Consumer Focus
Campaigning for a fair deal

The Hills fuel poverty review proposal for a new definition of fuel poverty: an analysis

A report to Consumer Focus from Richard Moore

About Consumer Focus

Consumer Focus is the statutory consumer champion for England, Wales, Scotland and (for postal consumers) Northern Ireland.

We operate across the whole of the economy, persuading businesses, public services and policy makers to put consumers at the heart of what they do.

Consumer Focus tackles the issues that matter to consumers, and aims to give people a stronger voice. We don't just draw attention to problems – we work with consumers and with a range of organisations to champion creative solutions that make a difference to consumers' lives.

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Preface

The Hills fuel poverty review interim report proposes a new definition of fuel poverty, termed the 'low income/high costs' definition[1]. The proposal represents a radical departure from the current definition of fuel poverty, namely households that need to spend 10 per cent or more of their income on fuel to maintain adequate temperatures in the home and meet other energy needs.

The proposed new definition has a number of advantages over the existing definition, for example it takes into account housing costs and household size in calculating income. Thus, it gives a much better indication of the resources low income households have available to spend on fuel. However, a number of fuel poverty researchers and advocates have raised concerns about the 'energy costs' threshold which forms part of the proposed definition. These concerns relate to the implications of the threshold both for households classed as 'fuel poor' and for future fuel poverty and climate change policy.

Consumer Focus therefore commissioned Dr Richard Moore to carry out an analysis of the proposed definition and some possible options for setting an alternative 'energy costs' threshold. This report presents the results of this research. We consider it provides a valuable insight into fuel poverty and makes an important contribution towards the fuel poverty review. We hope that the review team takes heed of the research findings with respect to refining its proposed definition of fuel poverty.

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[1] Hills, J (2011), *Fuel poverty – the problem and its measurement – interim report of the fuel poverty review,* Centre for Analysis of Social Exclusion

Executive summary

This report analyses the proposed 'low income/high costs' definition of fuel poverty as proposed by the Interim Report of the Hills fuel poverty review. It considers the equivalisation[2] of incomes and fuel costs, the low income threshold and the energy cost threshold. It suggests three alternative options for the energy cost threshold and analyses the impact on the various definitions of both fuel price rises and energy efficiency improvements. The paper finishes by examining the distribution of fuel poverty under the different definitions and includes conclusions and recommendations at the end of each section.

The research finds elements of the proposed new definition to be overly complex and non-transparent. This is largely as a result of its proposal to equivalise energy costs and set a threshold for 'unreasonable fuel costs' based on the median of total equivalised energy costs. While equivalisation is an established way of comparing the incomes of households of different size and composition, equivalising energy costs is untried and controversial.

DECC's existing energy model, used to calculate fuel poverty, already determines total energy costs according to actual household size. Analysis of 2009 English Housing Survey (EHS) data shows that unit energy costs (expressed as £/m^2) do not vary significantly by household size. Thus, the need to equivalise fuel costs can be avoided by using unit costs, rather than total energy costs. This would simplify the proposed definition considerably.

The ideal 'income threshold' for fuel poverty would be one based on the minimum income required by each household to afford fuel costs, as calculated from the EHS income after housing costs, the EHS fuel costs and the Minimum Income Standard (MIS) living cost budgets. However, the introduction of the MIS budgets into a Government definition of fuel poverty could prove politically difficult, as these show benefit levels for all but pensioner households to be inadequate.

The Hills review's proposed that 'income threshold' is determined by the addition of household fuel costs to the official (60 per cent of median) poverty line and correlates reasonably well with the EHS/MIS based measure of fuel affordability. Therefore, the proposed threshold is considered to be a reasonable compromise, albeit not ideal.

The research shows that the proposed definition is not directed at those most in need due to the proposed 'energy cost threshold' being based on total energy costs. It also appears to represent a charter for under-occupation. To avoid the exclusion from fuel poverty of households unable to afford their fuel costs who live in smaller low energy efficient homes, the research proposes that the energy cost threshold is based on un-equivalised unit fuel costs (£/m^2), rather than total costs. It also proposes setting the energy threshold at a value better than the median, because of the generally poor energy efficiency of the English housing stock. This would enable dwellings with fuel costs lower than the median, which are nevertheless of poor energy efficiency, to be included in the definition and improved.

[2] Equivalisation is a technique in economics in which members of a household receive different weightings. Total household income is then divided by the sum of the weightings to yield a representative income. (www.reference.com)

A threshold set at the median makes fuel poverty on the proposed 'low income/high costs' definition extremely difficult to eliminate by reducing fuel costs. Because a half of all households will always fail the threshold (by definition), this means that a significant reduction in the number of 'low income/high cost' homes can only be achieved by increasing the number of 'high income/high cost' homes. As the latter is where the greatest energy savings are to be made at the least cost to the taxpayer, this puts the definition in direct conflict with a successful carbon reduction programme.

The research examines three alternative options to setting the 'energy costs threshold':

1. A relative threshold based on 60 per cent of the median unit cost (£/m^2) for all households
2. An absolute threshold based on the median unit fuel costs of dwellings at the lowest threshold of EPC band C and above
3. A relative threshold set at 40 per cent above the median unit cost threshold of those living in the 10 per cent most energy efficient homes

The paper includes analyses of the effect of both fuel price rises and energy efficiency improvements on the numbers defined as fuel poor on the proposed definition and the above three alternatives. This shows that the absolute threshold (option 2) is the only one that generally reflects changes in fuel costs. However, it does not exaggerate the impact of such changes, as is the case of the existing definition. Under the relative definitions, neither major fuel price rises nor large energy savings programmes shift the number of households in fuel poverty substantially. It is possible for fuel poverty to actually increase under these definitions in the case of wider programmes that still deliver substantial savings to the energy costs of 'low income/high cost' homes.

The report also shows the impact of the various definitions on the distribution of energy efficiency, household composition and incomes of the fuel poor.

Introduction

This paper comments on the proposed 'low income/high costs' definition of fuel poverty, as proposed by the Hills Review in the Interim Report. It looks particularly at the proposed use of equivalisation for income and fuel costs, the low income threshold and the energy cost threshold. It suggests three alternative options for the latter threshold, to replace the proposed use of median total fuel costs and looks at the impact of the various definitions on both fuel price rises and improvements in energy efficiency. The paper finishes by examining the distribution of energy efficiency, household composition and incomes of the fuel poor under the different definitions. Conclusions and recommendations are included at the end of each section.

1 Use of equivalisation

The proposed new definition equivalises both the incomes of the household and their fuel costs, using the OECD[3] based 'Companion' scale. The 'Companion' scale gives a factor of 0.58 to the head of household, 0.42 to any partner, 0.2 to any children under 14 years and 0.42 to any older children or other adult persons in the household. These factors are then added together to give the total equivalence factor by which the household income, after housing costs, is divided to give the equivalised income. As a result, the incomes of couples without children remain unchanged, while those of lone person households are increased and those of couples with children are reduced.

1.1 Worked examples

An employed single person household and a working couple with one 13 year old child both have an income, after housing costs, of £10,000 and fuel costs of £1,200.

Clearly, the fuel cost will be easier to meet for the single person, as his or her other expenses on food, clothing, travel, socialising etc, are all likely to be significantly less than those required by the young family of three, to achieve the same standard of living. Consequently, it is appropriate to equivalise their incomes and give these households equivalent incomes, after housing costs (AHC), of £17,241 (£10,000/0.58) for the single person household and £8,333 (£10,000/1.20) for the family of three.

That the fuel costs of £1,200 should be equivalised to the same extent is far more questionable. As fuel poverty is specific to the household's existing home, particularly its energy efficiency and size, the set amount that both the single person and family of four need to pay to achieve a fully comparable standard of heating and other energy services is currently calculated as £1,200, this representing 7.0 per cent and 14.4 per cent of their equivalised incomes respectively.

On average, dwellings occupied by couples with one younger child are only 20 per cent larger than those of single person households (their mean floor areas being 88 and 72 m^2 respectively). Consequently, given the same energy efficiency, their space heating costs will be only correspondingly higher. This also largely applies to lights and appliance costs, although water heating and cooking costs are likely to be more proportional to household size. However, that the total fuel costs should be equivalised such that, like the equivalised incomes, one is made over twice as large as the other appears totally unrealistic.

1.2 The existing energy model

It is questionable whether any equivalisation of the fuel costs is necessary, given the extent to which, in the existing energy model, the fuel costs for space and water heating, cooking and lights and appliances are each already determined with specific reference to the actual size and/or composition of the household. However, the need for equivalisation may be dependent on how the fuel costs are used in the definition (see section 3).

The required space heating regime is related to the size and composition of the household by means of the Parker-Morris and Bedroom standards.

[3] http://www.oecd.org

The Parker-Morris standard gives a minimum floor area for a home depending on the number of occupants, while the Bedroom Standard allocates a separate bedroom to each occupant or combination of occupants, depending on the composition of the household and age and sex of any children. If the household has both surplus floor area and surplus bedrooms it is assumed to be under-occupied and require only partial heating. Thus, the cost of space heating is made dependant on the size and composition of the household, as well as on the energy efficiency and size of the home. Size of home generally, though not necessarily, also reflects household size. The way the energy model similarly accounts for the size and composition of the actual household in determining the energy costs for water heating, lights and appliances and cooking is described in Annex 3.

Using the 2009 EHS, Table 1 shows the comparative average fuel costs used for defining fuel poverty for different households (expressed as an index relative to the average cost for two adults), underneath the corresponding OECD equivalence factor for AHC incomes. The Table also shows the other main factors that affect the total fuel costs, namely the mean total floor area, the fuel cost per m^2 and the mean SAP rating for each household type (also generally expressed as an index). The Table is limited to the most common household types. It shows that the total fuel costs already generally reflect the size and composition of the household, but not to the extent suggested by the OECD based equivalence factors. It suggests that the unit fuel costs (£/m^2) are least affected by the size and composition of the household, varying from the average for households comprising two adults by typically only 3 or 5 per cent and by no more than 10 per cent.

Table 1: Comparative average fuel costs (index) by household size and composition

Household types (child = under 14)	**1 adult**	**1 adult 1 child**	**1 adult 2 chldn**	**2 adults**	**2 adult 1 child**	**2 adult 2 chldn**	**3 adults**	**3 adult 1 child**	**4 adults**
Equivalence factor	**0.58**	**0.78**	**0.98**	**1.00**	**1.20**	**1.40**	**1.42**	**1.62**	**1.84**
Space heating	0.88	0.80	0.78	1.00	0.90	1.03	1.03	1.10	1.11
Water heating	0.71	0.94	1.13	1.00	1.13	1.30	1.20	1.36	1.40
Lights & appliances	0.71	0.90	1.12	1.00	1.15	1.42	1.23	1.47	1.48
Cooking	0.90	1.04	1.15	1.00	1.13	1.25	1.12	1.26	1.26
Total fuel costs	**0.82**	**0.85**	**0.93**	**1.00**	**1.00**	**1.18**	**1.11**	**1.24**	**1.25**
Average floor area	0.77	0.73	0.82	1.00	0.92	1.11	1.06	1.20	1.19
Fuel cost per m^2	1.06	1.10	1.08	1.00	1.05	1.05	1.03	1.05	1.03
Average SAP rating	53.3	57.3	58.9	52.2	55.7	53.9	52.2	53.2	52.4

1.3 Conclusions

While there are arguably more accurate and transparent ways of equivalising incomes after housing costs than the 'Companion' scale (see next section), the OECD modified scales are nevertheless now widely used for equivalising incomes, notably in DWP's Households Below Average Income (HBAI) series. That the energy costs should be similarly equivalised is untried and far more controversial, any equivalisation being arguably unnecessary for the reasons outlined above. However, the need for equivalisation is dependent on how fuel costs are used in the definition.

The equivalisation of fuel costs might be needed:

1. If the energy model does not account sufficiently for the size and composition of the actual household or
2. If judging whether the fuel costs of a particular household are 'reasonable', relative to the costs of another household of a different type

In the proposed definition, the equivalisation of fuel costs is made necessary by comparing individual fuel costs with the single median fuel cost for all households. As shown by Table 1, larger households generally have higher fuel cost requirements than smaller households. To enable comparison with the median for all households it is therefore appropriate to equivalise their fuel costs in a similar, although arguably not exactly the same way as incomes.

As suggested in the Interim Report, another approach would be to compare each household's fuel costs with the median for the same type of household. The latter would provide a more transparent methodology, but is more complex and has practical difficulties related to data sample sizes – albeit, arguably the difficulties are over-played in the Report. As they exhibit less variation, an alternative would be to compare the unit fuel costs (£/m^2) with the equivalent median. The use of unit costs also has other important advantages, as discussed below.

If unequivalised fuel costs were used for determining the energy cost threshold, then it would not be necessary to also equivalise fuel costs in the calculation of the income threshold, thereby making the whole methodology far simpler and more transparent.

DECC's '*Annual Report of fuel poverty statistics, 2009'*[4] published figures for fuel poverty based on equivalised income without also equivalising fuel costs. The report did not favour the use of equivalised incomes, concluding that '*while an equivalised approach to income may make sense conceptually, it is not intuitive, and can over compensate in favour of larger households'.*

If it can be clearly shown that the existing energy model does not adequately account for the size and composition of the household, then it would seem sensible to revise the actual energy model so that it does, rather than use equivalisation to correct this. Avoiding the need to equivalise fuel costs and accepting the existing energy modelling or, if necessary revising the model, would both greatly simplify and make more transparent the currently overly complex methodology used in the Interim Report.

[4] DECC (2009) *Annual Report on Fuel Poverty Statistics, 2009*, DECC, London, October, p.44-47.

1.4 Recommendations

The following recommendations address the proposed equivalisation of fuel costs:

- The proposed definition is simplified by not equivalising the fuel costs
- Un-equivalised unit fuel costs (£/m^2) are used and compared to the corresponding median, rather than total fuel costs
- A detailed review of the existing energy model is undertaken to determine whether or not it adequately takes account of the size and composition of each household
- If it does not, detailed proposals for revising the energy model are developed

2 Proposed low income threshold

The Interim Report proposes that the low income threshold for fuel poverty should comprise the general poverty line of 60 per cent of the median income of all households, after housing costs, after equivalisation using the OECD companion scale, but with the addition of the similarly equivalised fuel costs for each individual household.

2.1 An alternative approach

Political considerations aside, a better threshold would be one based on the minimum income required by each household to afford fuel costs, as calculated from the EHS income after housing costs, the EHS fuel costs and the Minimum Income Standard (MIS) living cost budgets. This is because:

- The use of the MIS provides a far more transparent and easily understandable way of equivalising household incomes, compared to the arguably unscientific OECD 'Companion' scale
- The MIS also provides a much more sophisticated and accurate way of equivalising incomes, due to the way it can account for the higher living costs incurred by households in different rural areas, as well as the varying needs of adults and children at several different stages of life. When applied to the 2009 EHS sample, it generates 657 different living costs, compared to only 49 different equivalence factors generated by the OECD 'Companion' scale
- Compared to the OECD based scales, when used in the determination of fuel poverty, it does not over-compensate in favour of families, but includes a significantly larger proportion of singe person households
- It provides a fully consistent/coherent threshold, which the proposed threshold does not appear to do, comprising as it does a single relative value for income (60 per cent of the median for all households) plus an absolute value of fuel costs for each individual household

That said, the MIS strongly suggests that State benefit levels, for all but pensioner households, are inadequate to prevent social exclusion. Consequently, one can appreciate that the direct introduction of the MIS budgets into a Government definition of fuel poverty could prove politically difficult, and that a threshold related to the existing accepted poverty line of 60 per cent of median equivalised income would be easier for DECC and other Government Departments to accept.

2.2 Comparison of the income threshold with an EHS/MIS-based measure

Table 2 shows that the proposed income threshold correlates reasonably closely with the MIS based calculation of fuel affordability. Both measures produce similar numbers, the proposed income threshold having 5,867 households under the threshold and the MIS-based definition failing 5,828 households. Just under 90 per cent of households under the proposed threshold also fail the MIS-based definition, while conversely just over 90 per cent who cannot afford fuel on the MIS fall below the proposed income threshold.

Moreover, as shown by Table 3, in 67 per cent and 69 per cent of the cases that fail on one measure alone, the household is under 10 per cent from the threshold of the other measure and in 96 per cent and 94 per cent cases respectively under 20 per cent from the other threshold.

Table 2: Proposed income threshold by EHS/MIS based definition of fuel affordability

Thousand households/Row percentage/*Column percentage*

EHS/MIS based definition	**Low income/high costs definition**		**Total**
	Income fails threshold	**Income passes threshold**	**households**
Can afford fuel costs	603	15,104	15,707
	3.8	96.2	100.0
	10.3	*96.4*	*72.9*
Cannot afford fuel costs	5,264	564	5,828
	90.3	9.7	100.0
	89.7	*3.6*	*27.1*
Total households	**5,867**	**15,668**	**21,535**
	27.2	72.8	100.0
	100.0	*100.0*	*100.0*

Table 3: Proposed income threshold by surplus and shortfall in fuel affordability

Thousand households/ *Column percentage*

Shortfall in income AHC for EHS fuel costs + MIS living costs	**Low income/high costs definition**				**Total**
	Income below threshold (x 1000)	%	Income above threshold (x 1000)	%	**Households** (x1000)
Surplus of 30% or more	5	*0.9*	12,574	*83.2*	12,975
Surplus of 20 to 30%	20	*3.3*	1,033	*6.8*	875
Surplus of 10 to 20%	173	*28.7*	837	*5.5*	929
Surplus of less than 10%	405	*67.1*	660	*4.4*	928
Total with surplus	**603**	***100.0***	**15,104**	***100.0***	**15,707**
Shortfall of up to 10%	522	*9.9*	387	*68.6*	806
Shortfall of 10 to 20%	783	*14.9*	142	*25.1*	855
Shortfall of 20 to 30%	818	*15.5*	35	*6.1*	762
Shortfall of over 30%	3,141	*59.7*	1	*0.2*	3,405
Total with deficit	**5,264**	***100.0***	**564**	***100.0***	**5,828**

Using actual fuel costs, rather than equivalised fuel costs (as suggested above), would further improve the correlation between income poverty and the MIS-based measure of fuel affordability, albeit only slightly.

2.3 Conclusions

The Interim Report has concluded that fuel poverty is distinct from income poverty. It has therefore enhanced the standard '60 per cent of median income poverty line' in its setting of the proposed 'income threshold' for fuel poverty. This is to be wholly welcomed.

Given the reasonable correlation between the proposed 'income threshold' and the EHS/MIS based measure, setting the threshold at the poverty line plus the household fuel costs, while not ideal, represents an acceptable compromise.

2.4 Recommendations

As fuel poverty is distinct from income poverty, the following recommendation is made:

- To achieve greater accuracy, transparency and consistency and a slightly smaller number of households failing the threshold, consideration should be given to using the EHS/MIS based calculation of fuel affordability rather than the relative income poverty line plus absolute fuel costs, to determine the income threshold for fuel poverty

3 Proposed high energy cost threshold

While the proposed low income threshold is a reasonable compromise, the same cannot be said of the proposed high energy cost threshold. Setting this threshold at the median of the total energy cost for all dwellings causes a number of fundamental problems.

3.1 A practically unobtainable, yet inadequate threshold

First and foremost, a threshold set at the median means that fuel poverty on the 'low income/high costs' definition is extremely difficult to eliminate by reducing fuel costs. This is because however energy efficient the housing stock is made and energy costs are reduced, there will always be 50 per cent of households who have fuel costs higher than the median and so fail the threshold. For those on low incomes, progress can only be made against this threshold if the number of households with high fuel costs and higher incomes is allowed to increase. Moreover, depending on the distribution of new households, projected household growth may further exacerbate this problem.

Improvements in minimum wages, benefits and income inequalities can reduce the number of households failing the low income threshold. However, over the total population, improvements in the energy efficiency of the housing stock and the lowering of energy costs can never be similarly reflected in the number of households failing the high cost threshold, while this is set at the median. Given the stated objectives of good measurement, this appears a fundamental fault in the 'low income/high cost' definition, as currently proposed.

Secondly, the generally poor energy efficiency of the English housing stock makes the median of total fuel costs a high value relative to the fuel costs of energy efficient homes. As a consequence, many low income households have fuel costs below the median, which could nevertheless be significant reduced by improvements to the heating and/or insulation of their homes. This is especially true in smaller homes, where despite lower than average total fuel costs, the unit cost of energy (£/m^2) can be particularly high. If the occupants of such homes also have particularly low incomes, they may well be unable to afford their fuel costs without improvements to the poor energy efficiency of their homes. Yet without being classed as fuel poor, financial assistance towards such improvements could be denied them.

3.2 Worked examples

That the suggested new definition is not targeted at those most in need is illustrated by the example below of two different pensioner couples. As both are two person households, neither their incomes nor their fuel costs are changed by the, OECD based, equivalence factors proposed.

A pensioner couple (A) has a household income, after housing costs, of £10,600 and live in a three bedroom house of 100m^2 in an urban area. The house has above average energy efficient having unit energy costs of £13 per m^2 and total fuel costs of £1,300 per annum – 12.3 per cent of their income, AHC.

The Minimum Income Standard estimates that, for such households, nearly £172 per week (at 2009 prices) or some £8,900 per annum is the minimum budget required for all living costs, other than housing and fuel costs.

This gives the household a residual fuel budget of £1,700, which is more than sufficient to cover their energy costs. However, as the household income, after fuel costs, is under 60 per cent of median equivalised income (£11,135) and their fuel cost is also above the equivalised median (£1,235), this household is nevertheless classed as fuel poor under the proposed new definition.

A second pensioner couple (B) has a household income, AHC, of £9,600 and live in a one bedroom bungalow of 50m^2 in a similar area. The dwelling is largely un-modernised and inefficient having unit energy costs of £24 per m^2 and a total fuel cost of £1,200 per annum – 12.5 per cent of their income. This household has the same MIS living costs (£8,900) as the first couple, giving them a residual fuel budget, after housing and non-energy costs, of only £700. This is insufficient to meet their required fuel costs, although it is likely that the shortfall of £500 could be covered by energy savings, resulting from the improvement of their energy inefficient home. However, under the proposed new definition, this lower income household is not classed as fuel poor, their fuel cost being under the median of £1,235.

That household B should be excluded from fuel poverty appears fundamentally wrong, particularly when household A is classed as fuel poor, despite its higher income, more energy efficient home, higher space standards and adequate energy budget.

3.3 Actual Example from 2009 EHS

Sample address H1571201 is an actual case in the 2009 EHS, which is similar to example B, and shows the true depth of the problem. In the North East region, an elderly couple are renting a one-bedroom bungalow on a suburban estate from a registered social landlord. Their post-war bungalow is very inefficient, the heating system comprises a smokeless fuel fire, probably with a back boiler providing central heating and water heating[5]. The dwelling has had some insulation improvements, such as double glazing, but the loft insulation is only a basic 100mm. Overall, the SAP rating is calculated as 32, giving the bungalow an F energy performance certificate.

As a result, the unit energy costs are very high, at over £23 per square metre, the median for all pensioner couples being only some £14/m^2. However, the bungalow is small, having a total floor area of under 52 square metres, thus giving a total fuel cost of nearly £1,200. Albeit below the median for all households, this is still a lot more than the couple can afford. Their weekly rent of £56.77 reduces their full income of £9,369 to only £6.417, thus requiring a 42 per cent cut in their MIS living costs to afford their fuel costs. Yet the couple are particularly vulnerable, both occupants being 80 years of age and reporting a long term illness. Table 4 shows whether this elderly couple is classed as fuel poor under the different definitions.

[5] 'heatx' is coded as 'boiler system with radiators' but 'boiler' is coded as 'no boiler'

Table 4: Fuel poverty status of EHS example by different fuel poverty definitions

Definition	Relevant threshold	Household's value	Fuel poor?
Full income	10% of income	12.8%	Yes
Basic income	10% of income	11.6%	Yes
After housing costs	13.6% of income	18.7%	Yes
Twice the median	9% of income	12.8%	Yes
After fuel costs	Residual = fuel costs	42% cut in MIS needed	Yes
Low SAP/low income	< mean/median SAP	SAP 32	Yes
Low income/high costs	**Energy cost > £1,235**	**£1,200**	**NO**

The Table suggests that there is something seriously wrong with a definition which uniquely classifies this elderly couple as not fuel poor. It is true that their AHC income of £6,417 is very low, but it is no lower than the average income of two person households on benefits in the private rented sector that are classed as fuel poor under the 'low income/high costs' definition. While low income is an undoubted cause of their fuel poverty, it is not the only cause, as the poor energy efficiency of their home is also clearly contributing. While, in this case, arguably not capable of totally eliminating their shortfall in income, the savings possible through energy efficiency improvements could nevertheless go a long way to improving this elderly couple's standard of living, including the warmth of their home.

3.4 Unit fuel costs and under-occupation

This is by no means an isolated case. Table 5 shows the average AHC income, fuel costs, floor areas and unit fuel costs (£/m^2) of all low income two person households living in moderate or poorer energy efficient homes by whether they are classed as fuel poor under the proposed 'low income/high cost' definition. (The table is again confined to two person households to avoid any confusion caused by equivalisation, while Energy Performance Certificate (EPC) bands F and G were combined for reasons of sample size). In the poorer housing, the average incomes of those not classed as fuel poor are slightly lower than for those deemed fuel poor. In all EPC bands, their fuel costs are significant lower, but as shown by the penultimate column this is due to their much smaller homes. The final column shows that the average unit energy costs (£/m^2) are actually higher for the non-fuel poor households than for those classed as fuel poor.

Table 5: Average of low income, fuel costs, floor area and unit fuel costs (£/m^2) of two person households by energy efficiency and Low income/high costs categories

EPC (SAP ratings)	**Low Income/High costs** **Definition**	**Hholds** x 1000	**Income** **AHC** £	**Fuel costs** £	**Floor area** m^2	***Unit fuel*** **cost** £/m^2
D (SAP 55 - 68)	Low income/lower costs	473	8,425	1,024	71.3	15.4
	Low income/higher costs	97	8,349	1,374	108.4	14.3
E (SAP 39 - 54)	Low income/lower costs	146	7,923	1,099	62.9	18.7
	Low income/higher costs	324	7,936	1,515	97.5	17.2
F & G (SAP 1 - 38)	Low income/lower costs	15	8,446	1,115	36.5	33.3
	Low income/higher costs	255	8,670	2,121	104.6	22.9
Totals for above sample	**Mean**	**1,311**	**8,290**	**1,394**	**85.7**	**17.8**
	Median		*9,153*	*1,248*	*75.8*	*16.8*

Related to floor areas, the discussion of under-occupation as a major cause of fuel poverty is a serious omission in the Hills Fuel Poverty Review. Again limiting the sample to all two-person, low income households, Table 6 shows whether the households are under-occupying their home on several indicators. It also shows the energy efficiency of the home and the fuel poverty status of the household under the proposed new definition.

The Table shows that within each energy efficiency band, a significantly larger proportion of households who are classed as fuel poor (low income/higher costs) are under-occupying their homes than within the groups deemed as not fuel poor (lower income/lower costs).

Table 6: Measures of under-occupation and unit fuel costs (£/m^2) of two person households by energy efficiency and Low income/high costs categories

EPC (Sap ratings)	Low income/ high costs Definition	Hholds x 1,000	% under-[1] occupying	Average adults/m^2	Average pers/m^2	Unit fuel cost £/m^2
A to C (SAP 69 plus)	Low income/lower costs	180	5.9	36.2	32.2	13.5
	Low income/higher costs	3	100.0	126.1	93.3	7.7
D (SAP 55 - 68)	Low income/lower costs	473	13.7	38.2	35.7	15.4
	Low income/higher costs	97	37.6	58.5	54.5	14.3
E (SAP 38 - 54)	Low income/lower costs	146	8.7	35.3	32.0	18.7
	Low income/higher costs	324	31.3	52.0	49.0	17.2
F (SAP 21-38)	Low income/lower costs	10	0.0	21.3	21.3	27.2
	Low income/higher costs	190	46.1	54.5	53.8	20.0
G (SAP 1 -20)	Low income/lower costs	5	0.0	12.9	12.9	43.9
	Low income/higher costs	65	33.4	49.2	48.6	31.2
Totals		**1,494**	**22.7**	**44.5**	**41.8**	**17.3**

[1] Fuel poverty definition of under-occupation (see section 1 above)

Further evidence that the proposed 'low income/high costs' definition is not directed at those most in need is shown by Table 7. This cross-tabulates the categories in the new definition with the MIS based measure of fuel affordability by high, average and lower EPC bands. As shown, of the 2,716,000 low income households classed as fuel poor (low income/higher costs), some 5 per cent (134,000) live in quite energy efficient homes, having SAP ratings of 69 or above. Based on the MIS, some 13 per cent (347,000) also have a sufficient residual fuel budget to afford their higher fuel costs.

Conversely, of the 3,151,000 low income households not classed as fuel poor under the new definition, some 2,100,000 are in moderate or low energy efficient housing (D to G bands) and cannot afford their fuel costs (on the MIS definition). Of these, 613,000 live in homes of below average energy efficiency and would also need more than a 20 per cent cut back in the minimum living standard to afford their energy costs.

Table 7: Low income/high costs definition by energy efficiency and affordability of fuel costs, 2009

Thousand households

Low income/High costs	EPC ratings	Reduction in MIS living costs required for fuel				Total hholds
		None	Up to 20%	20 to 40%	Over 40%	
Low income/lower costs (Not classified as fuel poor)	A to C	70	157	263	374	864
	D	148	321	464	549	1,482
	E to F	39	154	249	364	806
	Total	**257**	**631**	**976**	**1,287**	**3,151**
Low income/higher costs (Classified as fuel poor)	A to C	21	19	24	70	134
	D	117	117	185	360	779
	E to F	208	371	424	799	1,803
	Total	**347**	**508**	**633**	**1,229**	**2,716**
Higher income/lower costs (Not classified as fuel poor)	A to C	1,615	73	4	0	1,691
	D	3,661	157	19	0	3,837
	E to F	1,983	106	5	0	2,094
	Total	**7,259**	**335**	**27**	**0**	**7,622**
Higher income/higher costs (Not classified as fuel poor)	A to C	276	4	0	0	280
	D	1,979	55	1	0	2,036
	E to F	5,589	127	14	0	5,730
	Total	**7,845**	**187**	**14**	**0**	**8,046**

Source: 2009 EHS

Key:

A to C (Sap 69 or above)	Proposed definition:	
D (Sap 55 to 68)	Appears justifiable	2,256 k
E to F (Sap below median of 55)	Is questionable	1,488 - 460 = 1,028 k
	Is highly questionable	613 - 21 = 592 k
		3,8746 k

3.5 Conclusions

The Hills Review appears to have produced an 'energy costs threshold' which is both inadequately low, yet practically unobtainable for 50 per cent of all households.

The definition, as it stands, also appears to represent a charter for under-occupation. To avoid the exclusion from fuel poverty of households unable to afford their fuel costs who live in smaller low energy efficient homes, the high energy cost threshold needs to be related to the unit fuel costs (£/m^2) rather than the total fuel costs. By controlling for floor area, this would relate the energy cost more directly to the energy efficiency of the home, the SAP rating itself being determined from the unit fuel costs. However, under SAP, unit costs do not cover all energy usage and are calculated using a single standard heating regime, standard occupancy rates and standardised fuel prices.

In the proposed improved definition, the fuel costs would continue to be calculated for all energy services, using several different heating regimes, actual occupancy numbers and fuel prices depending on the region and payment type – or, preferably, the actual household tariff used.

Table 8 gives the median total fuel costs, mean floor area and median unit fuel costs for each EPC energy efficiency band. It illustrates that, despite the important differences between the fuel costs that generate SAP ratings, and the fuel costs (shown) which are produced by the specific energy model constructed for fuel poverty, there is still a clear correlation between both the total fuel costs and the unit fuel costs and the energy ratings of the home.

Table 8: Median total fuel costs, mean floor areas and median unit fuel costs by energy efficiency EPC/SAP ratings, 2009

EPC	SAP	House-holds	Column percentage	Total fuel costs	Floor Area	Unit fuel Costs
		x 1,000	%	Median £	Mean m^2	Median £/m^2
A-B	(81-100)	129	0.6	568	49.4	11.38
C	(69-80)	2,841	13.2	821	72.9	12.91
D	(55-68)	8,134	37.8	1,111	87.3	14.37
E	(39-54)	7,331	34.0	1,411	98.0	16.52
F	(21-38)	2,416	11.2	1,774	107.6	19.70
G	(1-20)	686	3.2	2,260	96.4	27.72
Totals		**21,535**	**100.0**	**1,246**	**91.4**	**15.32**

In practice, using the median unit fuel costs rather than the median total fuel costs would reduce the number of low income households not classed as fuel poor who are living in homes of below average energy efficiency (EPC bands E to G) by a third, from 806,000 to 532,000.

But as well as using unit fuel costs, the energy threshold needs to be set at a value better than the median. Thus, dwellings with fuel costs lower than the median, which are nevertheless of poor energy efficiency, can be included in the definition of fuel poverty and improved. Unlike the median value, the threshold should also be one which would allow the numbers failing the threshold to decline with improvements in domestic energy efficiency and/or in the total required energy costs of the housing stock.

Such an energy cost threshold might take the form of:

- An absolute threshold for higher energy costs, such as the median unit fuel costs for dwellings with a set SAP rating
- A relative threshold such as a certain percentage below the median unit fuel costs (£/m^2) of all dwelling or a certain percentage above the median unit fuel costs of the most energy efficient dwellings

By setting the threshold at, say, 40 per cent above the median unit fuel costs for the 10 per cent most energy efficient dwellings, the number of all low income households not classed as fuel poor who are living in homes of below average energy efficiency could be reduced significantly, albeit with an increase in the total number deemed to be in fuel poverty in 2009.

3.6 Recommendations

With respect to the proposed energy cost threshold, we recommend the following:

- The threshold is based on the unit energy costs (£/m^2) rather than the total
- That, given the generally poor energy efficiency of the English housing stock, the threshold is set at a better value than the median
- That, unlike the median value, it is set at a value that would enable the number of households failing the threshold to show a reduction with the increasing energy efficiency of the housing stock and/or improvements in general domestic energy costs

4 Alternative energy cost thresholds

SAP 81 is often stated as the minimum currently required for fuel poverty proofing the stock, but this is really the minimum target SAP after improvement. What is needed for an energy cost threshold is a maximum trigger point for embarking on improvements capable of reducing fuel costs.

4.1 Options for the energy cost threshold

The analysis examined the following options for replacing the Hills review proposed median energy costs threshold:

1. One option would be to use the median, occupant related unit fuel costs (£13.64/m^2 in 2009) at the existing threshold for Energy Certificate Performance (EPC) C rated homes and above. In 2009 this was £13.64/m^2. Households with lower required unit costs (£/m^2) than this will already be living in reasonably energy efficient housing and have limited opportunities for making major fuel cost savings through energy efficiency measures to their homes. Such a threshold could both encourage action on the poorer stock and help to ensure that these were, at the very least, brought up to a reasonably efficient standard above the threshold. Although more an absolute than a relative threshold, this threshold would change to reflect longer term changes in fuel prices as the Standard Assessment Procedure (SAP) is periodically updated.
2. A relative energy cost threshold, which would maintain the reference to more energy efficient housing, could include all households who had unit energy costs more than 40 per cent higher than the median for households in the most energy efficient homes. The latter could be defined as the 10 per cent of households with the lowest unit energy costs. In 2009 these had median fuel costs of just under £10.18/m^2, making the threshold £14.25/m^2. Energy costs 40 per cent above the median is the equivalent of 60 per cent of median income, ie 40 per cent below median income. As the housing stock is gradually improved so this threshold is likely to shift in a similar way to the poverty line moving with generally increasing incomes.
3. Based on an examination of the actual fuel expenditure of low income households compared to spending in the housing stock as a whole, another option is to set the energy cost threshold at 60 per cent of the median unit fuel costs (£/m^2). For 2009, this produces a threshold of only £9.19/m^2 and consequently includes a much larger proportion of low income households.

As well as all using unit fuel costs (£/m^2), rather than total fuel costs, all three options use un-equivalised fuel costs, for the reasons stated above.

4.2 Impact of fuel prices rises

The following tables show the effect of fuel price rises on the number of households in fuel poverty on the existing full income definition, the proposed low income/high cost definition and the three alternative definitions using the same income threshold but different energy cost thresholds. The tables illustrate the impact of an increase, say over three years, of 30 per cent in required costs across all fuels.

In practice, such a rise in fuel prices would have less of an impact on fuel poverty numbers than shown, as any rises would be tempered by increases in incomes and improved energy efficiency.

Table 9 shows the effect on the numbers of households under the existing definition. With no countering effect of improved incomes and better energy efficiency, the number of fuel poor households increases dramatically from under 4.0 million in 2009 to nearly 6.5 million in 2012 – an increase of 64 per cent. This would tend to support the Review's conclusion that the existing 10 per cent threshold exaggerates the impact of fuel price rises.

Table 9: Increase in average fuel costs and fuel poverty resulting from 30 per cent increase in fuel prices across all fuels – Existing full income definition

	Not in fuel poverty Full income		**In fuel poverty Full income**		**Total households**	
	Before	After	Before	After		After
Mean fuel costs £	1,291	1,658	1,567	1,946	1,342	1,745
% increase[1]		*30.0*		*30.0*		*30.0*
Households	17,571	15,041	3,964	6,495	21,535	21,535
% increase		*-14.4*		*63.8*		*0.0*

[1] Calculated over the whole stock (not from means)

This dramatic increase is in stark contrast to the effect on fuel poverty numbers, as recorded under the proposed 'low income/high cost' definition. Table 10 shows that a 30per cent increase in everyone's fuel costs, un-tempered by any improvements in income or energy efficiency, results in only an 8 per cent rise in fuel poverty numbers. This is only 13 per cent of the proportional increase that would take place under the existing definition. This would appear to suggest that the proposed definition is equally under-estimating the effect of fuel price rises. The average fuel poverty gap appears to provide a better reflection of the increase in fuel costs, rising by a very similar 31 per cent, albeit this additional measure is still confined to the small number of households classified as fuel poor both before and after the price rises.

Table 10: Increase in average fuel costs and fuel poverty resulting from 30 per cent increase in fuel prices across all fuels – Median fuel cost threshold

	Low income/ lower costs		**Low income/ high costs**		**Higher income/ low costs**		**Higher income/ high costs**	
	Before	After	Before	After	Before	After	Before	After
Mean fuel costs £	1,172	1,525	1,467	1,911	1,173	1,524	1,527	1,985
% increase[1]		30.0		30.0		30.0		30.0
Households	**3,151**	**3,282**	**2,716**	**2,944**	**7,617**	**7,484**	**8,051**	**7,825**
% increase		4.2		8.4		-1.7		2.8
Average FP gap £			409	534				
% increase				30.6				

[1] Calculated over the whole stock (not from means)

Table 11 shows the comparable increases in average fuel costs and fuel poverty for a 'low income/high costs' definition using 60 per cent of the median unit fuel costs (£/m^2) as the energy cost threshold, rather than the median of total costs. This results in much higher numbers of fuel poor households with most low income households being included. However, the effect of a 30 per cent hike in fuel prices is very similar to the proposed definition, fuel poverty increasing by only 7 per cent.

Table 11: Increase in average fuel costs and fuel poverty resulting from 30 per cent increase in fuel prices across all fuels – 60 per cent of median threshold (£/m2)

	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Mean fuel costs £	134	140	5,611	6,019	1,103	1,097	14,687	14,280
% increase[1]		30.0		30.0		30.0		30.0
Households	**134**	**140**	**5,611**	**6,019**	**1,103**	**1,097**	**14,687**	**14,280**
% increase		4.9		7.3		-0.6		-2.8

[1] Calculated over the whole stock (not from means)

The next table shows the figures for an energy cost threshold, set at the median unit costs (£/m^2) for homes at the threshold for EPC band C. Unlike the previous two definitions, this shows a significant increase in fuel poverty resulting from the 30 per cent rise in fuel costs across the board. However, the 33 per cent increase in fuel poverty is still only half as high as that shown by the existing definition. Increases in incomes to match inflation over the three year period would reduce the rise in fuel poverty to around 24 per cent, with improvements in energy efficiency making further significant inroads into the 2012 total.

Table 12: Increase in average fuel costs and fuel poverty resulting from 30 per cent increase in fuel prices across all fuels – EPC C/D boundary threshold (£/m^2)

Tenure	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Mean fuel costs £	1,206	1,826	1,363	1,729	1,310	1,789	1,372	1,742
% increase[1]		30.0		30.0		30.0		30.0
Households	**1,379**	**339**	**4,366**	**5,820**	**6,104**	**2,146**	**9,686**	**13,231**
% increase		-75.4		33.3		-64.9		36.6

[1] Calculated over the whole stock (not from means)

The final table gives the increase average fuel costs and fuel poverty numbers for the definition based on an energy cost threshold which captures all low income households with energy costs over 40 per cent higher than the median in the most energy efficient homes. Being a relative definition this exhibits the same characteristics as the officially proposed 'low income/ high cost' definition and the previous definition, using an energy threshold of 60 per cent of the median. As in these options, the increase in the fuel costs of 30 per cent is reflected only slightly in the reduction of households classed as fuel poor, the increase again being only just over 7 per cent.

Table 13: Increase in average fuel costs and fuel poverty resulting from 30 per cent increase in fuel prices across all fuels – 40 per cent above median of most energy efficient housing (£/m^2)

	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Mean fuel costs £	1,203	1,590	1,377	1,795	1,302	1,688	1,384	1,797
% increase[1]		30.0		30.0		30.0		30.0
Households	**1,715**	**1,833**	**4,030**	**4,326**	**6,946**	**6,821**	**8,845**	**8,555**
% increase		6.9		7.4		-1.8		-3.3

[1] Calculated over the whole stock (not from means)

4.3 Impact of energy efficiency improvement

As well as not registering the real impact of rising fuel prices, the proposed 'low income/high cost' definition of fuel poverty largely fails to register any substantial energy efficiency improvements in the housing stock.

This can be shown by applying an improvement model designed to replicate 'business as usual' (BAU) energy efficiency improvements, as currently occurring within the English housing stock, and larger programmes aimed at both reducing fuel poverty and carbon emissions. The BAU model covers all significant energy improvement work in all tenures, and not just that undertaken under particular programmes such as Warm Front or the Decent Homes Standard. Details of the energy model are given in Annex 1 to this note. A much simpler model produces similar results as shown in Annex 2.

Scenario 1 – Business as Usual

Using this model, Table 14 shows how average annual energy improvements are likely to have been distributed by tenure and by the 'low income/high cost' categories in the period since the last (2009) EHS to the present day. As expected, more work takes place in dwellings with fuel costs above the median. However, activity is by no means confined to these dwellings.

Table 14: Distribution of energy work (BAU scenario) by tenure and low income/high cost categories, annual rates between 2009 and 2012

	Low income/ lower costs		**Low income/ high costs**		**Higher income/ low costs**		**Higher income/ high costs**	
	Improved	Total	Improved	Total	Improved	Total	Improved	Total
Owned mortgage	87	793	72	617	373	3,784	323	2,769
	10.9	*100.0*	*11.7*	*100.0*	*9.8*	*100.0*	*11.7*	*100.0*
Owned outright	34	353	97	663	164	1,735	522	3,853
	9.7	*100.0*	*14.6*	*100.0*	*9.5*	*100.0*	*13.6*	*100.0*
Privately rented	51	795	63	693	52	1,014	67	784
	6.4	*100.0*	*9.1*	*100.0*	*5.1*	*100.0*	*8.6*	*100.0*
Rented from LA	67	586	50	393	52	496	36	302
	11.4	*100.0*	*12.7*	*100.0*	*10.5*	*100.0*	*12.0*	*100.0*
Rented from HA	78	625	55	350	65	588	49	344
	12.5	*100.0*	*15.6*	*100.0*	*11.1*	*100.0*	*14.2*	*100.0*
All tenures	**317**	**3,151**	**337**	**2,716**	**706**	**7,617**	**998**	**8,051**
	10.0	*100.0*	*12.4*	*100.0*	*9.3*	*100.0*	*12.4*	*100.0*

Table 15 shows the impact of this BAU improvement activity on the total fuel costs for the homes improved and the total stock in each of the categories created by the proposed definition. It also shows that under the Interim Report's proposed definition fuel poverty does fall slightly, down from 2.7 to 2.6 million households or a reduction of nearly 3 per cent. However, this does not appear to adequately reflect the extent to which the 'low income/high cost' housing is improved. For the 33 per cent of homes improved, over the three years, their fuel costs have on average fallen from £1,580 to £1,189, a reduction calculated over all improved dwellings of over 22 per cent. Over the total stock in this category (improved and non-improved), the saving in fuel costs is over 8 per cent. The average fuel poverty gap of 291 – a reduction of 30 per cent – provides a better reflection of the amount of improvement activity, but is solely confined to those categorised as fuel poor.

Table 15: Reduction in average fuel costs and fuel poverty resulting from BAU improvement programme, 2009 to 2012

	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Improved stock								
Mean fuel costs £	1,217	1,036	1,580	1,189	1,207	1,055	1,643	1,299
% reduction[1]		15.8		22.3		15.1		21.7
Total stock								
Mean fuel costs £	1,172	1,107	1,467	1,325	1,173	1,112	1,527	1,392
% reduction[1]		4.8		8.3		4.2		8.1
Impact on								
Households	**3,151**	**3,122**	**2,716**	**2,636**	**7,617**	**7,645**	**8,051**	**8,132**
% reduction		0.9		2.9		-0.4		-1.0
Average FP gap			409	291				
% reduction				29.8				

[1] Calculated over the whole relevant stock (not from means)

Scenario 2: Enhanced Fuel Poverty & Climate Change Programmes

Scenario 2 represents a situation where action to improve the homes of both the fuel poor and those with high fuel costs and higher incomes is increased to cover 52 per cent of homes and to achieve an average cost saving per dwelling 5 per cent higher than in the BAU scenario. The targeting of increased activity on the homes of those with high fuel costs and higher incomes, as well as on the homes of the fuel poor, is a reasonable assumption. This is because the greatest energy savings can be made from this sector, with the least burden to the taxpayer.

Despite the substantially increased impact of the programme on 'low income/high fuel cost' homes (an increase in energy saving from 8 per cent to 13 per cent), the percentage reduction in fuel poverty only increases by 1 per cent (Table 16).

Table 16: Reduction in average fuel costs and fuel poverty resulting from Scenario 2 – enhanced fuel poverty and carbon reduction programme, 2009 to 2012

	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Improved stock								
Mean fuel costs £	1,217	991	1,599	1,164	1,207	1,009	1,624	1,227
% reduction[1]		20.0		26.6		19.4		25.4
Total stock								
Mean fuel costs £	1,172	1,081	1,467	1,247	1,173	1,081	1,527	1,320
% reduction[1]		6.0		13.8		5.4		13.4
Impact on								
Households	**3,151**	**3,104**	**2,716**	**2,611**	**7,617**	**7,663**	**8,051**	**8,157**
% reduction		1.5		3.9		-0.6		-1.3
Average FP gap			409	305				
% reduction				25.4				

[1] Calculated over the whole relevant stock (not from means)

Scenario 3 – Enhanced Climate Change Programme

The third scenario shows the effect of increasing improvement activity to meet the goal of reducing carbon emissions. It is assumed that all the additional activity takes place among middle to higher income households who have higher than median fuel costs. This scenario uses the same assumptions on targeting and the extent of improvements as the BAU scenario. However, for those with high fuel costs and higher incomes, it applies activity to all homes rather than just a proportion of 'deserving' homes. This increases the proportion of homes improved from 37 per cent to 62 per cent.

Table 17 shows that enhancing action specifically against carbon emissions would increase fuel poverty under the proposed definition by over 1 per cent. This is despite the substantial improvement in the fuel costs of those classed as fuel poor remaining the same as in Scenario 1. As there are more fuel poor in Scenario 2 than in the BAU Scenario, the average fuel poverty gap increases to £313, but despite the increase in fuel poverty numbers still remains well below its 'before improvement' value.

Table 17: Reduction in average fuel costs and fuel poverty resulting from Scenario 3 – enhanced carbon reduction programme only, 2009 to 2012

	Low income/ lower costs		**Low income/ high costs**		**Higher income/ low costs**		**Higher income/ high costs**	
	Before	After	Before	After	Before	After	Before	After
Improved stock								
Mean fuel costs £	1,217	1,036	1,580	1,189	1,207	1,055	1,643	1,299
% reduction[1]		15.8		22.3		15.1		21.7
Total stock								
Mean fuel costs £	1,172	1,107	1,467	1,325	1,173	1,112	1,527	1,300
% reduction[1]		4.8		8.3		4.2		13.5
Impact on								
Households	**3,151**	**3,006**	**2,716**	**2,752**	**7,617**	**7,762**	**8,051**	**8,015**
% reduction		4.6		-1.3		-1.9		0.4
Average FP gap			409	313				
% reduction				23.4				

[1] Calculated over the whole relevant stock (not from means)

Scenario 3 with alternative thresholds

As scenario 3 appears most problematic for the proposed 'low income/high costs' definition, since it increases the number of fuel poor, the scenario is used to test the alternative proposed definitions. Table 18 shows that if the definition based on a threshold of 60 per cent of median unit fuel costs for all households (£/m^2) is used, the improvement works do lead to a decrease in fuel poverty. However, the reduction is very small at only a little over 1 per cent.

Table 18: Reduction in average fuel costs and fuel poverty resulting from Scenario 3 – 60 per cent of median threshold (£/m^2)

	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Improved stock								
Mean fuel costs £	1,643	1,527	1,423	1,104	1,541	1,444	1,499	1,155
% reduction[1]		15.3		20.0		16.8		21.0
Total stock								
Mean fuel costs £	1,445	1,502	1,323	1,217	1,416	1,418	1,343	1,186
% reduction[1]		3.6		7.3		5.8		10.9
Impact on								
Households	**134**	**115**	**5,611**	**5,542**	**1,103**	**1,133**	**14,687**	**14,746**
% reduction		14.3		1.2		-2.7		-0.4

[1] Calculated over the whole relevant stock (not from means)

In contrast, using the definition based on the median fuel costs (£/m^2) at the boundary of EPC bands D and C, the improvement activity does bring about a significant fall in fuel poverty – a decline of over 11 per cent. As shown in Table 19, this is despite the fall in average total fuel costs for the improved housing (calculated over the whole stock in this category) being very similar to that recorded for the previous definition.

Table 19: Reduction in average fuel costs and fuel poverty resulting from Scenario 3 – EPC C/D boundary threshold (£/m^2)

	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Improved stock								
Mean fuel costs £	1,313	1,083	1,449	1,138	1,483	1,193	1,508	1,164
% reduction[1]		15.3		20.0		16.8		21.0
Total stock								
Mean fuel costs £	1,206	1,137	1,363	1,263	1,310	1,205	1,372	1,201
% reduction[1]		3.6		7.3		5.8		10.9
Impact on								
Households	**1,379**	**1,775**	**4,366**	**3,881**	**6,104**	**8,005**	**9,686**	**7,874**
% reduction		-28.8		11.1		-31.1		18.7

[1] Calculated over the whole relevant stock (not from means)

The next table shows the impact of an enhanced climate change programme on fuel poverty based on a threshold of 40 per cent above the median unit fuel costs for households in the most energy efficient homes. Being a relative definition, with a threshold slightly closer to the median for all households, this shows very little reduction in fuel poverty after improvement – less than 1 per cent. This is despite the fact that the level of savings achieved in 'low income/high cost' housing is very similar to that achieved under the previous definition.

Table 20: Reduction in average fuel costs and fuel poverty resulting from Scenario 3 – 40 per cent above median of most energy efficient housing (£/m^2)

	Low income/ lower costs		Low income/ high costs		Higher income/ low costs		Higher income/ high costs	
	Before	After	Before	After	Before	After	Before	After
Improved stock								
Mean fuel costs £	1,306	1,086	1,453	1,128	1,420	1,173	1,475	1,138
% reduction[1]		15.4		20.2		16.2		20.5
Total stock								
Mean fuel costs £	1,203	1,138	1,377	1,260	1,302	1,232	1,384	1,264
% reduction[1]		3.9		7.5		4.2		7.8
Impact on								
Households	**1,715**	**1,667**	**4,030**	**3,992**	**6,946**	**7,115**	**8,845**	**8,762**
% reduction		2.8		0.9		-2.4		0.9

[1] Calculated over the whole relevant stock (not from means)

The final analysis examines how scenario 3 would affect the fuel costs and number of households in fuel poverty under the existing full income definition. Table 21 shows that the energy efficiency improvements reduce the number of households in fuel poverty under the existing definition more than in any of the other definitions – reducing the headline figure by 16 per cent. In effect, this represents the reverse of the impact of fuel price rises (see Table 9). The analysis showed that fuel poverty under the current definition increased by a considerably larger amount due to price rises than was the case under the other definitions.

Table 21: Reduction in average fuel costs and fuel poverty resulting from Scenario 3 – existing full income definition

	Not in fuel poverty Full income		In fuel poverty Full income		Total households	
	Before	After	Before	After	Before	After
Improved stock						
Mean fuel costs £	1,370	1,115	1,717	1,345	1,446	1,145
% reduction[1]		17.9		22.9		19.0
Total stock						
Mean fuel costs £	1,291	1,208	1,567	1,436	1,342	1,243
% reduction[1]		5.6		9.0		6.2
Impact on						
Households (x1,000)	**17,571**	**18,205**	**3,964**	**3,330**	**21,535**	**21,535**
% reduction		*-3.6*		*16.0*		*0*

[1] Calculated over the whole stock (not from means)

4.4 Conclusions

Although difficult in practice, it is clearly theoretically possible to eradicate income poverty using a threshold of 60 per cent of median equivalised income, after housing costs. For example, if the median equivalised AHC income for all households is £20,000, then provided no household has an income lower than £12,000, no one will be in income poverty. In practice, the measure is concerned with income inequalities, but is only acceptable because the majority of households in the UK have reasonable residual incomes relative to their total living costs.

In contrast, because of the poor energy efficiency of the housing stock, the median fuel cost is not a reasonable cost on which to base a threshold. A comparable relative energy cost threshold would be one where households failing the threshold were spending more than 40 per cent above households in the most energy efficient properties. However, making the energy cost threshold a relative threshold, similar to that set for incomes is highly questionable. It is quite clear that a relative threshold largely masks changes in fuel costs, whether these are increases due to rising fuel prices or reductions due to improved energy efficiency.

The Government may well favour a relative definition that allows fuel prices to further escalate without dramatically increasing the number of households recorded as being in fuel poverty. However, it seems less likely a Government would want to sign up to a definition of fuel poverty that, in terms of the recorded numbers of fuel poor:

1. does not reflect major achievements in reducing the fuel costs of those targeted
2. is in direct conflict with a successful carbon emissions programme

4.5 Recommendations

The fuel poverty definition that uses a threshold based on the median unit energy costs (£/m^2) of homes at the existing threshold for homes rated EPC C and above, is the only definition which reflects both the real impact of fuel price rises and of improved energy efficiency on the ability of low income households to afford fuel costs. However, it does not 'over-exaggerate' the impact of fuel price rises, unlike the existing definition. It also explicitly encourages action on poorer quality properties and good standards of improvement. For these reasons, the definition is recommended.

Furthermore, in common with the other alternative options, it is significantly simpler and more transparent that the definition proposed in the Interim Report. This is because it does not require the equivalisation of energy costs.

5 Distribution of fuel poverty under different definitions

The following figures[6] illustrate the distribution of fuel poverty according to the current definition and three of the definitions considered in this report the:

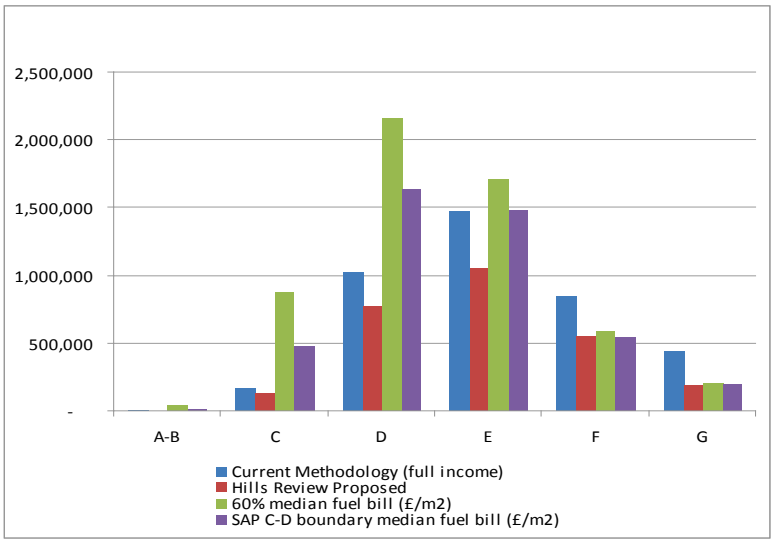
- proposed Interim Report definition
- 40 per cent of median unit fuel costs definition
- EPC C/D median unit fuel costs definition.

The figures look at distribution by EPC bands, household type and income decile.

5.1 Energy Performance Certificate (SAP) bands

The following graphs illustrate the distribution of fuel poverty under the four definitions according to EPC bands.

Figure 1: Total households by EPC ratings



[6] Figures provided by Toby Bridgeman, CSE

Figure 2: Percentage of households in each EPC band by definition

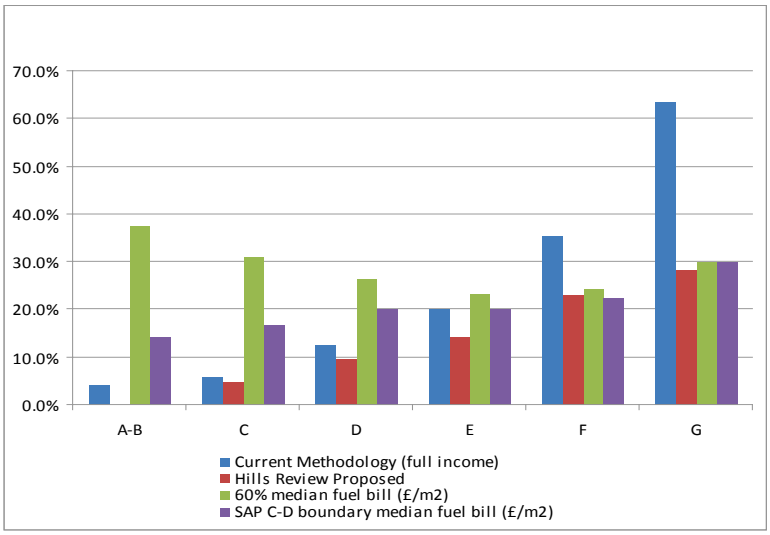
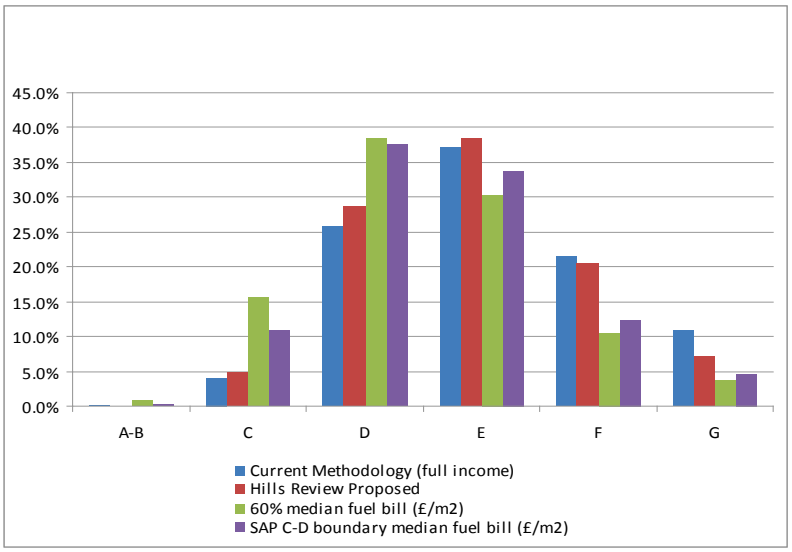


Figure 3: Percentage of total fuel poor in each EPC band by definition



5.2 Household composition

The following graphs illustrate the distribution of fuel poverty under the four definitions according to household composition.

Figure 4: Total households of each household type by definition

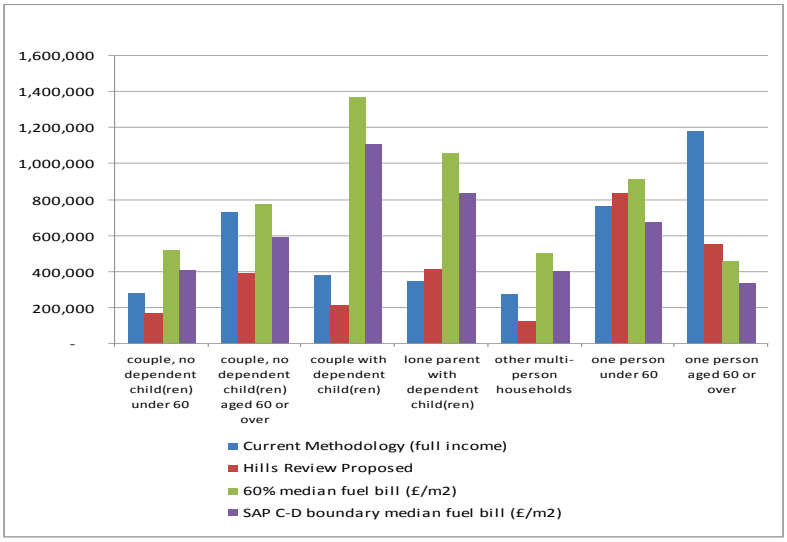


Figure 5: Percentage of each household type by definition

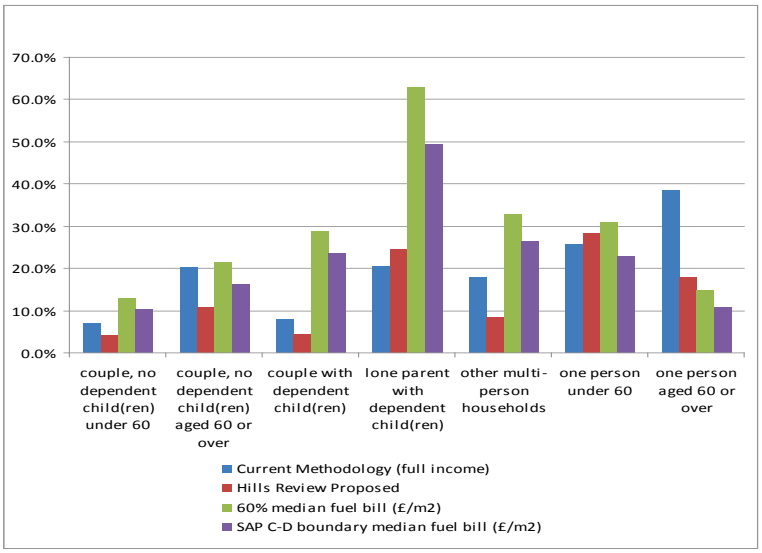
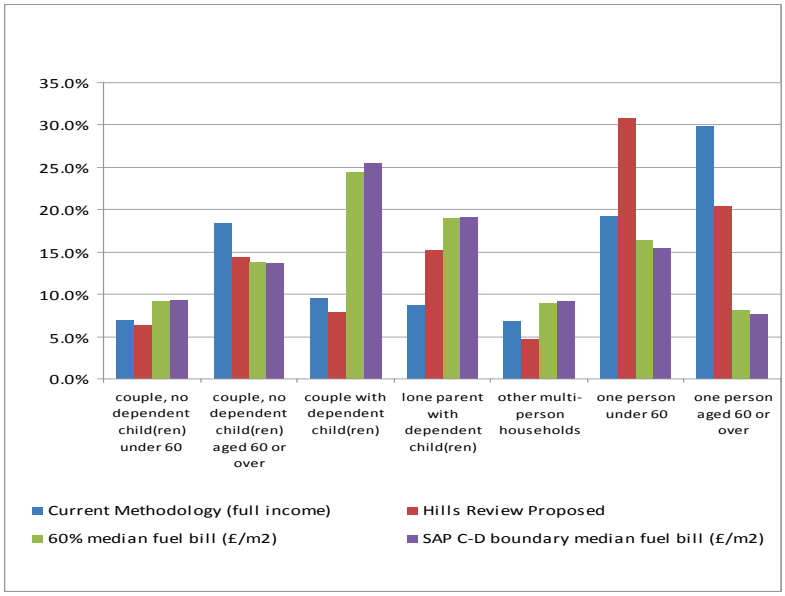


Figure 6: Percentage of total fuel poor of each household type by definition



5.3 Household income deciles

The following graphs illustrate the distribution of fuel poverty under the four definitions according to income deciles.

Figure 7: Total fuel poor by income decile by definition

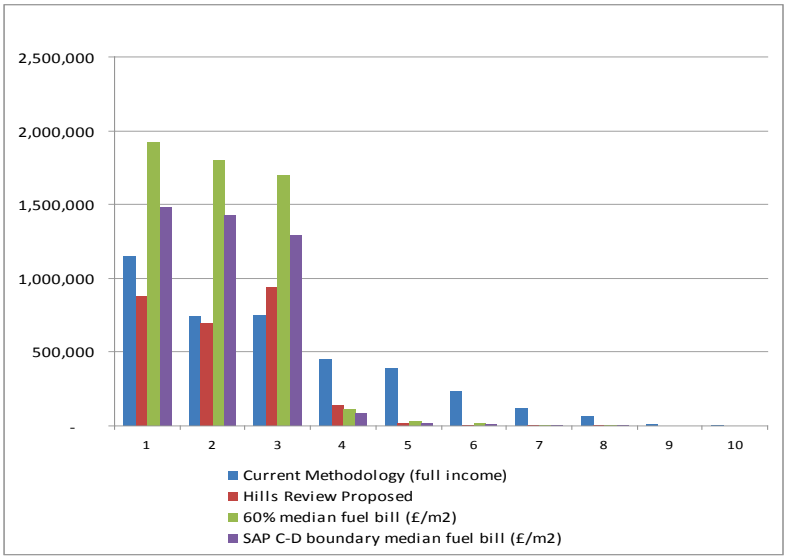


Figure 8: Percentage in each income decile by definition

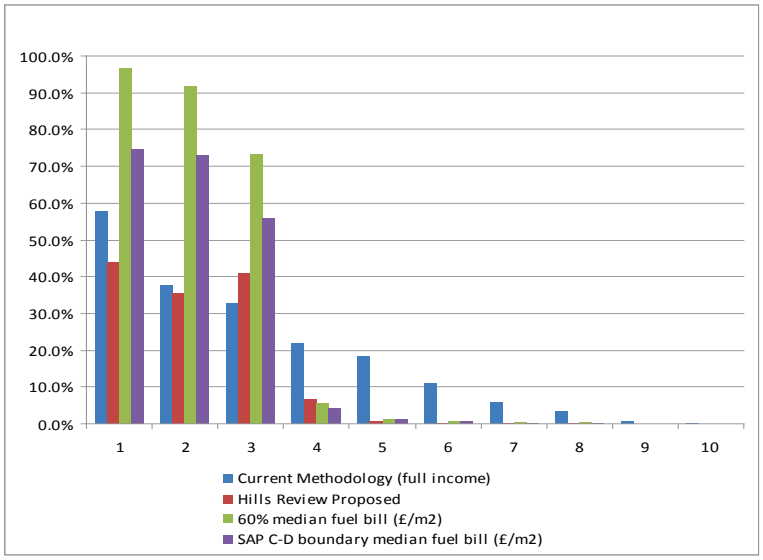
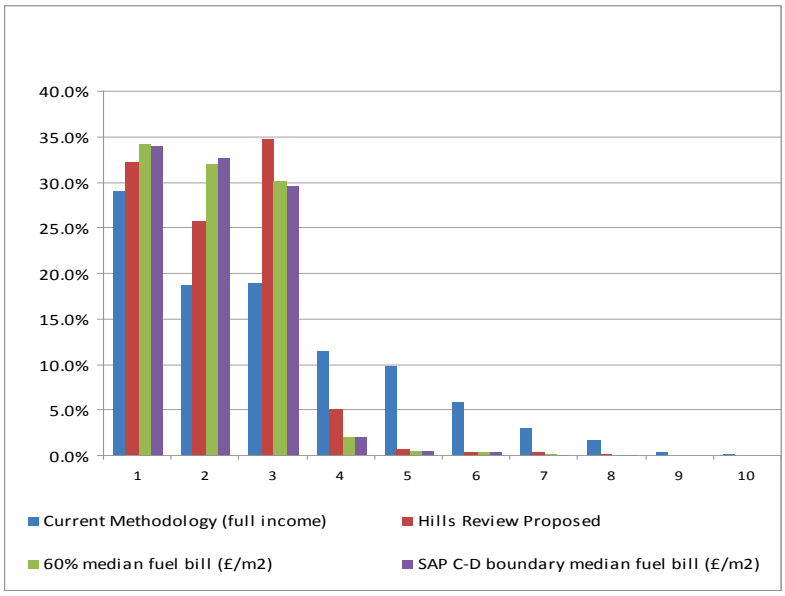


Figure 9: Percentage of total fuel poor in each income decile by definition



5.4 Conclusions

The above figures show that the number and distribution of households classed as fuel poor varies considerably by energy efficiency rating, household composition and income, depending on the definition used.

Annex 1: Methodology for improvement model

The recently updated and revised energy improvement model used for this research is based on a tried and tested model that has been applied in a number of previous research projects[7]. For example, it was used for determining the rates and distribution of 'business as usual' (BAU) improvements in the housing stock in previous analyses of the English House Condition Survey (EHCS), undertaken in association with Centre for Sustainable Energy (CSE) and ACE for the Energy Efficiency Partnership for Homes (EEPfH), Eaga-CT, South East England Development Agency (SEEDA), WWF and the Greater London Authority (GLA).

Dwellings improved

In modelling trends in energy efficiency, the first task is to determine which dwellings are most likely to be improved, following the 2009 EHS. In the private sectors it is assumed that significant energy efficiency improvements are only likely to occur voluntarily where, not only low thermal standards exist, but where the household is dissatisfied with their heating or standard of insulation. Unfortunately, unlike the EHCS, the EHS does not collect specific questions on dissatisfaction with energy standards. However, it does record if the household is dissatisfied with the accommodation generally and also whether they report problems of condensation, damp and mould, which could indicate poor heating conditions. In the 2009 EHS sample, therefore, likely improvers are taken as those owner occupiers who did not have a modern heating system and/or lacked wall and/or loft insulation and recorded problems of condensation, damp and/or mould or were not 'very satisfied' with their home.

Similar criteria are applied to those privately renting, except that with tenants being more likely to complain than owner occupiers and private landlords being often more reluctant to take action, dissatisfaction with the accommodation is only taken as an indicator of likely future action if the tenant is not 'satisfied' with their accommodation. In the public sectors, the assumption is that dwellings failing the thermal criteria of the decent homes standard (DHS) would be the first to receive energy measures. Thus, dwellings are scheduled for improvement after 2009 if they did not then have a modern heating system and failed the DHS on heating and/or lacked wall and/or loft insulation and failed the DHS in this regard. In addition, in both the private and social sectors, dwellings with SAP rating under 35 are assumed to be candidates for statutory action under the Housing Health and Safety Rating System (HHSRS).

Of the dwellings 'scheduled' for improvement, as above, only a proportion are actually selected for improvement (randomly from the EHCS address code) to reflect the fact that not all 'deserving' dwellings will be improved in practice, and to give rates of improvement comparable with those actually achieved in each tenure (as shown by the 2004 to 2007 longitudinal sample and 2009 EHS 'work done' data and increasing SAP ratings).

[7] Further details of the energy improvement model can be found at: ACE, Moore R, Impetus Consulting and CSE (2008), *Fuel poverty in London,* GLA

Extent of improvement

To determine the likely effect of any energy measures actually applied after 2009, the last longitudinal sample of the EHCS, containing dwellings surveyed in both 2004 and 2007, was analysed. From this sample, all dwellings showing significant energy efficiency improvements between 2004 and 2007 were examined. However, any dwelling showing an improvement in their SAP rating of less than five points was omitted, as such a small improvement could result from differences in the data collected in 2004 and 2007 rather than any significant energy measure.

Improvements in SAP costs rather than occupant determined fuel costs were used, as the latter are dependent on the particular household which in many cases will have changed since 2004. Using the final algorithms in the standard assessment procedure, the space and water heating costs etc before and after improvement were determined from the SAP ratings in 2004 and 2007.

As shown in Table A1, for each decile in the range of SAP ratings existing in each tenure before improvement in 2004, the average reduction in the SAP costs was determined, and 2007 costs expressed as a percentage of the original 2004 costs. As would be expected, those dwellings with the lowest SAP ratings in 2004 generally showed the greatest improvement and vice versa. This was the case in all tenures. However, within each rating band, the greatest average improvements were generally achieved in the social rented sectors and the least in the private stock.

Table A1: Average improvement in SAP fuel costs by original rating and tenure, 2004 to 2007 **(2007 costs as per cent of 2004 costs)**

2004 SAP Deciles	Owned with mortgage	Owned outright	Privately rented	Rented From LA	Rented From RSL
SAP < 29.2	69.1	69.5	65.3	53.2	63.3
29.2 to 36.4	74.5	76.9	75.3	70.1	73.0
36.4 to 40.9	77.8	78.2	78.2	73.1	71.7
40.9 to 44.6	77.3	78.9	78.6	74.0	73.8
44.6 to 48.2	79.2	81.0	80.2	76.9	79.5
48.2 to 51.6	81.9	81.0	77.8	81.7	79.4
51.6 to 55.3	81.6	84.9	77.6	80.9	81.4
55.3 to 59.4	84.8	86.4	83.2	83.5	82.6
59.4 to 65.0	85.9	86.6	82.7	87.7	86.3
65.0 or	95.8	87.7	93.4	88.1	86.5

Source: 2004-2007 EHCS longitudinal sample

These SAP cost improvements were applied to the corresponding dwellings in the full 2009 EHS sample, selected for likely improvement after 2009 on the above criteria, and the energy cost savings after improvement thereby determined.

Improvement rates

The first column of Table A2 shows the average annual rate of major improvements in SAP costs achieved between 2004 and 2007. An indication of equivalent recent improvement rates is given by questions in the 2009 EHS on work done by occupiers and/or landlords over the previous 12 months. Using this data, dwellings are selected which have received significant energy related work (for example, excluding boiler servicing alone) and now have an above average SAP rating for their particular tenure, age and built form. As shown in the second column of the Table, the resulting annual rates are similar to those recorded between 2004 and 2007.

For the dwellings scheduled for improvement following the 2009 EHS, it was assumed that the take up rate of energy measures up to 2012 will be similar to those recorded in 2009. For these dwellings, it is further assumed that that the extent of improvement of the actual occupant related fuel costs will be proportional to the reduction in SAP costs shown for dwellings improved between 2004 and 2007.

Table A2: Annual percentage of homes improved 2004-2007, 2008-2009 and 2009-2012

	Annual % of homes with major cost savings			**Total hholds**
	2004 to 2007	2008 to 2009	2009 to 2012	2009 (x 1,000)
Owned mortgage	10.8	11.0	10.7	7,962
Owned outright	11.5	12.5	12.4	6,604
Privately rented	6.8	7.1	7.1	3,287
Rented from LA	11.4	11.5	11.6	1,776
Rented from RSL	11.7	12.8	12.9	1,907
All tenures	10.9	11.1	10.9	21,535

Given the increasing priority afforded to energy work, albeit tempered by the recession, the overall improvement rates appear reasonable, as in practice Government programmes such as Warm Front only account for a relatively small proportion of total energy related work in the private sectors. However, the model does assume reasonably good targeting of energy work, especially in the social sectors.

Annex 2: The Impact of energy efficiency improvements shown by a simpler model

The median energy cost threshold makes it extremely difficult to achieve progress towards eliminating fuel poverty by improving the housing stock or otherwise reducing energy costs. This is because however energy efficient the housing stock is made and energy costs are reduced, there will always be 50 per cent of all households who have fuel costs higher than the median and so fail the threshold. Consequently, significant progress in reducing fuel poverty against this threshold can only be made by, in total, reducing the high fuel costs of low income households much more than those of higher income households.

This problem is illustrated by Table A3, which shows the number of households in each of the four 'low income/high cost' definition categories, before improvement (in 2009) and after four different improvement programmes, all targeted at homes with higher fuel costs. In programmes 1 and 2, energy costs are reduced by 25 per cent in respectively 30 per cent and 70 per cent of homes in both the higher cost categories. In programme 3, energy costs are cut by 25 per cent in 70 per cent of low income homes, but only in 30 per cent of higher income homes. Finally, in programme 4, a half of homes are targeted in both categories, with energy costs cut by 35 per cent for lower income households, but only by 15 per cent for those on higher incomes. In all programmes it is assumed that improvement is precisely targeted at homes with both above median fuel costs and the lowest SAP ratings.

Programme 1 has only a marginal effect on reducing fuel poverty under the proposed definition, but the much larger improvement programme 2 also produces virtually the same number of fuel poor. Only in programmes 3 and 4, where either the number of homes improved or the level of individual energy savings is much greater for households falling the income threshold than for those above the threshold, is there any significant reduction in fuel poverty. However, even here, the level of reduction, of well under half a million households, still appears a very poor reflection of the size of the improvement programmes and total cost savings achieved.

These examples, moreover, do not allow for any growth in the net number of households during the period of each improvement programme. Additional new households, particularly when housed in efficient new build housing, will tend to counter any reduction in fuel poverty achieved.

Table A3: Impact on fuel poverty numbers of four simple improvement programmes

Definition category	Before	Programme 1	Programme 2	Programme 3	Programme 4
Low income/high costs > High income/high costs >	**Improvement** (2009)	25% cut in 30% 25% cut in 30%	25% cut in 70% 25% cut in 70%	25% cut in 70% 25% cut in 30%	35% cut in 50% 15% cut in 50%
Low income/low costs (thousands/*column %*)	3,151 *14.6*	3,142 *14.6*	3,083 *14.3*	3,477 *16.1*	3,426 *15.9*
Low income/high costs (In fuel poverty)	**2,716** *12.6*	**2,658** *12.3*	**2,656** *12.3*	**2,262** *10.5*	**2,272** *10.5*
High income/low costs	7,617 *35.4*	7,627 *35.4*	7,686 *35.7*	7,298 *33.9*	7,341 *34.1*
High income/high costs	8,051 *37.4*	8,109 *37.7*	8,111 *37.7*	8,498 *39.5*	8,496 *39.5*
Total households	**21,535** *100.0*	**21,535** *100.0*	**21,535** *100.0*	**21,535** *100.0*	**21,535** *100.0*

Annex 3: Determination of energy costs for water heating, lights, appliances and cooking

This annex shows how the existing energy model used in the calculation of fuel poverty specifically takes account of the size and composition of the actual housing in the dwelling when determining the energy costs for water hearting, lights and appliances and cooking.

The energy demand for water heating Q_U (*Watts*) is determined from the number of actual occupants N using the algorithm: $Q_U = (78 + 52N) \times 1.2$. The energy requirement for water heating E_W (*GJ/yr*) is then given by the algorithm:- $E_W = k(Q_U + Q_{LOSS} – Q_S)E_{W,}$ where Q_{LOSS} are energy losses through water storage and/or distribution, Q_S is solar heating, E_W is the efficiency of the water heater and k is a constant. Hot water storage losses are most influenced by any hot water tank insulation and the tanks volume, but a factor is also applied if there is very low occupancy in a property as this generally means that hot water will be stored for a longer period of time. Thus, the cost of water heating is very largely determined by the size of the household.

The energy requirement for lights and appliances E_{LA} (*GJ/yr*) is given by the algorithms:-

$E_{LA} = 4.47 + (0.0232 \times TFA \times N$ *for TFA x N < 710*

$E_{LA} = 11.98 + (0.0146 \times TFA \times N) – 2.78 \times 10^{-6} \times (TFA \times N)$ *for TFA x N > 710 but < 2400*

$E_{LA} = 31.01$ *for TFA x N > 2400*

where TFA is the total floor area of the dwelling in m^2 and N is the actual number of occupants. Thus, the fuel cost for lights and appliances is also dependant on the household size, as well as the dwelling size.

Finally, the energy requirement for cooking E_K (GJ/yr) is determined from the number of actual occupants N by using the algorithm:- $E_K = f_{GAS} (2.98 \times 0.6 N) + f_{Electricity} (1.7 \times 0.34 N)$, where f_{GAS} and $f_{Electricity}$ are the proportions of demand for gas and electric cooking respectively. If there is no gas in a property then all cooking energy is assumed to be supplied by an electric cooker, but otherwise both f_{GAS} and $f_{Electricity}$ are assumed to be 0.5. Thus, aside from the fuel prices used, the cost of cooking is wholly dependent on the household size.

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The Hills fuel poverty review proposal for a new definition of fuel poverty: an analysis

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