
Wimpey no fines	249
Bison Crosswall	120
C-frame	94
Reema HP	86
SNW	76
BISF Steel frame	39
Unity	32

State of non-traditional housing / Improvements

Slough have carried out external cladding, energy efficiency heating system, double glazing, loft and cavity wall insulation and recirculating extractor fans to the Reema HP, Bison LSP and C-frame properties.

Stock investment

The council was unable to provide any information on SAP or NHER ratings, however, the works on cost £38,000 per Bison Crosswall flat, £41,000 to 44,000 per C-frame flats and £37,000 per Reema house.

Notes

Properties listed by the BRE as defective in their area: Reema Hollow Panel.

Sheffield City Council

Public housing in Sheffield area is managed by an ALMO (Arms Length management Organisation) Sheffield Homes. In total 55,000 properties are managed by Sheffield homes with 4,200 (8%) that are non-traditional.

Type	Number	Type	Number
Vic Hallam	1286	Malthouse	75
5m Timber/Steel Frame	700	Orlit	64
Reema HP	623	G Type Modular	53
G Type	477	Dyke	52
Wates	273	Prefab Timber Frame	40
Wimpey no fines	216	Shepherd	21
Airey	176	Iron frame	5
Unity	114		

State of non-traditional housing / Improvements

Sheffield Homes have double glazed and externally clad their Wates and Wimpey no fines properties with 50 mm of phenolic insulation which has been finished with a polymer based render system.

Many of their preformed reinforced concrete (PRC) properties were designated defective under the Housing Act 1985 (see notes). Sheffield Homes routinely surveys these properties prior to performing insulation works to ensure that they have not reached the end of their serviceable life i.e. due to carbonation of concrete. Studies are carried out in accordance with the approach outlined in the Non-traditional Homes Appraisal Scheme (NTHAS).

The council has also fitted or upgraded central heating in the majority of its PRC and Wimpey no fines stock. The table below shows the SAP and NHER rating for the non-traditional properties before and after any works carried out.

Type	**SAP**	
	Before	**After**
PRC (no central heating)	33 to 35	67 to 69
PRC (non condensing boilers)	42 to 45	67 to 69
Wimpey no fines	43	67 to 69

Stock investment

Sheffield Homes stated that the insulation works to Wates and Wimpey no fines homes cost approximately £5,000 per property.

Notes

Properties listed by the BRE as defective in their area: Airey, Boot Pier and Panel, Dyke CCC, Orlit Type I & II, Reema Hollow Panel, Unity Type I & II and Wates.

City of Bradford Metropolitan Council

Bradford council did not provide the study with any information. However, their website contained details of the number and type of the non-traditional properties in Bradford. The council has 5,430 non-traditional homes which detailed in the table below:

Type	**Number**
Wimpey no fines	2,409
Easiform	1,369
Cornish Units Type I & II	461
Trusteel	302
Unity	295
Wates	171
Bison	152
Airey	128
Bradford direct works	71
BISF Steel frame	69
Boot Pier and Panel	3

Notes

Properties listed by the BRE as defective in their area; Airey, Boot Pier and Panel, Cornish Unit Type I & II, Unity Type I & II and Wates.

Rugby Borough Council

Rugby Borough Council stated that they owned 4,300 properties; however, they did not know what number or proportion was non-traditional. The council was only able to provide numbers for properties designated defective under the Housing Act i.e. 30 Airey units.

State of non-traditional housing / Improvements

The council has previously replaced the concrete walls of Airey properties with a new brick filled cavity, applied 200mm of loft insulation and fitted double glazing. Unfortunately the costs of these works and their effects on SAP or affordable warmth were not known to the officer contacted.

Stock investment

The council has estimated that it would cost between £70,000 and £80,000 to improve the remaining 30 properties, and £70,000 and £80,000 to demolish and rebuild them. Thus the council has decided to opt for demolishment.

Notes

Properties listed by the BRE as defective in their area; Airey, Smith and Tarran Temporary Bungalow.

Falkirk Council

Falkirk Council owns a total of 19,453, of which 4,096 properties are non-traditionally built. The table below shows the number and type:

Type	Number	Type	Number
Anchor Timber	12	Scotcon	152
Atholl Steel	6	Semi Trad Flat Roofed Houses	23
Banton	658	Skarne Cruden High Rise	511
BISF	85	Skarne Cruden Med Rise	124
Bison High Rise	167	Swedish Timber	12
Blackburn	62	Tarran Mk4	3
Cruden	34	Thain/Chisholm	211
Dorran AGW	15	Timcon	68
Hilcon	85	Trad Agricultural	1
Lawerance Mk	142	Weir Quality(or Wier Steel)	25
Livingston	62	Weir Timber	309
Multicom	32	Whitson Fairhurst	81
No fines	655	Wimpey High Rise	330
Orlit	262	Dugdale Dennis	70

Unfortunately the council was unable to provide any details of improvements made to these properties, the associated costs and the probable improvements to SAP rating or affordable warmth.

Notes

Properties listed by the BRE as defective in their area; Dorran, Orlit Type I & II, Tarran Temporary Bungalow and Whitson-Fairhurst.

West Lothian

West Lothian has 1,385 non-traditional properties within its total housing stock of 17,190. Although the council can not identify the proprietary system for all 1,385 properties, the council has identified the following properties:

Type	Number
Orlit Type I & II	241
Weir Masonry	215
Weir Timber Late	204
Weir Timber Early	189
BISF Steel frame	140
Blackburn Permanent	112
Tarran Prefabs	68
Miller	50
Swedish Timber	48
Dunedin	21
No-fines Early	9
Lawrence	2

State of non-traditional housing / Improvements

The council has carried out the following work previously:

- Weir Steel (1991-2002): Upgraded central heating, loft insulation, replacement of lead pipes, external rendering of walls, and the addition of a party wall in roof space.
- Swedish Timber (1992-1999): Internal upgrading of the wall insulation, replacement central heating, and repairs to the timber lining.
- Blackburn Permanent (1995-96): Replacement central heating, loft and cavity wall insulation, and double glazing.
- Weir Timber (2000-02): Replacement central heating, loft insualtion, external rendering of walls, and double glazing.
- Weir Timber Late: Replacement central heating and loft insulation.
- Orlit (1983): Concrete frame repairs, external rendering of walls, full house gas central heating, and new roofs coverings.
- Cruden properties were demolished and Tarran were converted by repacing exterior walls with brick cavities.

Although the council has previously carried out a significant amount of improvements in their non-traditional housing, a report commissioned in 1998 identified further improvements. The following suggestions were made:

- Swedish Timber: Fire upgrading of external walls, internal walls and ceilings, thermal upgrading of external walls, essential repairs (especially to the roof) and general upgrading and modernisation.
- Weir Masonry: Fire upgrading of internal walls, thermal upgrading of external walls, additional double glazing and essentials repairs and general replacement of kitchens and bathrooms.
- Dunedin: Structural upgrading to the floor, fire upgrading of internal walls, thermal upgrading to external walls, replacement double glazing essentials repairs and replacement to internal fittings to make them more modern.
- Blackburn Permanent: Fire upgrading of internal walls, thermal upgrading of external walls, additional double glazing and essentials repairs (especially to the roof) and general replacement of kitchens and bathrooms.
- No-fines and Millar homes: Thermal upgrading of external walls, replacement double glazing, essential repairs and general modernisation.
- Weir Timber Early: Fire upgrading of internal walls, thermal upgrading of external walls, replacement double glazing, essential repairs and general modernisation.
- Weir Timber Late: Thermal upgrading of external walls, replacement double glazing, essential repairs and general modernisation works.
- Lawrence: Thermal upgrading of external walls, replacement double glazing, essential repairs and general modernisation of the home.

Stock investment

The report identified the following costs for the proposed works:

- Swedish Timber: £38,250 per house
- Weir Masonary: £15,250 per house
- Dunedin: £16,550 per house
- Blackburn Permanent: £20,500 per house
- No-Fines early: £14,500 per house
- Millar: £7,000 per house
- Weir Timber Early: £14,000 per house
- Weir Timber Late £13,650 per house
- Lawrence £11,700 per house

Notes

Properties listed by the BRE as defective in their area; Orlit Type I & II

Blackburn with Darwen Borough Council

Blackburn with Darwen Bourough Council transferred its housing stock to Twin Valley Homes in 2001. Twin Valley Homes has records of 16 types of non-traditional housing in the area, including the 'derelict' property types Orlit and Wate. The table below summarises numbers recorded in the area:

Type	**Total**
Easiform	463
Gregory House	255
Orlits*	245
Sectra	183
Skarne	153
Lowton	130
Wimpey	118
Lesser	103
Wates*	103
Middleton	73
Stenni	58
Guildway	48
BISF	45
Townson	41
Crosswall	18
Cawl	18

** Designated under the Housing Defects Act*

State of non-traditional housing / Improvements

A lot of work has been carried out by Twin Valley Homes, not only on properties classified as defect but on all the other non-traditional systems in the area as well. Measures implemented include:

- roofing works
- external doors replacement – using security-rated, insulated, draught-proofed external doors.
- new PVC windows
- double glazing
- loft insulation (to 250mm standards)
- cavity wall insulation
- external wall insulation
- rendering – an external finish applied to either the rockwool or wall surface
- central heating systems – controllable 'wet' heating system fuelled by gas via a 75% SEDBUK boiler
- re-wiring – including new consumer units and re-wiring of lighting and poer, usually in kitchens
- new kitchens
- new bathrooms

The 245 Orlit properties (classified as defect) located in the area will be improvemed during 2005. External door replacements, new PVC windows/ double glazing, installation of central heating systems, re-wiring and kitchen replacements are all due to take place in the coming months, along with rendering and loft and external wall insulation.

Wates properties (classified as defect) have already been improved with the addition of new roofs, external wall insulation (render finished), and installation of central heating systems. Loft insulation and double glazing are to be installed in 2006.

Information on SAP ratings is currently being updated and will be available during summer 2005.

Stock Investment

The average costs of measures implemented in the area are detailed below:

Measure	**Average cost per unit**
Roofing	£2,723
Replacement of external doors	£2,832
New PVC Windows	£5,000
Double glazing	£4,459
Loft insulation	£200
Cavity wall insulation	£250
External wall insulation	£3,750
Render coating	£3,750
Central heating with programmer	£3,560
Re-wire	£900 part / £2,200 full
New kitchen	£1,700
New bathroom	£1,200

Notes

Properties listed by the BRE as defective in their area; Gregory, Orlit Type I & II and Wates.

Ellesmere Borough Council

Ellesmere Borough Council manages its own properties and was able to provide information on both its own, local authority properties and those in the private sector.

Type	**Local Authority**	**Private Sector**	**Totals**
Airey*	1	1	2
Alum Bungalow	106	174	280
BISF	52	48	100
Cornish Type II*	93	5	98
Kenkast	11	4	15
Tarran	0	6	6**
Wates*	862	218	1080
Totals	1125	456	1581

**Designated under the Housing Defects Act*
***24 additional dwellings were demolished between 2002-2003.*

State of non-traditional housing / Improvements

Various improvement measures have been carried out on properties in the area including installing an outer brick ‘skin’ with insulated cavity, draught proofing and new double glazing. These works have been carried out on 2 Airey houses

(1 LA, 1 private sector), 851 Wates units (718 LA, 133 private sector) and 2 private sector Tarran properties. A selection of works has also been carried out on 98 Cornish Type II properties (93 LA, 5 private sector).

Of the remaining Wates houses, 31 are currently being improved, 47 are scheduled for 2005/6 with the final 66 targeted for 2006/7. Numerous small scale energy efficiency works, e.g. installation of loft insulation and central heating systems, have been carried out in some of the other non-traditional dwellings. However, at present there are no plans to carry out major improvements to them.

The authority has seen noticeable improvements in SAP ratings as a result of these works. Ratings for Wates properties have increased from 42 to 80. The Airey and Cornish Type II properties now have average SAP ratings of 47, however the increase cannot be calculated as the rating prior to work is unknown. In comparison, BISF Steel framed, Aluminium Bungalows and Kenfast properties have unimproved ratings of 50, 48 and 40 respectively.

Stock Investment

Improvements made to the Airey and Wates properties (as listed above) cost an average of £20,000 per unit and works on Cornish Type II properties cost around £2,500 per unit.

Notes

Properties listed by the BRE as defective in their area; Airey, Cornish Unit Type I, Cornish Unit Type II, Tarran Temporary Bungalow and Wates.

Wakefield Metropolitan District Council

The council indicated that they have 3,865 non-traditional properties, which account for 11% of their total stock (34,500).

Type	**Number**
Winget*	1032
Trusteel	510
Spooner	490
BISF	254
Shepherd	274
Airey*	252
Unity*	230
Reema*	207
Tarran*	199
Wimpey no fines	119
Hawksley	95
Cornish Unit*	50
Waites	40
Howard	38
Kenkast	34
Osb	29
Timber frame fibre glass	8
Gregory	4

Unfortunately the council was unable to provide any details of improvements made to these properties, the associated costs and the probable improvements to SAP rating or affordable warmth.

Notes

Properties listed by the BRE as defective in their area; Airey, Cornish Unit Type I & II, Reema Hollow Panel, Tarran Temporary Bungalow, Unity Type I & II, Wates and Winget.

Bristol City Council

Bristol City Council manages its own housing stock and was able to provide figures on both local authority stock and privately owned properties. The data submitted to the BRE in 1986 for the type and quantity of non-traditional properties (totally 6259 properties), both private and council owned are detailed below:

Type	**No. of privately owned**	**No. of council owned**	**Total**
Woolaway*	241	509	750
Unity*	242	680	922
Airey*	116	264	380
Cornish*	539	1617	2156
Wates*	207	482	689
Reema*	172	524	696
Parkinson*	Unknown	Unknown	600
Dorlonco	Unknown	Unknown	Unknown
BISF	Unknown	Unknown	Unknown

**Designated under Housing Defects Act*

State of non-traditional housing/ improvements

Figures for the number of properties that have been improved relate to 2001 council owned property figures. It is apparent that there are now significantly fewer council owned properties (4581 compared to 6259). The reason for this was unknown; however it is possible that many of them have been puirchased as a result of right to buy.

All of the Parkinson properties are due to be demolished. However, significant levels of improvement works have been carried out on the other types of property, including those not designated ‘defective’. In total 65% of the 595 council owned unity properties have been improved, 70% of the 489 Woolaway properties and 94%, 98% and 100% of the Reema, Wates and Dorlonco properties respectively have also received treatment.

Of 1368 council owned Cornish properties, 1070 have been improved through the addition of over cladding and an improvement programme is in progress to improve the BISF properties (146 of 167 have already received treatment works). Unfortunately details of specific works were not available.

It was not possible to locate details of SAP ratings properties. However, works currently being carried out on 48 of the Airey properties will result in wall u-values of 0.22w/m2k.

Notes
Properties listed by the BRE as defective in their area; Airey, Cornish Unit Type I & II, Parkinson, Reema Hollow Panel, Tarran Temporary Bungalow, Unity Type I & II, Wates and Woolaway.

Northern Ireland

The NIHE is responsible for approximately 140,000 properties, of which 22,270 can be classified as non-traditional. The following details the prevalence of non-traditional in Northern Ireland:

Type	Number
No-Fines (various patented systems)	11,000
Solid wall construction e.g. rural cottage type	5,000
Flats, five storey and over	3,600
Aluminium / Ulster cottages	2,000
Two-storey concrete frame	670

State of non-traditional housing / Improvements

The NIHE has recently finished quantifying the extent of non-traditional housing in their stock. The NHIE now plans to review the state of their non-traditional housing and the improvements required to raise average SAP to 60. The executive is aware of no fines coal heated properties built in the late 1970’s with SAP ratings of 24, which will require a significant investment to achieve the required target. The NIHE stated their interest in taking part in a future targeted research examining thermal efficiency and fuel poverty in more depth.

Notes

Proprietary systems built in Northern Ireland are not listed by the BRE.

REFERENCES

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