

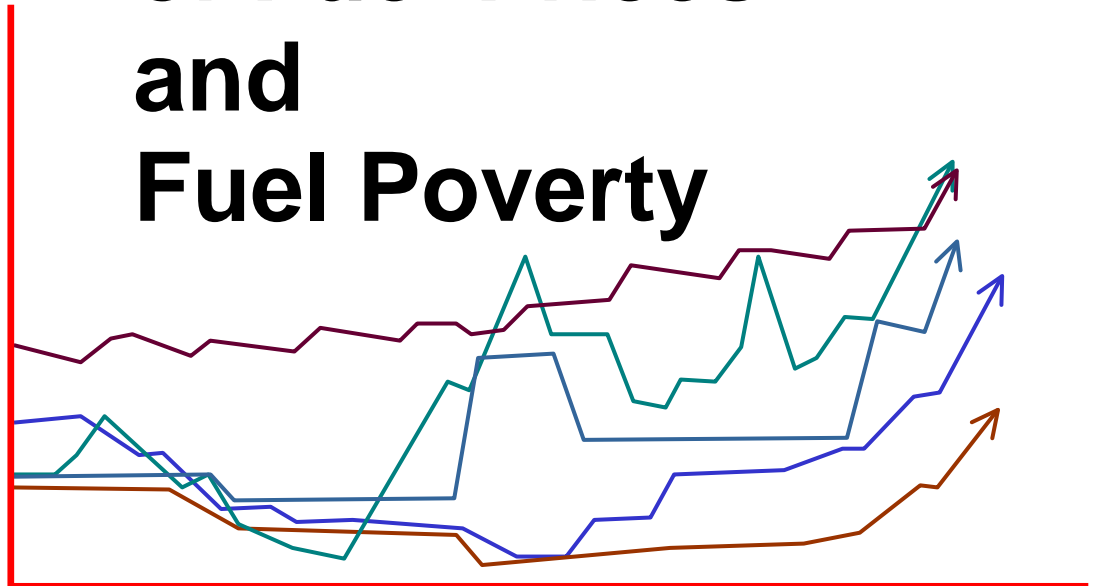


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The Fall and Rise of Fuel Prices and Fuel Poverty



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The best scenario ... is for gas and electricity prices to rise no more than 10% over the period 2005 to 2009, and thus effectively to stay static or fall slightly in real terms, while incomes rise by 20%. Together with the reasonably generous assumptions made about energy improvements, this would produce a significant fall in fuel poverty. However, by the first quarter of 2009, the total number of fuel poor would still be well over a million. With some 0.9 million of these still being vulnerable households, the chances of the Government meeting its target would be extremely slim.



Dr Richard Moore
July 2005

THE FALL AND RISE OF FUEL PRICES AND FUEL POVERTY

1. INTRODUCTION

Background

In England, the Government are committed to the eradication of fuel poverty “as far as is reasonably practicable” for vulnerable households by 2010 and for all other households by November 2016. Up to 2002, official estimates of changes in the number of households in fuel poverty showed the Government well on the way to meeting this target, but since that date and, particularly, within the last two years the prospects for success have dramatically changed.

The 2001 English House Condition Survey (EHCS) estimated that, since 1996, the number of households in fuel poverty had fallen by as much as 60% on the Government’s preferred ‘full’ income definition (from some 4.3 to 1.7 million)¹. However, this dramatic fall can be shown to result far more from reductions in fuel prices after 1996 and higher incomes in 2001 than any permanent improvement in the energy efficiency of the housing stock.

The First Annual Progress Report of the UK Fuel Poverty Strategy stated that “much of this reduction is thought to be due to changes in incomes and energy prices”² while for a fall of some 20% on the ‘basic’ income definition between 1991 and 1996, the 1996 EHCS concluded that “Lower fuel prices has done the most to reduce the total number of fuel poor”³. In Scotland, it is estimated that 35% of the reduction in fuel poverty between 1996 and 2002 was attributable to decreases in fuel prices, a half due to increases in household incomes and only 15% to improvements in the energy efficiency of the stock⁴.

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 January 2001, electricity prices were over 23% lower in real terms than five years earlier, while gas prices fell by over 18% in real terms over the same period⁵.

Since 2001, however, the fall in fuel prices has been reversed. In the last two years (from Q1 2003 to Q1 2005) electricity prices had risen in real terms by nearly 11% and in cash terms by over 15%. Moreover, for the predominant heating fuel, increases in wholesale gas prices in the late 2000 began to feed through to domestic customers from 2001 onwards. By the first quarter of this year, the price of domestic gas had risen in real terms by 16% and in cash terms by nearly 21% since the first quarter of 2003.⁶ These recent trends and the announcement of further fuel price increases, now raises the real possibility of a major increase in the number of households in fuel poverty and the need for further additional resources to be made available to the fuel poverty programme.

¹ BRE (2003) , *Detailed Breakdowns of Fuel Poverty in England in 2001*, Version 2, July, DTI & Defra.

² DTI/Defra (2003), *The UK Fuel Poverty Strategy, 1st Annual Progress Report*, DTI 2003

³ DETR (2000), *English House Condition Survey. 1996, Energy Report*, DETR, 2000

⁴ Scottish Communities (2004), *Fuel Poverty in Scotland*, Scottish Executive, April .

⁵ DTI (2005), *Retail Prices Index, Fuel Components, Fuel price index numbers relative to the GDP deflator, Monthly figures*

⁶ DTI (2005), *Quarterly Energy Prices*, DTI, June 2005.

Aims and Objectives of the Study

The aim of this study is to analyse the effects of likely fuel price rises on the number and distribution of households in fuel poverty in England and to estimate the additional cost to the fuel poverty programme. To this end, the four main objectives of the study are:-

- (1) to develop a series of realistic fuel price rise scenarios for the period up to 2010, by:-
 - a) analysing the actual rises in fuel prices by company and region since 2001;
 - b) undertaking a literature review of any writings/predictions on the subject;
 - c) consulting with personnel with expertise in the field in the fuel companies, regulatory bodies, 'watchdog' organization and in academia; and
 - d) specifying the fuel price scenarios for testing.

- (2) to develop a computer model to ascertain the effects of these scenarios on the number and distribution of households in fuel poverty, by:-
 - a) constructing a fuel prices/fuel poverty model based on the 2001 EHCS fuel poverty model, used to provide the Government's official fuel poverty estimates;
 - b) refining and finalizing the fuel price/fuel poverty model;
 - c) extending the model to provide fuel poverty estimates after housing costs, as well as those based on the existing 'full' and 'basic' income definitions; and
 - d) running the model for each of the likely fuel price scenarios, developed at (1) above.

- (3) To estimate the cost to the fuel poverty programme of fuel prices rises and the consequent increase in the number of households in fuel poverty, by:-
 - a) determining the average cost for individual energy measures from Warm Front and other improvement programmes;
 - b) constructing an energy efficiency improvement model based on one developed for the 1996 EHCS Energy Report;
 - c) entering the average cost of measures into the improvement model;
 - d) finalising the improvement cost model after preliminary runs and validations; and
 - e) running the model for the consequences of each of the likely fuel price scenarios, developed at (1) above.

- (4) To report on the effects of the fuel price scenarios on the number and distribution of fuel poor households and the costs to the fuel poverty programme, by:-
 - a) analysing, for each different scenario, the number and distribution of households in fuel poverty compared with the numbers and distribution existing in 2001;
 - b) analyzing, the additional cost to the fuel poverty programme of countering the effects of fuel price rises with the improved energy efficiency of the housing stock;
 - c) drafting a Preliminary Report for the NEA Conference on 8-10 September 2004;
 - d) drafting an Interim Report at the completion of stage 2; and

drafting the Final Research Report at the completion of stage 3.

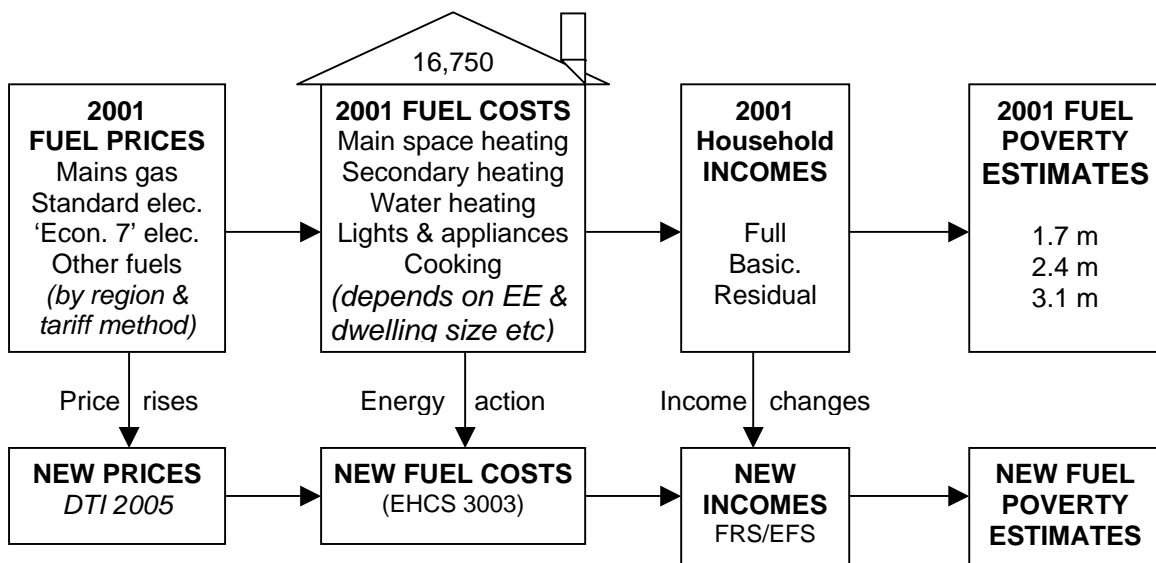
2. THE METHODOLOGY

The Overall Fuel Prices Model

The project has involved ‘un-picking’ the Government’s 2001 fuel poverty model and Figure 2.1 is a simplified diagram of the resulting NRFC fuel prices model. The model is based on the detailed data on fuel prices, domestic energy efficiency, household incomes and fuel poverty used in or obtained from the core sample of 16,750 households in the 2001 English House Condition Survey (EHCS). At the time of writing, this is the last survey in the series for which relevant data is publicly available.

For mains gas, standard tariff and ‘Economy 7’ electricity, the Government’s fuel poverty model provides the average unit fuel price and standing charge paid in 2001, for the region in which each sample dwelling is located and the method of payment used by the particular householder, namely direct debit, credit or pre-payment. However, the 2001 price of other fuels has been obtained from data for three regional groupings obtained for SELKENT UK.

Figure 2.1: Simplified diagram of NRFC fuel prices model



Depending on the fuels used for the main space heating, any secondary heating, water heating and cooking, the size of the dwelling and its energy efficiency, the relevant fuel prices can be fed into the model to determine the 2001 fuel costs for each sample dwelling.

These fuel costs are in turn related to the household’s full and basic incomes to reproduce the respective official estimates of 1.7 million and 2.4 million households in fuel poverty in 2001. In addition, the residual income after housing costs is also determined for each household and the corresponding estimate produced of 3.1 million households in fuel poverty on this more meaningful definition.

Once the 2001 model has been disassembled, it is possible to estimate the effect on fuel poverty numbers of fuel price rises and other changes in subsequent years.

- The regional fuel prices used in 2001 can be updated using fuel price data compiled by DTI and other sources, and projected forward.
- Pending the release of energy efficiency data from the 2003 EHCS “in late 2005”, it is possible to model the likely improvement in the energy efficiency of the stock since 2001.
- Government surveys such as the Family Resources (FRS) and ‘Family Expenditure’ (EFS) surveys can similarly be used to project 2001 household incomes forward to the present day and beyond.

The model thereby accounts for changes in fuel prices, changes in the energy efficiency of the stock and changes in household incomes since 2001. However, there are some changes that the model is unable to account for. It does not account for new housing built since 2001, but this should have little if any affect on the results. This housing will generally be the most energy efficient in the current stock and as such is likely to have very low rates of fuel poverty. More importantly, the model does not account for demographic changes within the existing stock, but assumes that the existing household population remains static as in 2001.

New fuel prices can be related to the housing stock, taking into account any energy improvements, to determine new fuel costs and these in turn related to new incomes to produce new fuel poverty estimates. In practice, this is done in two stages:-

- Firstly, the estimates are updated to as close to the present day as is possible (in practice, the first quarter of 2005) using the latest actual data available.
- secondly, the estimates are projected forward from this point, using possible, but inevitably more speculative scenarios on future changes in fuel prices, energy efficiency and incomes

The 2001 EHCS Fuel Poverty Model

There is limited information in the public domain on the details of the Government’s 2001 fuel poverty model, with just three component variables being provided in the 2001 EHCS public dataset, namely:-

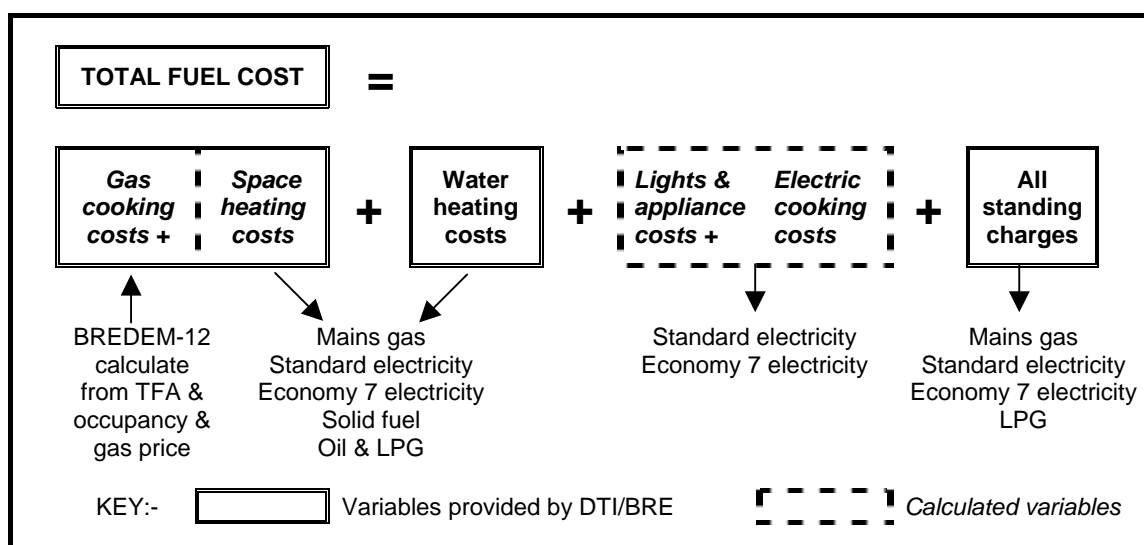
- 1) the total fuel cost
- 2) the full household income, and
- 3) the basic household income.

Following extensive and protracted correspondence with DTI and BRE, however, two additional derived variables for the 2001 model were provided, with eventually an explanation of what these included and how the variables were related . These comprised, a household based variable for:-

- 4) the space heating and gas cooking costs combined, and
- 5) the water heating costs.

In addition spreadsheets were supplied for the average unit fuel price and standing charges for mains gas, standard tariff and economy 7 electricity, broken down by Government Office Region and payment method; direct debit, credit or pre-payment. Although less than originally requested, this information enabled further components of the total fuel costs to be derived, as shown in Figure 2.2 below, and the Government’s fuel poverty model to be re-created with a reasonable degree of accuracy.

Figure 2.2: 2001 EHCS Fuel Poverty Model (Calculation of total fuel costs)



The Government's 2001 EHCS fuel poverty variables have been calculated using the 1996 version of the Building Research Establishment Domestic Energy Model BREDEM-12⁷. The separate cost and fuel use required for gas and electric cooking, lighting and the running of normal domestic appliances can be determined from the BREDEM-12 fuel use algorithms. These algorithms are based on the floor area of the dwelling and /or the number of occupants. However, unlike the 1996 EHCS where the actual number of occupants was used in all the non-heating fuel use algorithms, the 2001 fuel poverty methodology models the number of occupants on the basis of the floor area of the dwelling using the algorithms in Table 2.1 below:-

Table 2.1 Calculation of number of occupants (BREDEM-12)

Floor area		Modelled number of occupants
Smaller	TFA ≤ 450 m ²	$N = 0.0365 * TFA - 0.00004145 * TFA^2$
Larger	TFA > 450 m ²	$N = 9 / (1 + 54.3 / TFA)$
where	TFA =	Total floor area of the dwelling (m ²)

The floor area used in BREDEM calculations is specified and is not the same as the general floor area variable provided by the 2001 EHCS. Despite several requests, this variable was not provided by DTI/BRE and consequently had to be modelled. Using the 1996 EHCS, regression analysis was used to determine that the main factors determining the relationship between the EHCS and BREDEM specified floor areas were the size of the dwelling, the type of dwelling and the presence of stairs. A variable was derived from these factors, and the average extent to which the BREDEM floor area was higher or lower than the EHCS area determined for each category in 1996. Using the equivalent variable, the same averages were then used to impute the BREDEM floor area for the 2001 sample.

With respect to figure 2.2, the logic of combining gas cooking with space heating costs in a single variable is not clear, although it suggests that the Government may have crudely assumed all space heating to be gas. This is likely to significantly

⁷ B R Anderson et al (1996), *BREDEM-12 Model description*, BR 315, BRE, 1996.

under-estimate fuel poverty numbers and, on the assumption that this was not actually done, the gas cooking element is separated in the NRFC model.

For cooking, the 2001 EHCS fuel poverty model assumes that all dwellings have a gas hob and an electric oven, unless the dwelling is recorded as having no gas supply, in which case an all electric cooker is assumed. The energy requirements (GJ/year) of the cooker in each sample dwelling is determined using the BREDEM-12 algorithms shown in Table 2.2.

Table 2.2: Calculation of standardised fuel costs for cooking (BREDEM-12)

Type of cooker	Energy requirement (GJ/year)
All electric cooker	Energy = $1.70 + 0.34*N$
Gas hob and electric oven	Energy = $1.49 + 0.30*N$
Fuel cost for cooking =	Energy = $0.85 + 0.17*N$
	energy (GJ) x fuel price (£/GJ)

where N = Number of occupants as determined in Table 2.1

Using the second and last of the above algorithms, the energy requirements and cost for gas cooking in 2001 was determined for each dwelling. The fuel costs were subtracted from the combined space heating/gas cooking variable to determine the space heating costs. The EHCS data on the heating system was analysed and for each dwelling, the fuel used for the main space heating determined as:-

- Mains gas;
- LPG;
- Solid fuel;
- Economy 7 off-peak electricity;
- Standard tariff electricity;
- Heating oil;
- Liquid paraffin; or
- Communal heating (generally assumed as gas).

As 2001 fuel prices for each of these fuels can be determined (dependent on the region and method of payment), so the space heating energy requirement for 2001 can also be calculated from the simple formula:-

$$\text{Energy requirement (GJ)} = \text{Fuel cost (£)} / \text{Unit fuel price (£/GJ)}.$$

A similar analysis was undertaken for the water heating system in the dwelling, and the main fuel used for water heating determined, using the same categorisation of fuels. Again this enables the energy requirements for water heating to be determined, as the various unit fuel prices are known for 2001.

The standing charges for 2001 were determined from the fuel used in the dwelling, its region and the method of payment.

Although requested from DTI/BRE, no variable for electric cooking and lights and appliances was provided. However, as the total fuel costs was available, this variable could be determined once the gas cooking and space heating costs, water heating costs and standing charges had all been determined. Depending on whether the dwelling used 'Economy 7' electricity, the cost of electric cooking and lights and appliances was assumed to depend on either standard tariff electricity or

the day rate for 'Economy 7' electricity. This information and the use of the appropriate electricity prices, also enabled the energy requirement for these non-heating uses to be determined for 2001.

One all of the individual heating and non-heating cost variables had been disaggregated in this way into the energy requirement and the fuel price for each fuel, the fuel prices could be changed and the effect on the total fuel costs determined.

3. FUEL POVERTY NUMBERS IN 2001

As the baseline for determining the effects on fuel poverty of fuel price rises and other changes is the Government's estimate for fuel poverty in 2001, it is important to determine whether this is sound. However, changes made to the Government's fuel poverty model after 1996 suggest that the 2001 baseline figures may significantly under-estimate fuel poverty relative to the 1996 results. As shown in Table 3.1, three main changes were made to the model after 1996.

Table 3.1: Methodological changes made to Government's fuel poverty model after 1996

1996 Fuel poverty model	2001 Fuel poverty model
<ul style="list-style-type: none"> • Heating costs derived from SAP (BREDEM-9) corrected for different heating regimes, regional climate etc 	<ul style="list-style-type: none"> • Heating costs derived using BREDEM-12 with built in calculations for heating regimes, regional climate etc
<ul style="list-style-type: none"> • Fuel costs based on household fuel tariffs 	<ul style="list-style-type: none"> • Fuel costs based on average fuel tariffs
<ul style="list-style-type: none"> • Non-heating costs based on actual occupant numbers 	<ul style="list-style-type: none"> • Non-heating costs modelled solely from total floor area

In 1996, the space and water heating costs were generated using the Standard Assessment Procedure (BREDEM-9), the penultimate stages of the SAP model providing the standardised total heating cost for each household in the 1996 EHCS sample. However, the SAP heating costs are based on a single standard heating regime, standardised average fuel prices and 'average' climatic conditions for the UK. For the estimation of fuel poverty in England, these fuel costs had to be modified to take account of:-

- The use of more than one heating regime to reflect different household needs.
- Real variation in fuel prices due to the different fuel tariffs of households.
- Regional climatic variation affecting required heating costs across the UK; and
- The additional fuel costs associated with cooking, lights and appliances.

The latter were derived using algorithms for the more flexible BREDEM-12 model and after 1996, it was decided that it would be better if all of the fuel costs were generated using BREDEM-12. As well as providing the non-heating costs, this had the advantage of being able to specify different heating regimes, fuel prices and different external climates within the model. The use of BREDEM-12 should provide more accurate estimates, but as the 1998 version used in 2001 is compatible with the 1998 SAP model (a shortened version of BREDEM) this change should not have materially altered the results.

This is not the case, however, with the two other changes made. In 1996, the number of households in fuel poverty was based on householder's actual fuel tariffs as collected by the 1996 EHCS fuel consumption survey. With no tariff survey in the 2001 EHCS, the 2001 estimates used the average fuel price for each method of payment - direct debit, credit or pre-payment - in each region. The implications of this change are discussed in detail later in this section.

In both the 1996 and 2001 fuel poverty models, the non-heating fuel costs for cooking, lights and appliances were generated using the BREDEM-12 algorithms. In these algorithms, the costs are calculated from the floor area of the dwelling and/or the number of occupants, as well as the fuel price. In 1996, the actual number of occupants in each sample dwelling was used in these calculations. However, as already mentioned, in 2001 the number of occupants was modelled from the floor area alone using the BREDEM-12 algorithms shown in Table 2.1 above.

The precise reason for this change is not clear, but it does seem extraordinary given that the whole focus of measuring fuel poverty relates to determining the required fuel costs of different households and that the actual number of occupants is readily available from the 2001 EHCS.

Of the three main changes, however, the potentially most important is the change in the nature of the fuel prices used. The top part of Table 3.2 shows gas prices (p/kWh), including standing charges, for customers in London on the highest tariffs, average and lowest tariffs who are paying by direct debit, credit or pre-payment meters. The costs are based on a consumption of 18,000 kWh and cover the period from the fourth quarter of 2000 to the third quarter of 2001. It can be seen that within each payment method, the highest tariffs are significantly above the average, particularly for those with pre-payment meters, where they are over 11% higher in London. Other gas regions show a similar pattern and the same is true for electricity regions, where the divergence is sometimes greater. For example, in the North West the highest electricity pre-payment rates are over 20% higher than the average such rate for the region.

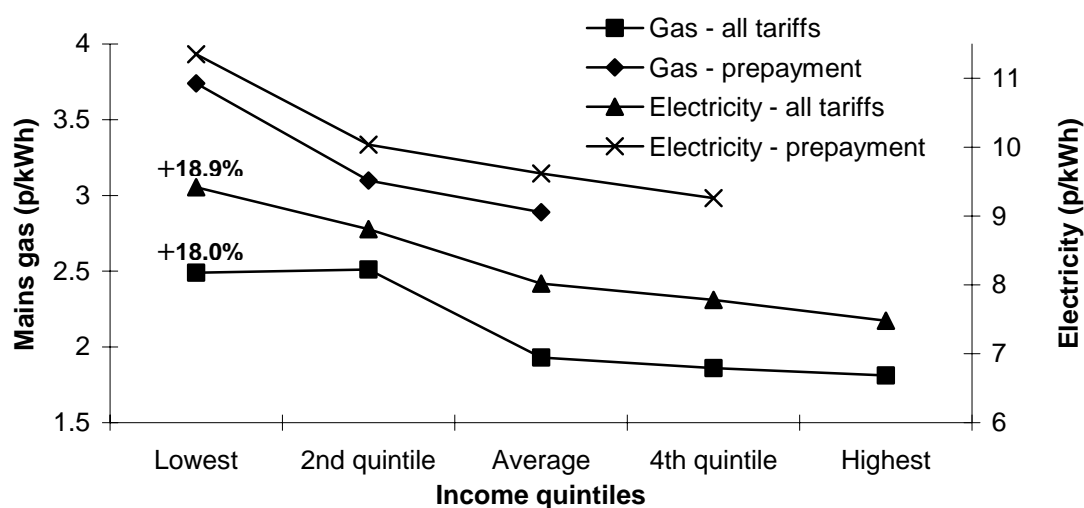
Table 3.2: Comparison between gas prices in London in 2001 and those used in the Government's fuel poverty model (Source: DTI Quarterly energy prices)

London DTI statistics	Total gas prices (p/kWh) incl. standing charges for consumption of 18,000 kWh (Q4 2000 to Q3 2001)		
	Direct debit	Credit	Pre-payment
Highest tariff	1.52 (+2.0%)	1.71 (+4.9%)	1.90 (+11.1%)
Average	1.49	1.63	1.71
Lowest tariff	1.23	1.34	1.69
DTI FP model	Unit price (p/kWh) + annual standing charge £		
Unit price + st. charge	1.33 + 29.39	1.38 + 44.98	1.44 + 49.9
Combined price	1.49	1.63	1.72

The first line of the lower half of Table 3.2 shows the unit prices (in p/kWh) and the additional annual standing charges for the London region used in the Government's 2001 fuel poverty model. For a consumption of 18,000 kWh, these convert to the combined prices, including standing charges, as shown in the final line. Clearly, these are the same as the average prices for the region.

Although broken down by region and payment method, the use of average fuel prices in the Government's 2001 fuel poverty model suggests that the current official estimates may be seriously underestimated, relative to the 1996 results, where fuel prices were based on householders actual fuel tariffs. This is because, it is households on low incomes that tend to have the highest fuel prices and vice-versa. This is largely confirmed by Figure 3.1 derived from the 1996 EHCS fuel survey. Although this survey did not distinguish between those paying by direct debit and those on credit, it did record households using pre-payment meters. The figure shows, by the income level of the household, the average fuel prices paid by households with gas and electric pre-payment meters as well as the average unit price, including standing charges, for all gas and electricity customers. In the case of gas, households on the lowest 20% of incomes were generally paying some 18% more than the average for all households, while in the case of electricity, the equivalent figure was some 19% more.

Figure 3.1: Average fuel prices by income quintiles (Source: 1996 EHCS fuel survey – dropped in 2001 EHCS)



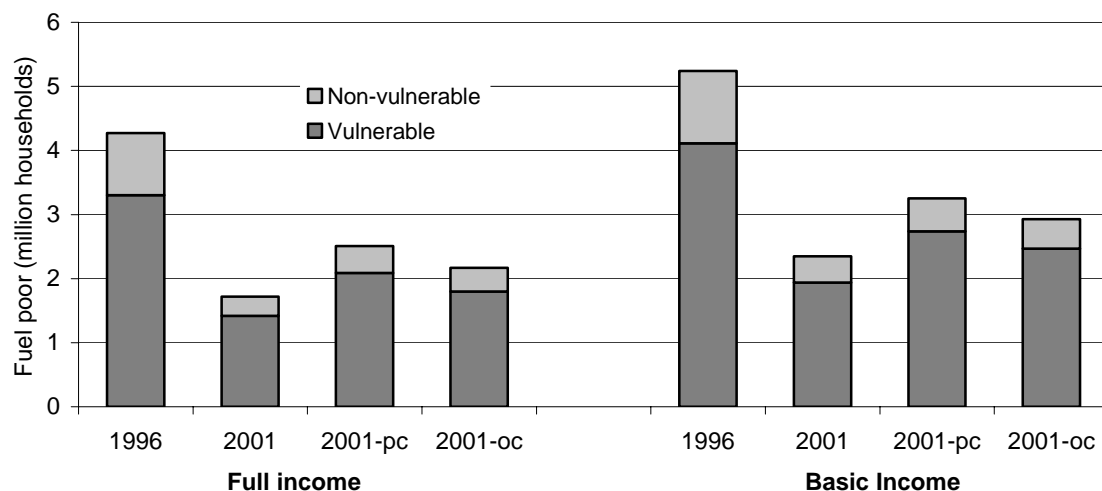
A rough idea of the extent by which the 2001 fuel poverty figures may be underestimated relative to 1996 can be gained by assuming that the distribution of fuel prices by income followed a similar pattern in 2001 as in 1996. Using this assumption, the average regional fuel prices used in the Government's 2001 estimates are inflated or deflated according to the income level of the household and the particular fuels used. However, no correction is made for other non-metered fuels.

Correcting the fuel prices in this way produces significantly higher figures for 2001 than the official estimates. Correcting for fuel prices only, increases the number of households in fuel poverty on the full income definition from 1.7 to some 2.5 million, Of these some 2.1 million are vulnerable households. However, if energy requirements are also brought in line with the 1996 estimates, by using actual occupancy to calculate the non-heating fuel costs, the total estimate is reduced to just under 2.2 million. Of these 1.8 million are vulnerable households.

Using the basic income definition, this more realistic treatment of fuel prices increases the total from 2.4 to nearly 3.3 million, of which over 2.7 million are vulnerable. However, after correcting for actual occupancy, these figures are reduced to some 2.9 and 2.5 million households respectively. For both official

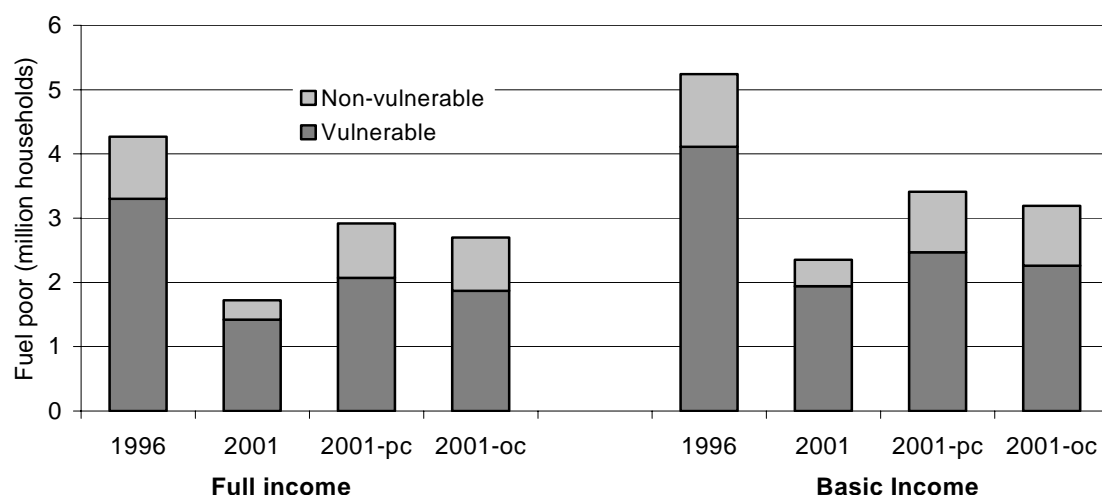
definitions, figure 3.2 shows the 1996 estimate, the official 2001 figures and then the new 2001 estimates, corrected for fuel prices only and finally further adjusted using actual occupancy for the non-heating costs.

Figure 3.2: Trends in fuel poverty, with fuel prices corrected for income and fuel costs for actual occupancy



Rather than assuming that 2001 fuel prices were distributed relative to income in the same way as in 1996, it may be reasonable to assume that, say, 20% of those on low incomes are on the highest tariffs recorded by the DTI's regional fuel price statistics for 2001. Conversely, 20% of those on high income can be assumed to have the lowest tariffs. As shown in figure 3.3, such assumptions produce similar estimates for the number of vulnerable households in fuel poverty, but generally increase the number of non-vulnerable households also so defined.

Figure 3.3: Trends in fuel poverty assuming 20% of low income households on highest tariffs and 20% of high income on lowest tariffs.



4. TRENDS IN FUEL PRICES

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 January 2001, electricity prices were over 23% lower in real terms than five years earlier, while gas prices fell by over 18% in real terms over the same period⁸.

Figure 4.1 shows the trend in average gas and electricity prices since 1996 relative to the Retail Price Index (RPI). It can be clearly seen that the 2001 EHCS coincided with the low point in fuel prices, the prices used in the Government's 2001 fuel poverty model being generally the lowest recorded over the past 10 years. The 2003 EHCS should reflect some of the subsequent increases in gas prices, but clearly the main increases in the price of both fuels have been since this survey.

Figure 4.1: Trends in gas and electricity prices relative to RPI – 1996 to 2005
(Source: Dti Quarterly Energy prices)

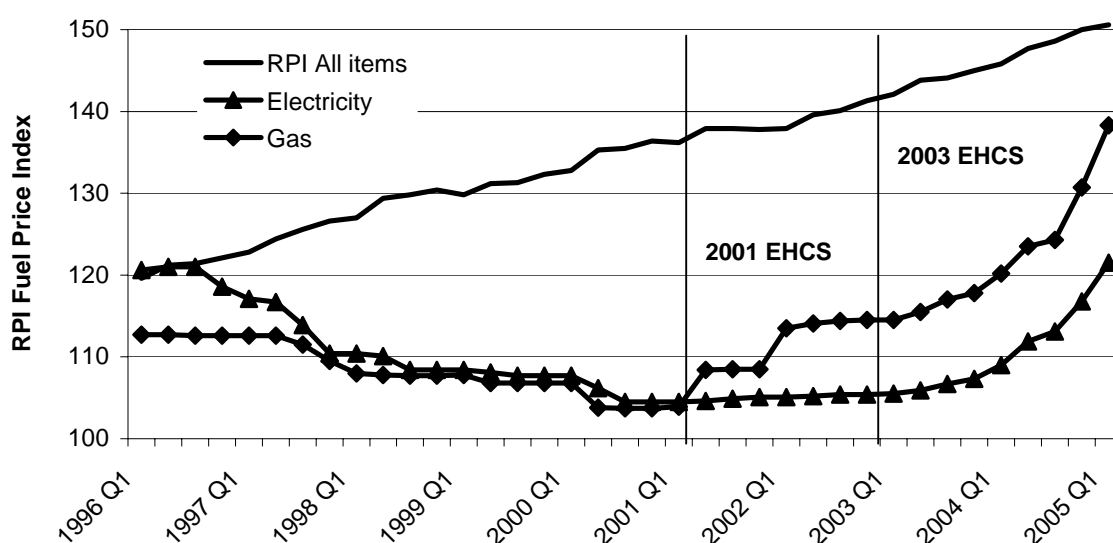
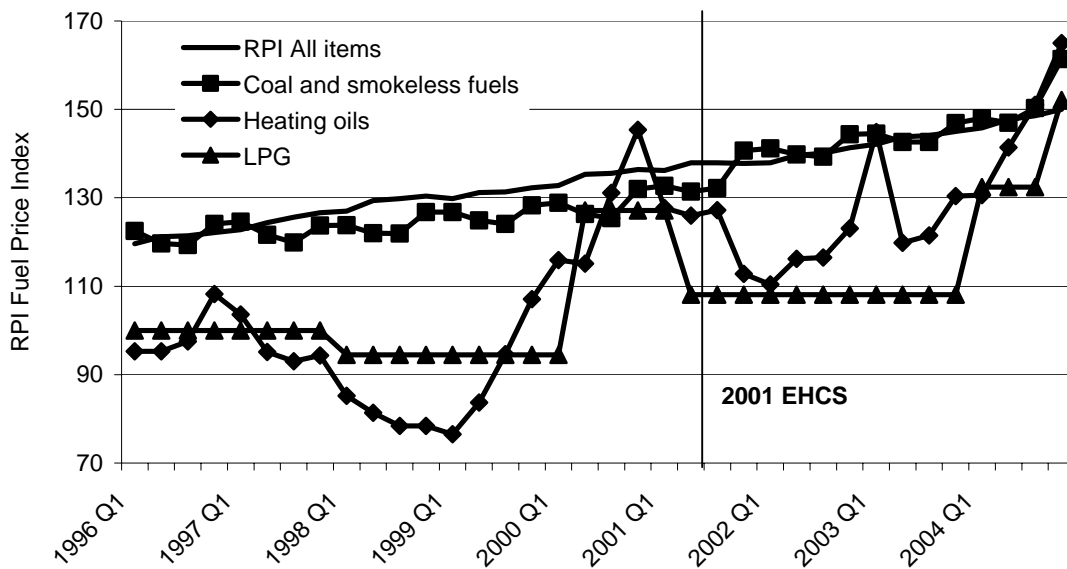


Figure 4.2 shows the corresponding trends for non-metered fuels – coal and smokeless fuels, heating oil and LPG. Up to 2001, the price of coal and smokeless fuels remained more or less constant, decreasing slightly relative to the RPI. The price of heating oils generally fell up to the beginning of 1999, rose to a peak in the last quarter of 2000, but had fallen again by the time of the 2001 EHCS. LPG followed a similar trend to heating oils, a fall in 1998 being followed by high prices during 2000 and a subsequent fall in 2001.

After 2001, coal and smokeless fuels have generally risen above the price of inflation with a sharp increase from the end of 2004. After an initial fall, the price of heating oils also generally rose, particularly during 2004. LPG prices remained constant until 2004, after which they have risen sharply in line with heating oils.

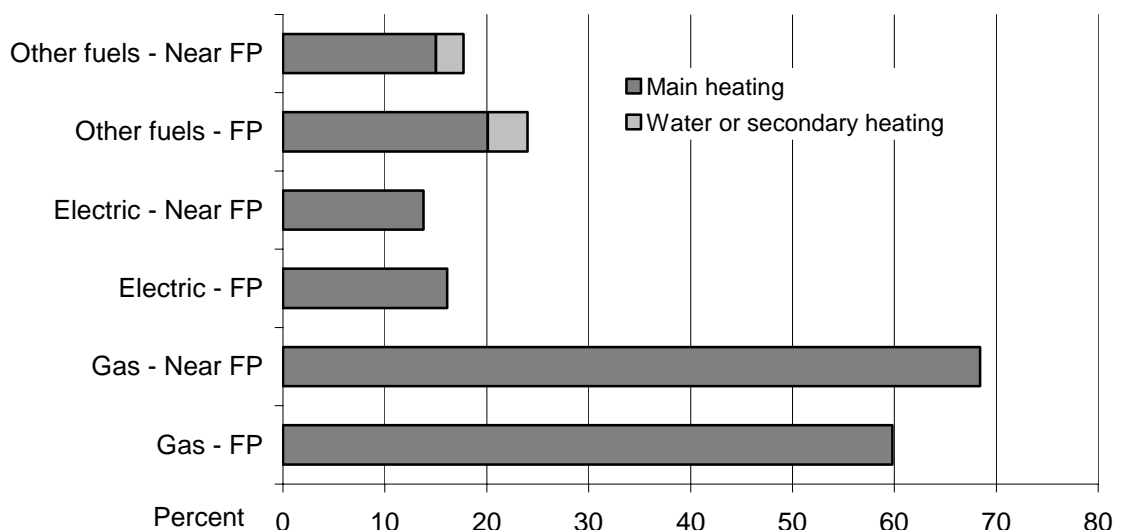
⁸ DTI (2004), *Retail Prices Index, Fuel Components, Fuel price index numbers relative to the GDP deflator, Monthly figures, January 1987 to December 2003.*

Figure 4.2: Trends in non-metered fuel prices relative to RPI – 1996 to 2005



The price of non-metered fuels is important for the estimation of fuel poverty as a significant proportion of the fuel poor and those on the borderline of fuel poverty still rely on such fuels. Figure 4.3 shows the percentage of the fuel poor and the 0.5 million households who are closest to being in fuel poverty who use gas, electricity or other non-metered fuels for their main heating. The proportion using other fuels only for water and/or essential secondary heating is also provided. As shown, nearly 1 in 4 of the fuel poor and approaching 1 in 5 of those on the borderline of fuel poverty were reliant on non-metered fuels for their main space heating, water heating or secondary heating in 2001.

Figure 4.3: Heating fuels used by fuel poor and 0.5 million households on borderline of fuel poverty in 2001



For estimating the effect of fuel price rises on fuel poverty numbers, the Government have assumed no real change in prices other than for gas or electricity. (see http://www.dti.gov.uk/energy/consumers/fuel_poverty/ready_reckoner.pdf). With such

a large number of those in fuel poverty or on the borderline of fuel poverty using other non-metered fuels and with the recent real term increases in these fuels, it is likely that the Government's predictions significantly under-estimates the overall effect on fuel poverty numbers.

As shown in the previous section, the use of general averages rather than the use of fuel prices more relevant to particular household groups tends to underestimate fuel poverty numbers. Thus, even if one accepts the average regional fuel prices by payment type for 2001, how these prices are updated to 2005 is critical to determining the consequent effect on fuel poverty numbers. For preliminary estimates, blanket increases in the fuel price of different fuels were assumed, but this approach was found to under-estimate the effect.

For the final estimates, the percentage increase in the fuel price for mains gas, standard tariff and Economy 7 electricity has been determined for each payment type – direct debit, credit and pre-payment – in each of the nine Government Office regions, using DTI regional data on fuel prices billed between 2001 and 2004. (This is for fuel consumed between the fourth quarter of the preceding year and third quarter of the year in question.) However, with no standardised regional data available beyond 2004, these increases were further updated from 2004 to the first quarter of 2005 using the more general DTI fuel price index for gas and electricity. This general index was also used to inflate the price of non-metered fuels from 2001 to Q1 2005. Finally, each overall percentage increase was applied to the fuel price used in the 2001 EHCS, depending on the region and particular method of payment.

5. TRENDS IN ENERGY EFFICIENCY

Pending the release of relevant data from the 2003 EHCS “in late 2005”, improvements in the energy efficiency of the housing stock since 2001 has been modelled for each tenure, using the date and condition of each property in 2001, the attitudes of the occupant and data on trends between 1996 and 2001.

To determine which owner-occupied homes in the 2001 EHCS sample would be improved, it was assumed that significant energy measures were only likely in:-

- homes that were 10 or more years old in 2001; and
- where the owner then said that the heating and/or insulation was not very or not at all effective.

Similarly for homes in the private rented sector, such improvements were assumed only in:-

- homes that were 10 years or more years old in 2001; and
- where the tenant complained that the heating and/or insulation was not very or not at all effective.

To determine which local authority and HA/RSL homes would be improved, it was assumed that significant energy measures were only likely in:-

- homes that were 10 or more years old in 2001; and
- that failed the thermal criteria of the Decent Homes Standard in 2001.

To determine the likely effect of any energy measures applied after 2001, the longitudinal sample of the EHCS containing dwellings surveyed in both 1996 and 2001 was analysed. From this sample, all dwellings showing significant energy efficiency improvements between 1996 and 2001 were examined. However, any

dwelling showing an improvements in their SAP rating of less than 5 points was omitted, as such a small improvement could result from differences in the data collected in 1996 and 2001 rather than any significant energy measure.

As shown in Table 5.1, for each decile in the range of SAP ratings existing in each tenure before improvement in 1996, the average extent by which the SAP rating had risen by 2001 was determined. As would be expected, those dwellings with the lowest SAP ratings in 1996 generally showed the greatest improvement and vice versa, and 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 owner occupied stock.

Table 5.1: Average improvements in SAP rating by original rating by tenure, 1996-2001

Original SAP rating	Improvement in SAP rating 1996 to 2001			
	owner occupied	private rented	local authority	RSL
<SAP 26	+ 20.0	+ 26.0	+ 30.4	+ 32.4
26-35	+ 17.0	+ 17.5	+ 20.0	+ 25.4
35-40	+ 13.5	+ 14.3	+ 15.2	+ 19.9
40-44	+ 15.2	+ 16.5	+ 16.4	+ 15.1
44-48	+ 12.3	+ 11.4	+ 15.7	+ 16.8
48-52	+ 12.1	+ 12.8	+ 13.7	+ 11.9
52-55	+ 10.6	+ 12.6	+ 12.4	+ 15.9
55-60	+ 9.6	+ 14.4	+ 13.3	+ 12.2
60-66	+ 8.1	+ 7.7	+ 10.1	+ 13.3
66 plus	+ 6.7	+ 7.2	+ 8.8	+ 8.3
All improved	+ 14.3	+ 16.8	+ 18.0	+ 18.9

Assuming that the type of energy measures undertaken in each sector has probably not changed substantially since 2001, these SAP improvements have been applied to the dwellings in the full 2001 EHCS sample selected for likely improvement after 2001 on the above criteria.

Table 5.2 shows the annual rate of improvement so achieved compared to that achieved between 1996 and 2001 as well as the average SAP ratings in each tenure in 1996, 2001 and in 2005 assuming the above improvements

Table 5.2: Assumptions on % of homes improved after 2001 and consequent improvement in energy efficiency of the stock.

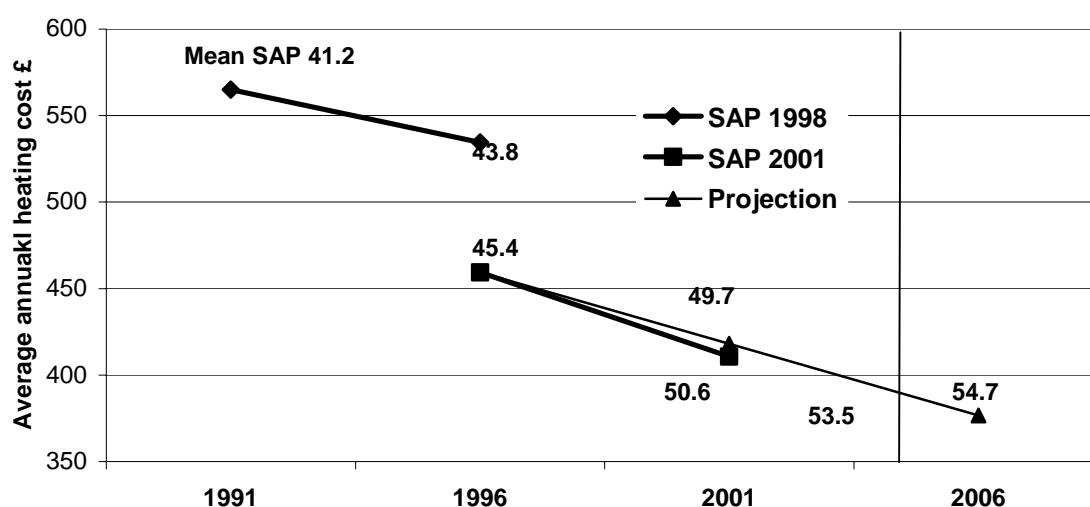
	% of homes improved per year		Average SAP (2001) ratings		
	1996 to 2001	2001 to 2005	1996	2001	2005*
Owner occupied	4.5	4.7	45.5	49.9	52.2
Private rented	6.2	6.1	15.2	45.3	49.2
Local authority	7.0	7.5	46.4	53.6	58.3
HA/RSL	6.3	4.8	53.9	60.3	63.5
All tenures	5.3	5.4	45.4	50.6	53.5

* Excludes dwellings built since 2001

The final table in this section shows trends in the mean SAP ratings of the English stock since 1991 and the corresponding average heating cost. As shown, the 1998 version of the Standard Assessment Procedure (on which the 1996 fuel poverty figures were based) produces significantly lower average ratings and higher average heating costs than the 2001 version of SAP.

Analysis of the SAP ratings in the 2001 EHCS shows that new housing, that is dwellings built since the previous survey, accounts for nearly 1 SAP point in the average of 50.6. Consequently, the average of 53.5 estimated for existing dwellings in the first quarter of 2005 probably equates to an average of around 54.5 for the total housing stock.

Figure 5: Reduction in standard SAP heating costs due to stock improvements 1991 to 2005



6. TRENDS IN INCOME

Before looking at how incomes have changed since 2001, we need to define the incomes that are relevant to fuel poverty. Government statistics use two definitions of household income.

- Full income, including Housing Benefit (ISMI) and Income Support for Mortgage Interest (ISMI).
- Basic Income, excluding HB and ISMI .

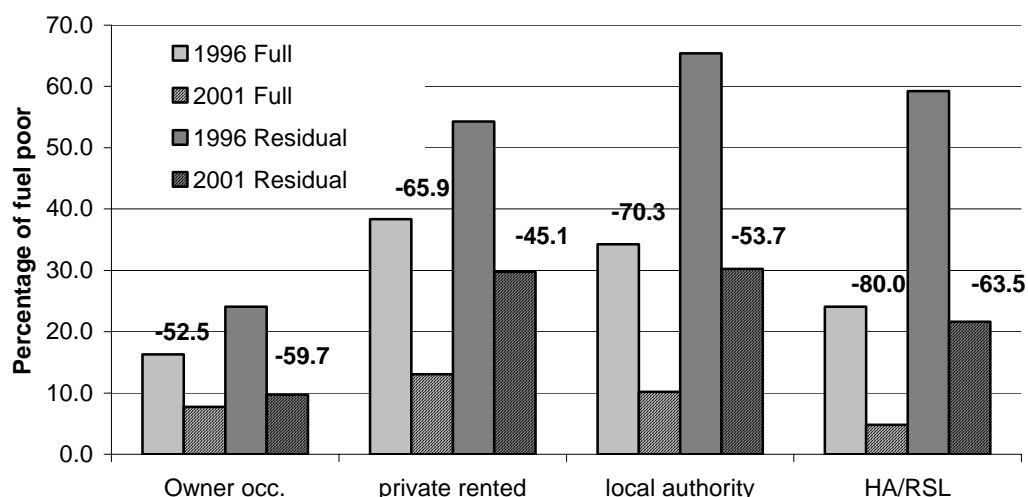
Many believe, however, that the most relevant and meaningful measure of income for determining fuel poverty is residual income, after housing costs. This is because, unlike other forms of income related poverty, fuel poverty is specific to a households existing dwelling and the housing costs for this dwelling cannot, therefore, be spent on fuel. Using residual income instead of full or basic income has major implications not only for the number and distribution of households classed as fuel poor, but for trends from year to year. The number of fuel poor and their distribution is further changed substantially if incomes are equivalised to account for household size and composition (see Appendix 1).

Figure 6.1 shows the percentage of households in fuel poverty in 1996 and 2001 in each of the main tenures on both the full (before housing costs) and residual (after housing costs) definitions. It shows that the latter definition not only substantially

increases the incidence of fuel poverty, but also significantly changes both the distribution of the problem and the rates of change between the two years.

Under the full income definition, fuel poverty was highest amongst households renting privately and lowest amongst owner-occupiers in both 1996 and 2001. After the deduction of housing costs, the lowest incidence (but highest number) remain amongst owner occupiers, but local authority tenants now show the highest proportion in fuel poverty in both years.

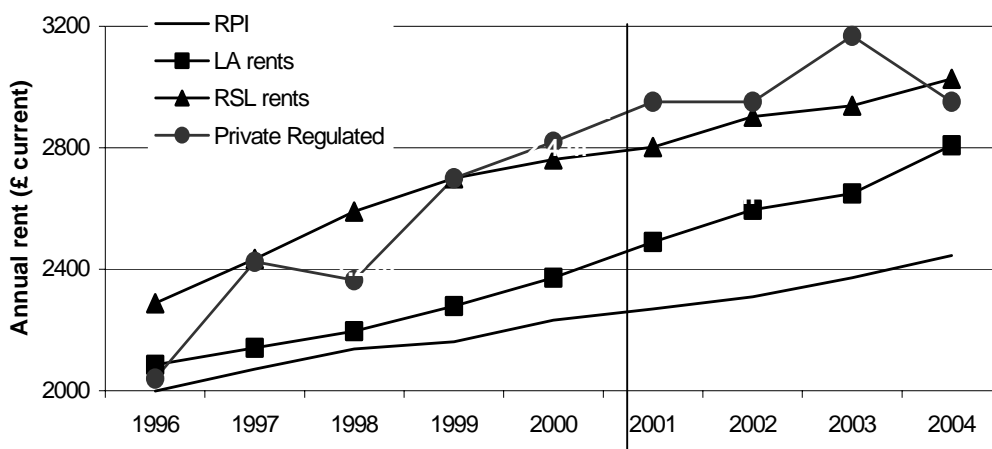
Figure 6.1: Trends in fuel poverty numbers by tenure by definition – 1996 to 2001



Ignoring the differences in methodology (described in section), the fall in fuel poverty between 1996 and 2001 is greater on the residual income definition (-60%) than when measured with full incomes (-53%). However, the reverse is the case in all the rented sectors, these all showing significantly smaller falls when measured using the more meaningful residual income definition than with the Government's full income definition. For example, in the private rented sector, the fall is cut from 66% down to 45% - even before any correction for fuel prices.

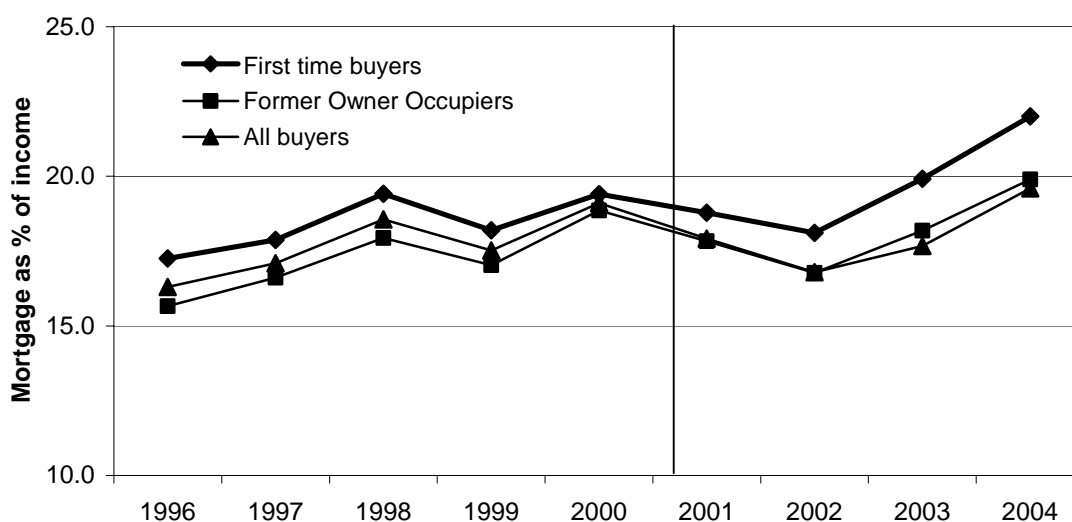
These differences are clearly due to the relative movement of mortgages and rents between 1996 and 2001. In this period, all rents were rising ahead of inflation, but this was particularly true for rents in the private regulated sector – as shown in Figure 6.2

Figure 6.2: Average annual rents (£ current prices) in social and regulated rented sectors (Source: ODPM rent statistics)



Housing costs for owner-occupiers followed a somewhat different pattern. Figure 6.3 shows that with rising house prices, average mortgage payments generally increased relative to income after 1996 for both first time buyers and existing owner occupiers. However, with decreasing interest rates, they fell again at the beginning of this Century to end in 2002 only slightly higher than in 1996. Following 2002, however, there have been greater increases in mortgage repayments relative to income, largely due to rising interest rates. This follows the rise in the Bank of England base rate from 3.5% in July 2003 to 4.75% from August 2004. [

Figure 6.3 Average mortgage re-payments as a percentage of income, 1996 to 2004 (Source: ODPM mortgage statistics)

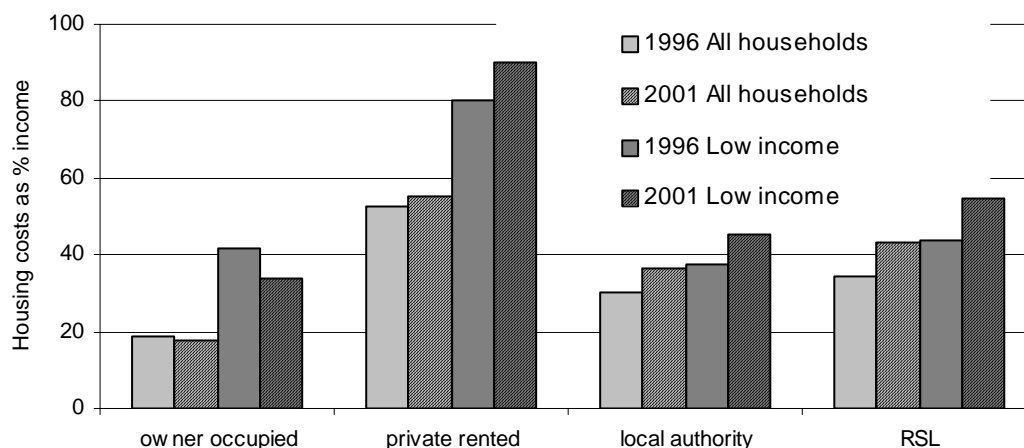


The 1996 and 2001 EHCS largely confirms this picture for all households and for those on the lowest 30% of basic incomes. As shown in figure 6.3, for all mortgagees there was little change in the average repayment as a % of income between 1996 and 2001. However, lower income owner occupiers, who are

generally less likely to increase their mortgage, saw a real fall in their re-payments relative to income over this period.

In contrast, all tenants, particularly those in the social rented sectors, saw average rents increase as a % of income during this period. This was particularly the case for households on lower incomes, their average rent as a percentage of their basic income increasing significantly in all the rented sectors, both public and private.

Figure 6.4 Average housing costs as % of income for all households and low income groups by tenure, 1996 and 2001 (Source: 1996 & 2001 EHCS)



Determining income trends since 2001

There have also been differential movements in incomes before housing costs. As show in Table 6.1, large families with children have generally seen the largest increases. The lowest rises in income have been for large multi adult households and single retired households and retired couples, not mainly dependent on state pensions. The incomes of retired single persons and couples, dependent on state pensions, have both increased above the average, while the rise in those of single parent households have been average.

To determine trends in income since 2001, therefore, the households in the sample were categorised into the 17 different types shown above. The categories depend on the total number of members, whether the adults are married/co-habiting or otherwise sharing, the number of dependent and independent children and in the case of single-persons and couples without children, whether or not they were retired, and if retired, whether or not they were dependent on state pensions.

The percentage increase in the average basic disposable income of each of these 17 household types was determined for the period 2000/01 to 2003/04, using data from the DWP's *Family Resources Survey* and ONS's *'Family Spending' Expenditure and Food survey*. Using the same data sets, the income trends were further extrapolated from 2003/04 to the first quarter of 2005, but corrected such that the income increase for all households over this additional period was the same as that recorded by the latest editions of *Economic Trends*. Depending on the particular household type, the percentage increase for the period 2000/01 to Q1 2005 was then applied to the actual basic incomes of each household as recorded in the 2001 EHCS to give corresponding estimates for the later date.

Table 6.1 : Increases in disposable income (BHC) by household composition, 2001 to 2005 (Sources: EFS, FRS and Economic Trends)

Household composition	Average weekly income £			Change 01-05
	2000-01	2003-04	Q1 2005	
One adult, Retired on state pensions	108	128	135	1.25
One adult, Other retired households	208	203	222	1.07
One adult, Non-retired households	263	288	293	1.11
One adult, one child	222	252	260	1.17
One adult, two or more children	237	268	276	1.17
Couple, retired on state pensions	169	209	223	1.32
Couple, other retired households	350	366	365	1.04
Couple, non-retired households	508	584	607	1.19
Two men or two women	441	472	475	1.08
One man one woman, one child	526	607	631	1.20
One man one woman, two children	571	631	645	1.13
One man one woman, three children	533	703	769	1.44
Two adults, four or more children	467	609	663	1.42
Three adults	592	678	703	1.19
Three adults, one or more children	638	727	752	1.18
Four or more adults	840	804	852	1.01
Four or more adults, one or more children	630	853	941	1.49
	409	464	480	1.17

To determine full incomes for each household in 2005, the element of Housing Benefit or ISMI was first determined as used in the 2001 EHCS income data. The increase in housing costs for 2000/01 to Q1 2005 was then determined separately, for each tenure, using housing costs data from ODPM. For owner-occupiers with a mortgage, the percentage increase in average repayments was determined for the period 2000/01 to 2003/04 for a condensed list of the 17 household types. For private tenants, the increase in average rents was determined over the same period for each different type of tenancy. For both local authority and RSL tenants, the percentage increase in LA and RSL rents between 2001 and 2004 was determined for each of the nine Government Office regions. For each tenure, the rents were also updated from 2003/04 or 2004 to Q1 2005 using the relevant RPI rate of inflation.

Depending on the tenure and particular categories used, the percentage increase for the period 2000/01 to Q1 2005 was applied to the actual housing costs of each household as recorded in the 2001 EHCS to give the housing costs in the first quarter of 2005. The amount of Housing Benefit or ISMI in 2001 was then inflated in line with the increase in housing costs for each household. Finally, the new HB or ISMI figure was added to the new basic income to give the full income of each household in the first quarter of 2005. To give the residual income, after housing costs, the newly calculated housing costs were simply subtracted from the new full income at Q1 2005.

7. TRENDS IN FUEL POVERTY 2001 TO 2005

If one accepts the Government's baseline estimate of 1.7 million in fuel poverty on the full income definition in 2001, falling to 1.4 million in 2002, figure 7.1 shows that the subsequent rises in fuel prices alone would have added well over a million fuel poor to these figures, giving 3.0 million by the first quarter of 2004. However, improvements in energy efficiency since 2001, are estimated to reduce this number to 2.6 million, while income rises have had a greater effect, leaving some 1.9 million households in fuel poverty by Q1 2005. In short, fuel poverty has risen by some 200,000 since 2001.

By the same processes, the number of vulnerable households is estimated to have changed from 1.4 million in 2001 and 1.2 million the following year, to some 1.6 million by the first quarter of 2005.

Figure 7.1 Effect of fuel price rises on fuel poverty etc (2001 Full BHC income definition) 2001 to 2005

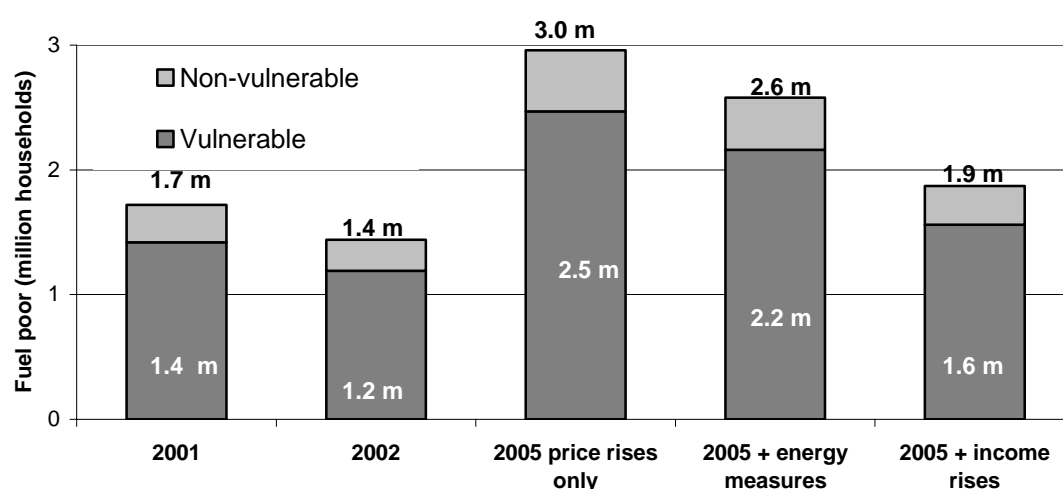


Table 7.1 shows the number and percentage change to the number of vulnerable and non-vulnerable households in fuel poverty due to fuel price rises, energy measures and increased incomes between 2001 and the first quarter of 2005. Fuel price rises are estimated to have had a greater effect on vulnerable than non-vulnerable households, fuel poverty rising overall by over 10% among the former compared to only by some 2% for the latter group.

Table 7.1: Changes in fuel poverty (full income definition) due to price rises, energy measures and increased incomes by vulnerability, 2001 – Q1 2005

Vulnerability	2001	2005 price rises only	2005 + E measures	2005 + incomes	Total change 2001-05
Vulnerable	1.42	2.47	2.16	1.56	
% change		+ 75	- 13	- 27	+ 10.4
Non vulnerable	0.30	0.49	0.42	0.31	
% change		+ 61	- 14	- 26	+ 2.4
All households	1.72	2.96	2.58	1.88	
% change		+ 72	-13	-27	+ 9.0

Before accounting for energy measures and income increases, fuel poverty amongst vulnerable households increased by 75%, compared to 61% for non-vulnerable

households. However, there appears little difference between the two groups in the decreases brought about by energy measures, these measuring 13 and 14% respectively. However, the further reductions caused by income rises are similar for non-vulnerable than vulnerable households, the corresponding figures being – 27% and –26%

Table 7.2 looks at individual household types and shows the greatest increases occurring amongst elderly households, particularly the single elderly.

Table 7.2: Fuel poverty in England by household type, 2001 and Q1 2005 (Full, BHC income definitions)

Tenure	Thousand households/Row percentages						Total households thousands
	2001 full income			Q1 2005 full income			
	All households in fuel poverty		In severe FP	All households in fuel poverty		In severe FP	
	thousands	percent	percent	thousands	percent	percent	
Couple under 60 yrs	99	2.4	0.2	98	2.4	0.2	4085
Couple, 60 years plus	222	7.6	0.5	251	8.6	0.6	2925
Couple with dep. children	70	1.4	0.2	58	1.2	0.2	4986
Lone parent with dcs.	140	8.7	0.7	122	7.6	0.4	1597
Other multi-person hhold	233	16.2	2.2	251	17.4	2.9	1443
One person, under 60 yrs	276	11.5	1.8	284	11.8	1.8	2397
One person, 60 yrs plus	682	22.2	2.3	811	26.4	2.2	3077
Total households	1722	8.4	0.9	1876	9.1	0.9	20510

Table 7.3 shows that under the full income definition, all of the net increases in fuel poverty have come in the private sectors, the number of owner occupiers and private tenants that are fuel poor increasing by 15% between 2001 and the first quarter of 2005. By contrast, public sector tenants have seen a net loss of nearly 16%.

That said, before the improvements due to energy efficiency and higher incomes, fuel poverty amongst public tenants increases by 96% compared to an overall increase of 66% in the private sectors. However, on the assumptions made about energy measures since 2001, these figures are reduced substantially more in the public sectors (-26%) than in the private sectors (-9%). This is in line with the higher SAP ratings and, consequently, reduced fuel costs generally achieved by energy improvements in the local authority and RSL sectors, as showed by successive EHCS.

Table 7.3: Changes due to price rises, energy measures and increased incomes by tenure, 2001 – Q1 2005

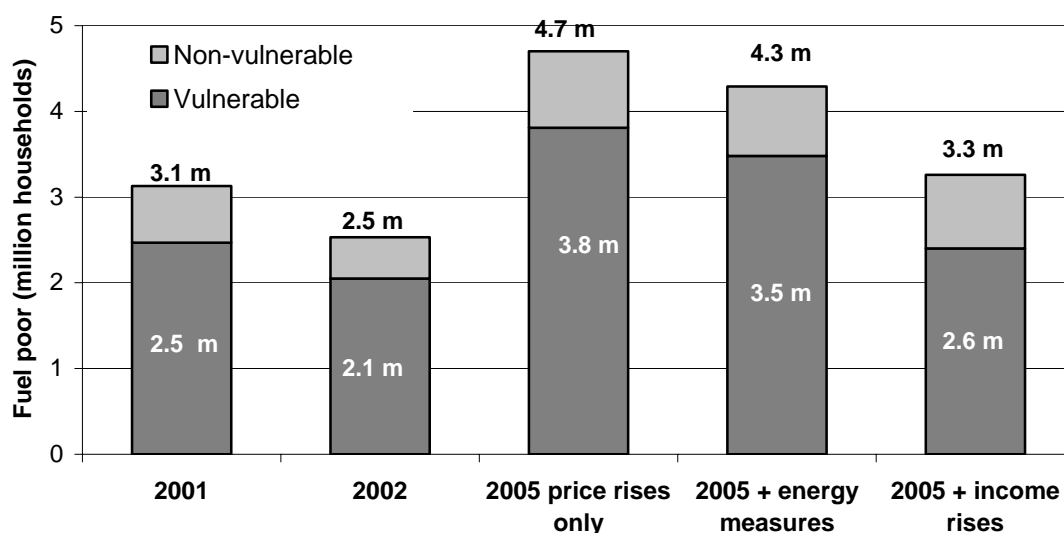
Vulnerability	2001	2005 price rises only	2005 + E measures	2005 + incomes	Net change 2001-05
Private sectors	1.39	2.31	2.09	1.59	
% change		+ 66	- 9	- 24	+ 14.9
Public sectors	0.34	0.66	0.49	0.28	
% change		+ 96	- 26	- 42	- 15.6
All tenures	1.72	2.96	2.58	1.88	
% change		+ 72	- 13	- 27	+ 9.0

In addition, the reduction due to increased public tenant incomes is also higher (-42%) than due to higher incomes in the private sector (-24%). However, these

higher incomes are largely attributable to increased housing benefits, following the sharply increasing rents in the public sector. In practice, many tenants have little more to spend on fuel and, as will be shown later, a somewhat different picture emerges when the same analysis is undertaken using residual incomes, after housing costs.

Compared to 2001, a similar overall net increase is recorded if fuel poverty is measured using the residual (unequalised) income definition, after housing costs. On this more meaningful definition, 3.1 million households were in fuel poverty in 2001, falling to some 2.5 million in 2002. In this case, the estimated increase to 4.7 million caused by the fuel price rises is reduced by energy measures to 4.3 million households and further by higher incomes to 3.3 million households in fuel poverty by the first quarter of 2005.

Figure 7.2 Effect of fuel price rises on fuel poverty etc (2001 AHC income definition) 2001-05



As with the full income definition, vulnerable households are most affected by the price rises, before accounting for any improvements in the stock or income rises. The number of vulnerable fuel poor increase by over 50%, while the increase amongst non-vulnerable households is only some 35%. However, on the assumptions made, energy measures decrease these numbers by some 9% for both groups, while income increases appear to benefit vulnerable households more, further reducing the number of fuel poor by 24% compared with 15% for non-vulnerable households.

Table 7.4: Changes in fuel poverty (AHC income definition) due to price rises, energy measures and increased incomes by vulnerability, 2001 – Q1 2005

Vulnerability	2001	2004 price rises only	2004 + E measures	2004 + incomes	Total change 2001-05
Vulnerable	2.47	3.81	3.45	2.63	
% change		+ 54	- 9	- 24	+ 6.7
Non vulnerable	0.66	0.89	0.81	0.69	
% change		+ 35	- 9	- 15	+ 5.0
All households	3.12	4.70	4.29	3.32	
% change		+ 51	-9	-23	+ 6.3

Table 7.5 indicates that on the residual income definition, fuel poverty may have fallen slightly amongst younger couples and those with dependent children despite the fuel price rises. However, by 2005 it has increased in all other groups, the largest increasing being amongst single elderly households (+12%) and multi-person households (+11%). However, the extent of severe fuel poverty does not appear to have materially altered, remaining highest amongst multi person households and younger single households on this definition.

Table 7.5: Trends in Fuel poverty in England by household type, 2001 to Q1 2005 (Residual, AHC income definitions)

Tenure	Thousand households/Row percentages						
	2001 AHC income			Q1 2005 AHC income			Total households
	All households in fuel poverty		In severe FP	All households in fuel poverty		In severe FP	
	thousands	percent	percent	thousands	percent	percent	thousands
Couple under 60 yrs	198	4.9	1.1	190	4.7	1.1	4085
Couple, 60 years plus	310	10.5	1.1	328	11.1	1.2	2925
Couple with dep. children	163	3.3	0.5	138	2.8	0.4	4986
Lone parent with dcs.	433	26.8	4.4	452	28.0	4.0	1597
Other multi-person hhold	395	27.0	8.9	434	29.7	9.7	1443
One person, under 60 yrs	584	24.1	7.9	612	25.3	7.7	2397
One person, 60 yrs plus	1041	33.3	4.8	1168	37.4	4.3	3077
Total households	3124	15.2	3.2	3322	16.2	3.1	20510

On the residual income definition, the number of fuel poor is increased by fuel price rises by around 50% in both the public and private sector, before accounting for any other changes. The improvement due to energy efficiency measures is still greater in the public than private sectors, but to a lesser extent to than shown by the full income definition. The further effect of income improvements is also greater in the public sector, but again not to same extent as shown by the previous definition. The net effect is again to increase fuel poverty in the private sectors and reduce it in the public sectors, but on this definition the diverge is far less pronounced.

Table 7.6: Changes due to price rises, energy measures and increased incomes by tenure, 2001 – Q1 2005

Vulnerability	2001	2005 price rises only	2005 + E measures	2005 + incomes	Net change 2001-05
Private sectors	2.00	3.03	2.80	2.24	
% change		+51	- 8	- 20	+ 11.9
Public sectors	1.12	1.67	1.49	1.08	
% change		+ 49	- 11	- 28	- 3.6
All tenures	3.12	4.70	4.29	3.32	
% change		+ 50	- 9	- 23	+ 6.3

8. TRENDS IN FUEL POVERTY 2005 TO 2009

Having used existing data on fuel prices, energy improvements and household incomes to estimate the position at the first quarter of 2005, it is possible to project these forward towards the first target date of 2010 using a series of possible scenarios. Using these scenarios, the analysis projects the 2005 estimates forward to the first quarter of 2009, this being the same period of time from the 2001 EHCS to the Q1 2005. This is sufficiently near to the Government's target date to determine whether under each scenario the target is likely to be met.

Up to first quarter of 2005, gas and electricity prices had increased respectively by some 33% and 16% in cash terms since the 2001 EHCS. By comparison, average incomes had increased by over 17%. All of these increases were significantly above inflation, the RPI for all items showing less than an 11% increase over the same period.

In the light of these trends, the following percentages are chosen to represent high, medium and low increases for the price of gas and other un-metered fossil fuels, for the price of electricity and increases in household incomes over the full four year period. All are actual cash increases and the low figures of plus 10% therefore effectively represent no real increase or a slight fall, assuming the current low rate of inflation is sustained over the next four years. (Table 8.1)

Table 8.1: Assumed total increases (in cash terms) between 2005 and 2009

	% cash increase between Q1 2005 and Q1 2009		
	High	Medium	Low
Gas & fossil fuel prices	+ 30%	+ 20%	+ 10%
Electricity prices	+ 20%	+ 15%	+ 10%
Household incomes	+ 20%	+ 15%	+ 10%

Pending the completion of a full energy improvement model, increases in energy efficiency over this period are initially assumed to be the same as estimated for 2001 to 2005. To achieve a similar rate of improvement, all dwellings in the private sectors with a SAP rating in 2005 of less than 42 and all those in the public sectors with a rating under 52 are assumed to be improved, unless, as in a relatively small number of cases, these were already included for improvement in the period 2001 to 2005.

Table 8.2 shows the number of homes improved per annum between 2005 and 2009 and the resulting SAP ratings, in comparison with that achieved between 2001 and 2005. As this again excludes all dwellings built since 2001, the total averages for each tenure in 2009 would be higher in all cases.

Table 8.2: Assumptions on % of homes improved after 2005 and consequent improvement in energy efficiency of the stock.

	% of homes improved per year		Average SAP (2001) ratings		
	2001 to 2005	2005 to 2009	2001	2005*	2009*
Owner occupied	4.7	4.7	49.9	52.2	55.1
Private rented	6.1	6.6	45.3	49.2	54.1
Local authority	7.5	6.7	53.6	58.3	62.5
HA/RSL	4.8	4.9	60.3	63.5	66.8
All tenures	5.2	5.2	50.6	53.5	56.7

* Excludes dwellings built since 2001

Reflecting increasing improvement standards, this second programme achieves an average reduction in heating costs in the improved stock of 30% compared with under 26% for the 2001 to 2005 programme. However, by assuming that all improvements in all tenures are targeted on the stock with the poorest energy efficiency, this improvement programme for 2005 to 2009 probably over-estimates the reductions in heating costs that would be achieved in practice with current levels of improvement activity.

Similarly, by applying blanket increases in fuel prices and incomes between 2005 and 2009, this stage of the modelling may also be over-estimating any improvement in fuel poverty numbers. In practice, increases are likely to vary between households with fuel price increases being more and income increases often less amongst lower income groups.

The worst scenario would be for the fuel prices rises to be high (gas + 30% and electricity + 20%) and income increases to be low (+10%). This would further increase fuel poverty to over 2.1 million households in 2009 of which nearly 1.8 million would be vulnerable households. (Table 8.3)

Table 8.3: Fuel poverty (full income definition) at Q1 2009 assuming gas prices + 30%, electricity +20% and incomes + 10% and current energy programmes

	Not in fuel poverty		In fuel poverty		Total households	
	millions	%	millions	%	millions	%
Not vulnerable	5.9	94.3	0.4	5.7	6.2	100
Vulnerable household	12.5	87.5	1.8	12.5	14.3	100
Total households	18.4	89.6	2.1	10.4	20.5	100

If both gas and electricity price rises were medium and income increases also medium, the improvement programme described above would result in the figures in Table 8.4. The 1.6 million of all households and 1.3 million of vulnerable households in fuel poverty in 2009 would be only slightly below the 2001 totals.

Table 8.4: Fuel poverty (full income definition) at Q1 2009 assuming gas prices + 20%, electricity +15% and incomes + 15% and current energy programmes

	Not in fuel poverty		In fuel poverty		Total households	
	millions	%	millions	%	millions	%
Not vulnerable	5.9	95.5	0.3	4.5	6.2	100
Vulnerable household	13.0	91.1	1.3	8.9	14.3	100
Total households	18.9	92.4	1.6	7.6	20.5	100

The best scenario provided by Table 8.1, is for gas and electricity prices to rise no more than 10% over the period 2005 to 2009, and thus effectively to stay static or fall slightly in real terms, while incomes rise by 20%. Together with the reasonably generous assumptions made about energy improvements, this would produce a significant fall in fuel poverty. However, by the first quarter of 2009, the total number of fuel poor would still be well over a million. With some 0.9 million of these still being vulnerable households, the chances of the Government meeting its first target would be extremely slim. (Table 8.5)

Table 8.5: Fuel poverty (full income definition) at Q1 2009 assuming gas prices + 10%, electricity +10% and incomes + 20% and current energy programmes

	Not in fuel poverty		In fuel poverty		Total households	
	millions	%	millions	%	millions	%
Not vulnerable	6.0	96.8	0.2	3.2	6.2	100
Vulnerable household	13.4	93.9	0.9	6.1	14.3	100
Total households	19.4	94.8	1.1	5.2	20.5	100

With future price rises already in the pipeline, however, it seems very unlikely that a cash increase of under 10% in fuel prices and thus a fall in fuel prices in real terms will be achieved. It seems equally unlikely that income increases will be significantly above 20% over this period, and thus substantially better than in the favourable period of 2001 to 2005.

To achieve the Government's targets in a period of rising fuel prices, it is clear that an energy improvement programme that deals with considerably more than 5 to 7% of the housing stock per year will be required. This will need to include an increasing amount of demolition of the least efficient properties and their replacement with the most efficient.

Richard Moore
June 2005

APPENDIX 1

Effects of equivalisation on the number and distribution of fuel poverty when measured using the full and residual income definitions

This appendix looks at the effects of equivalising incomes (as used in the DWP's HBAI series) on the number and distribution of households in fuel poverty, when measured using the full (before housing costs) and residual (after housing costs) income definitions. For full (BHC) incomes, estimates are given using the modified OECD scales, as well as for the McClements equivalence scale values. All values have also been rescaled such that the average income of all households is the same both before and after equivalisation.

The analysis is based on data from the 2001 English House Condition Survey, and looks particularly at the distribution of fuel poverty by tenure, household type and vulnerability. The paper draws some conclusions and the methodology is also briefly described.

Tenure

Under the full income definition, equivalisation (using the McClement's scale) reduces the total number of households in fuel poverty from over 1.7 million to nearer 1.5 million before rescaling. Rescaling to make the average income of all households the same both before and after equivalisation, reduces this total further to just over 1.3 million. However, it has little effect on the distribution of fuel poverty by tenure, the highest proportion of fuel poor remaining in the private rented followed by the local authority sector and the best sector being that owned by registered social landlords. (Table 1.1)

Table 1.1: Fuel poverty in England by tenure, 2001 (Full, BHC income definitions)

Tenure	Thousand households/Row percentages						
	<u>Non-equivalised BHC income</u>			<u>McC equivalised BHC income</u>			Total households
	All households in fuel poverty		In severe FP	All households in fuel poverty		In severe FP	
thousands	percent	percent	thousands	percent	percent	thousands	
Owner occupied	1123	7.8	0.9	869	6.0	0.8	14488
Private rented	263	13.1	1.9	218	10.8	1.8	2010
Local authority	273	10.2	0.6	188	7.0	0.4	2684
Housing association/RSL	64	4.8	0.4	45	3.4	0.1	1328
Totals households	1722	8.4	0.9	1320	6.4	0.8	20510

After re-scaling to keep the same average income, using the modified OECD equivalence scale further reduces the total number of households in fuel poverty to well under 1.3 million. However, it has little effect on the distribution of fuel poverty by tenure, the rank order remaining unchanged. (Table 1.2)

Table 1.2: Fuel poverty in England by tenure, 2001 (Full, BHC equivalised incomes)

Thousand households/Row percentages

Tenure	<u>McClements scale</u>			<u>Modified OECD scale</u>			All households
	All households in fuel poverty		In severe FP	All households in fuel poverty		In severe FP	
	thousands	percent	percent	thousands	percent	percent	thousands
Owner occupied	869	6.0	0.8	826	5.7	0.7	14488
Private rented	218	10.8	1.8	213	10.6	1.6	2010
Local authority	188	7.0	0.4	178	6.6	0.3	2684
Housing association/RSL	45	3.4	0.1	40	3.0	0.1	1328
Total households	1320	6.4	0.8	1257	6.1	0.7	20510

As shown in Table 1.3, deducting housing costs from income before equivalisation has the effect of significantly increasing fuel poverty in all of the rented sectors. The percentage of fuel poor amongst Council tenants is now marginally higher than amongst those renting privately, while owner occupiers are least affected.

Table 1.3: Fuel poverty in England by tenure, 2001 (Residual, AHC income definitions)

Thousand households/Row percentages

Tenure	<u>Non-equivalised AHC income</u>			<u>McC Equivalised AHC income</u>			Total households
	All households in fuel poverty		In severe FP	All households in fuel poverty		In severe FP	
	thousands	percent	percent	thousands	percent	percent	thousands
Owner occupied	1404	9.7	1.8	1224	8.5	1.7	14488
Private rented	599	29.8	10.1	494	24.6	8.0	2010
Local authority	812	30.2	5.2	538	20.1	3.1	2684
Housing association/RSL	287	21.6	3.0	184	13.9	1.7	1328
Total households	3124	15.2	3.2	2455	12.0	2.5	20510

Equivalising residual incomes again reduces the number in fuel poverty, from over 3.1 million to just over 2.6 million households in 2001, before rescaling. However, rescaling to keep the average residual income the same both before and after equivalisation, again further reduces the total to under 2.5 million. Equivalisation also restores the private rented sector to the worst position, but keeps owner occupiers with the lowest proportion of fuel poverty. That said, due to the dominance of this sector, the highest number of fuel poor are owner occupiers under all definitions.

Household type and vulnerability

Under the full income definition, vulnerable households have double the incidence of fuel poverty as non-vulnerable households, and this is reduced only slightly by equivalisation. However, the lower part of Table 2.1 shows that the process does have the pronounced effect of shifting the problem of fuel poverty away from single person households, particularly the single elderly, to families with children and other multi-person households.

Table 2.1: Fuel poverty in England by household type, 2001 (Full, BHC income definitions)

Tenure	Thousand households/Row percentages						Total households thousands
	Non-equivalised BHC income			McC Equivalised BHC income			
	All households in fuel poverty thousands	percent	In severe FP percent	All households in fuel poverty thousands	percent	In severe FP percent	
All not vulnerable	304	4.9	0.8	246	4.0	0.8	6209
All vulnerable households	1418	9.9	1.0	1073	7.5	0.8	14301
Couple under 60 yrs	99	2.4	0.2	147	3.6	0.5	4085
Couple, 60 years plus	222	7.6	0.5	225	7.7	0.8	2925
Couple with dep. children	70	1.4	0.2	263	5.3	0.6	4986
Lone parent with dcs.	140	8.7	0.7	166	10.4	1.1	1597
Other multi-person hhold	233	16.2	2.2	318	22.0	4.2	1443
One person, under 60 yrs	276	11.5	1.8	65	2.7	0.5	2397
One person, 60 yrs plus	682	22.2	2.3	136	4.4	0.0	3077
Total households	1722	8.4	0.9	1320	6.4	0.8	20510

Replacing the McClements with the Modified OECD scale slightly decreases fuel poverty amongst non-vulnerable households. As shown in Table 2.2, it also tends to shift fuel poverty back towards single households and away from family and multi-person households, although the latter remains with the highest rate of fuel poverty (19%, down from 22%).

Table 2.2: Fuel poverty in England by household type, 2001 (Full, BHC equivalised incomes)

Tenure	Thousand households/Row percentages						Total households thousands
	McClements scale			Modified OECD scale			
	All households in fuel poverty thousands	percent	In severe FP percent	All households in fuel poverty thousands	percent	In severe FP percent	
All not vulnerable	246	4.0	0.8	228	3.7	0.6	6209
All vulnerable households	1073	7.5	0.8	1029	7.2	0.7	14301
Couple under 60 yrs	147	3.6	0.5	129	3.2	0.4	4085
Couple, 60 years plus	225	7.7	0.8	203	7.0	0.6	2925
Couple with dep. children	263	5.3	0.6	244	4.9	0.5	4986
Lone parent with dep.	166	10.4	1.1	155	9.7	1.1	1597
Other multi-person hhold	318	22.0	4.2	274	19.0	3.0	1443
One person, under 60 yrs	65	2.7	0.5	83	3.5	0.6	2397
One person, 60 yrs plus	136	4.4	0.0	169	5.5	0.1	3077
Total households	1320	6.4	0.8	1257	6.1	0.7	20510

As shown in the first part of Table 2.3, deducting housing costs from income somewhat lessens the divergence in the rate of fuel poverty between vulnerable and non-vulnerable households, albeit the former remains the most affected.

Before equivalisation, omitting housing costs from income also has the effect of increasing fuel poverty amongst lone parents and other multi-person households, although older single person households retain the highest percentage with 1 in 3 now being in fuel poverty. However, equivalising incomes changed this position dramatically, other multi-person households, followed by lone parents, having the

highest proportion of fuel poverty and older single persons now having the very lowest incidence (just over 6%).

Table 2.3: Fuel poverty in England by tenure, 2001 (Residual, AHC income definitions)

Thousand households/Row percentages

Tenure	Non-equivalised AHC income			McC Equivalised AHC income			Total households thousands
	All households in fuel poverty		In severe FP	All households in fuel poverty		In severe FP	
	thousands	percent	percent	thousands	percent	percent	
All not vulnerable	661	10.6	3.8	541	8.7	2.8	6209
All vulnerable households	2461	17.2	2.9	1912	13.4	2.4	14301
Couple under 60 yrs	201	4.9	1.1	273	6.7	1.5	4085
Couple, 60 years plus	307	10.5	1.1	347	11.9	1.7	2925
Couple with dep. children	166	3.3	0.5	532	10.7	1.6	4986
Lone parent with dep.	429	26.8	4.4	402	25.1	4.9	1597
Other multi-person hhold	390	27.0	8.9	487	33.8	12.1	1443
One person, under 60 yrs	578	24.1	7.9	216	9.0	2.1	2397
One person, 60 yrs plus	1025	33.3	4.8	191	6.2	0.5	3077
Total households	3124	15.2	3.2	2455	12.0	2.5	20510

Conclusions

Equivalised incomes, both before and after housing costs, are used widely in the study of general and child poverty and equivalisation is promoted as being a fairer way of comparing household incomes. However, using equivalised incomes to measure fuel poverty has the effect of significantly reducing the number of households classes as fuel poor (from over 1.7 to around 1.3 million in 2001 on the full income definition).

Figure 3.1 shows that of all 960 thousand single persons in fuel poverty on the full income definition (55% of the total), over 700 thousand (73%) are taken out of fuel poverty by equivalisation using the Modified OECD scale. This is also true of some 120 thousand or 24% of fuel poor couples, if the values are re-scaled to maintain the same average income after equivalisation. (Without re-scaling, equivalisation has normally no effect on couples in fuel poverty). By contrast, only some 360 thousand larger households are taken into fuel poverty by equivalisation, leaving a net loss of some 460 thousand fuel poor.

Figure 3.1: Changes in fuel poverty due to equivalisation by household size

Before equivalisation	Full income fuel poverty status after equivalisation						Total
	One person		Couples		3 or more persons		
	Not in FP	In FP	Not in FP	In FP	Not in FP	In FP	
Not in fuel poverty	4522	0	6671	0	7232	363	18788
In fuel poverty	<u>706</u>	256	<u>122</u>	391	0	246	1722
All households	5228	256	6793	391	7232	610	20510

For the purposes of measuring fuel poverty, it can be argued that only equivalised incomes after the deduction of housing costs would be appropriate. This is because, fuel poverty is specific to a households existing dwelling and, with widespread under-

occupation, the size and running cost of the dwelling may well be closer to that required by a larger household than, say, the actual single elderly occupant.

A similar argument can be used for the fuel costs. As the principal of equivalisation is that a larger household will need a higher income than a smaller one to enjoy a comparable standard of living, it is generally based on the premise that a larger household will have, among other things, higher housing and fuel costs than a smaller one. But in practice, this may not be the case where there is severe under-occupation. Consequently, 10% of equivalised income may under-estimate the fuel costs required by, say, a lone pensioner, where they are under-occupying a house more appropriate to a larger household.

After the deduction of the main housing costs, however, particularly rents and mortgage payments, equivalised residual income may provide a better relative income measure for many households of how much they require to spend on essentials, such as food, clothes and fuel.

Another problem with the adoption of equivalisation may be the way it dramatically shifts the problem of fuel poverty away from single elderly households to family and other larger, low income households. This could well present political problems, the former still being widely perceived, rightly or wrongly, as the more 'deserving poor'. However, the way it further reduces fuel poverty numbers is likely to prove much more appealing to Government !

Methodology

The process of equivalisation involves adjusting the relative income of households according to their size and composition, following the principle that to enjoy a comparable standard of living a larger household will need a higher income than a smaller one.

To equivalise the income data in the 2001 EHCS, the person level data on age and working/educational status was first used to determine the age of each person in each household and in the case of older children whether they were dependant or independent. The results were then aggregated to household level and each household categorised according to the marital status of the head and any partner, the number of independent children or other adults and the number and age of any dependant children.

This information was then used to assign an equivalence factor to each household member, using the HBAI 'equivalence scale variants' in the first column of Table 2.1 in Appendix 2 of the latest WDP *Households Below Average Income* Report. The sum of the scale values was calculated for each household and the income of the household then divided by this sum to give the measure of equivalised household incomes as used in the HBAI series. However, following expert advice⁹, the equivalence values were finally rescaled such that the average income of the grossed EHCS sample was also the same both before and after equivalisation.

This process was done using EHCS figures for full income and repeated for residual income, after housing costs, using the different HBAI equivalence scale values. Finally, the process was repeated using the much simpler Modified OECD equivalence scale values in place of the McClements HBAI equivalence scale.

⁹ The author is grateful to Professor Dave Gordon of the Townsend Centre for International Poverty Research at the University of Bristol for his help with the methodology.

Table 4.1 shows the mean, minimum and maximum sum of the McClements scale values (before re-scaling) for the 2001 EHCS for the 13 main household types, as used in the ONS *Family Spending* (EFS) survey. In these types, all persons under the age of 18 and unmarried are classed as children, whether or not dependent. For full incomes, the factors by which the EHCS incomes are divided range from 0.61 for a one person household to 3.65 for a household comprising nine adults. The equivalent factors for the equalisation of residual incomes range from 0.55 to 3.85. The final part of the table shows the mean, minimum and maximum household incomes (excluding outliers) before equalisation, after dividing by the sum of the scale values and after re-scaling to maintain the same mean income both before and after equalisation.

Table 4.1: Sum of McClements scale values by EHCS household composition

Household composition	Sum of scale values, BHC			Sum of scale values, AHC			Total Hhld thousands
	Mean	Min	Max	Mean	Min	Max	
1 adult	0.61	0.61	0.61	0.55	0.55	0.55	5484
1 adult & 1 child (dep/ind)	0.84	0.7	1.07	0.78	0.62	1.00	695
1 adult & 2+children	1.24	0.79	2.74	1.18	0.69	2.74	908
Couple	1.00	1.00	1.00	1.00	1.00	1.00	5643
2 men or 2 women	1.07	1.07	1.07	1.00	1.00	1.00	846
Couple & 1 child (dep/ind)	1.29	1.09	1.42	1.29	1.07	1.44	2467
Couple & 2 children	1.52	1.18	1.78	1.54	1.14	1.85	2730
Couple & 3 children	1.77	1.36	2.14	1.79	1.32	2.25	923
Couple & 4+ children	2.22	1.54	3.63	2.27	1.5	3.85	359
3 adults	1.49	1.49	1.49	1.45	1.45	1.45	248
3 adults & 1+ children	1.87	1.58	2.58	1.84	1.52	2.57	54
4+ adults	2.03	1.85	3.65	2.05	1.85	3.85	140
4+adults & 1+children	2.64	2.06	3.30	2.69	2.06	3.39	13
All households	1.08	0.61	3.65	1.06	0.55	3.85	20510
Unequalised income £	19,906	2,714	182,947	17,074	214	183,830	
Equalised income £	18,794	2,641	180,321	16,607	331	172,625	
E. income after rescaling £	19,906	2,797	190,993	17,074	340	177,475	

The final table shows the mean, minimum and maximum sum of the modified OECD equivalence scale values (adjusted for couple without children=1 but before re-scaling to mean income) for the same 13 main household types in the 2001 EHCS sample. Using this new scale, the sum of the equivalence values range from 0.67 for a single person household to 3.38 for a couple with 8 mainly older children. The final part of the table again shows the mean, minimum and maximum household incomes (excluding outliers) before and after equalisation and after re-scaling to maintain the same average income of the sample after grossing.

Table 4.2: Sum of Modified OECD scale values by EHCS Hhold composition

Household composition	Sum of scale values, BHC			Total Hhld thousands
	Mean	Min	Max	
1 adult	0.67	0.67	0.67	5484
1 adult & 1 child (dep/ind)	0.90	0.87	1.00	695
1 adult & 2+children	1.25	1.07	2.52	908
Couple	1.00	1.00	1.00	5643
2 men or 2 women	1.00	1.00	1.00	846
Couple & 1 child (dep/ind)	1.27	1.20	1.33	2467
Couple & 2 children	1.49	1.40	1.66	2730
Couple & 3 children	1.73	1.60	1.99	923
Couple & 4+ children	2.14	1.80	3.38	359
3 adults	1.33	1.33	1.33	248
3 adults & 1+ children	1.71	1.53	2.39	54
4+ adults	1.83	1.66	3.31	140
4+adults & 1+children	2.43	1.86	3.05	13
All households	1.08	0.67	3.38	20510
Unequalised income £	19,906	2,714	182,947	
Equalised income £	18,469	2,956	180,322	
E. income after rescaling £	19,906	3,187	194,447	