



Department
of Energy &
Climate Change

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FUEL POVERTY

Methodology Handbook



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1. Introduction

The purpose of this methodology handbook is as a guide for all users of the DECC fuel poverty statistics. Within it, the user will find descriptions of the methodology used to calculate the 2014 fuel poverty figures for England, and the consistent fuel poverty time-series produced back to 2003. Information on what data are available and where to find it is also included.

Users should note that the detailed methodological descriptions found in Chapters 2 to 6 are for the English fuel poverty statistics only (information for the other devolved nations are provided in Section 1.3).

This is the 2016 version of this document, relating to the 2014 fuel poverty figures, and supersedes all earlier methodology documents and updates.

1.1 What is fuel poverty

Fuel poverty in England is monitored using the Low Income High Costs (LIHC) Indicator.

Under the LIHC definition, a household is considered to be fuel poor if:

- they have required fuel costs that are above average (the national median level)
- were they to spend that amount, they would be left with a residual income below the official poverty line.

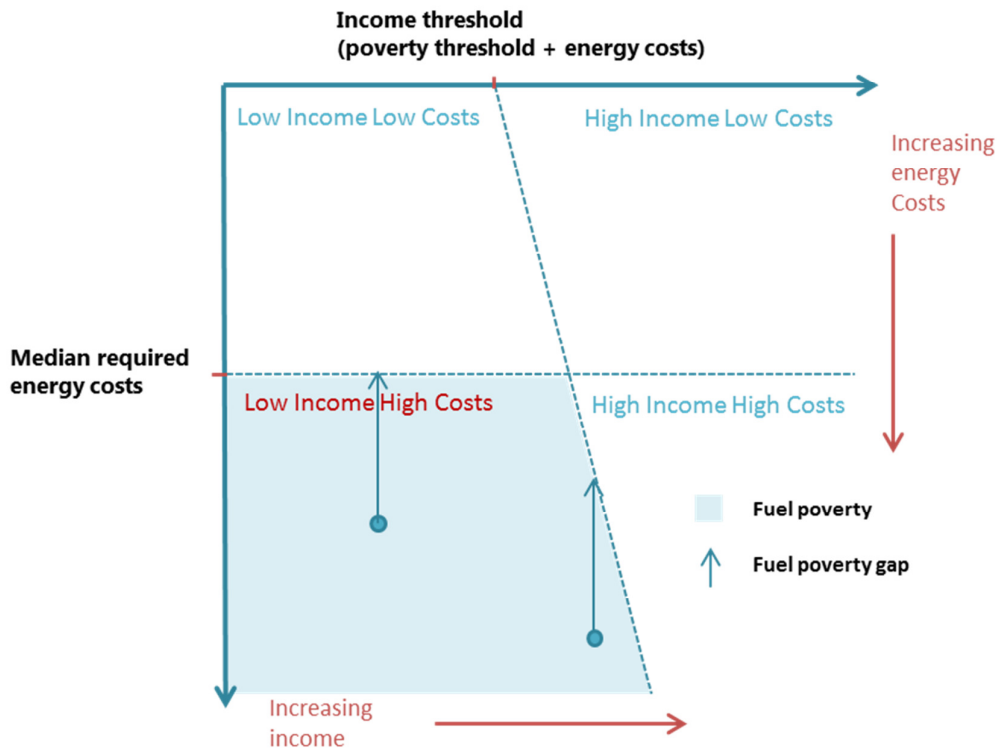
The LIHC definition is a relative indicator as it compares households to the national median energy costs and income – thereby reflecting contemporary trends.

The Low Income High Costs indicator is a twin indicator consisting of:

- i) the **number** of households that have both low incomes and high fuel costs (shown by the shaded area in the bottom left hand quadrant in Figure 1); and
- ii) the **depth** of fuel poverty amongst these fuel poor households. This is measured through a fuel poverty gap (shown by the vertical arrows in Figure 1) which represents the difference between the required energy costs for each household and the nearest fuel poverty threshold.

For a detailed explanation of how to calculate the Low Income High Costs indicator, see Chapter 6.

Figure 1: Fuel poverty under the Low Income High Costs indicator



The key elements in determining whether a household is fuel poor under the LIHC indicator are:

- Household Income;
- Household Energy Requirements (dependent on dwelling characteristics and the lifestyle of householders); and
- Fuel costs.

The cost of energy is modelled rather than based on actual spending. It is calculated by combining the fuel requirements of the household with corresponding fuel prices. These costs capture four areas of energy requirements:

- Space heating;
- Water heating;
- Lights and appliances; and
- Cooking.

The modelling ensures that the household achieves the adequate level of warmth (as set out in the definition of fuel poverty) subject to a range of characteristics concerning the dwelling and its occupants.

The household energy requirements are modelled based on a number of factors including:

- The size of the property;
- The number of people who live in the dwelling;
- The energy efficiency of the household; and
- The mix of different fuels used by each household.

1.2 What are the uses of fuel poverty statistics?

Fuel poverty data has a wide range of uses both within and outside of Government. As well as being used to track objectives against targets, it is used to help develop, focus and target policies. Whilst it is not possible to use the dataset to identify individual and specific households that are in fuel poverty, within Government it is used to provide an understanding of the demography and geography of the fuel poor, and to indicate which groups are particularly susceptible to fuel poverty.

In addition, the wider English Housing Survey (EHS) dataset can provide detail around the heating and energy requirement of different types of households and homes. This information can be used to form an understanding of the role and impact of energy efficiency measures on fuel poverty and also help to target policies to improve the thermal efficiency of the housing stock.

Detailed demographic and dwelling-level splits of fuel poverty in England are available for users, published as part of the annual fuel poverty reporting. In addition to the current year figures, a spreadsheet showing long term trends in fuel poverty amongst different types of household is updated and published annually.

DECC also publish the full fuel poverty dataset each year at the household level. This is made available from the UK Data Archive at around the same time or soon after the EHS data are made available. This is helpful for users who want to extend their analysis of fuel poverty.

DECC continue to endeavour to meet user requirements for sub-regional estimates of fuel poverty. These data are used particularly by local authorities, who combine this data with information they hold themselves to help target schemes at a local level. In recent years, improvements have been made in terms of both making this data available annually, and bringing the publication date forward to make it more timely and aligned to the national release. Sub-regional LIHC fuel poverty data are now available as Experimental Statistics¹ for 2011, 2012, 2013 and 2014.

¹ Experimental statistics are defined in the Code of Practice for Official Statistics as “new official statistics undergoing evaluation. They are published in order to involve users and stakeholders in their development and as a means to build in quality at an early stage.”

1.3 Why are fuel poverty statistics reported separately for England, Wales, Scotland and Northern Ireland?

Fuel poverty is a partially devolved matter, with each separate administration having individual policy targets, measurement and outputs. The main reason for the devolution is that the separate administrations have the power to affect certain aspects of fuel poverty policies (such as energy efficiency programs) but not others (such as incomes and market conditions, which impact fuel prices). As a result, different indicators of fuel poverty are used, that are based on different methodological assumptions.

Fuel poverty in Wales, Scotland and Northern Ireland, is currently calculated using a 10% indicator to determine the proportion of fuel poor in these nations.

Under the 10% indicator, a household is considered to be fuel poor if they were required to spend more than 10% of their income on fuel, so as to maintain an adequate standard of warmth. The fuel poverty ratio, used under this method, is defined as:

$$\text{Fuel Poverty Ratio} = \frac{\text{Modelled fuel costs (i. e. modelled consumption} \times \text{price)}}{\text{Income}}$$

Where this ratio has a value greater than 0.1 (10%), the household is considered to be fuel poor.

The 10% definition of fuel poverty was previously used to calculate the fuel poverty statistics in England, from 2001 - 2011. In 2012, an independent review was published by Professor John Hills², recommending a new method to calculate fuel poverty, with separate indicators that calculate both the **extent** and **depth** of fuel poverty. This is known as the Low Income High Costs (LIHC) indicator and has been used since the 2011 fuel poverty statistics (published in 2013) to produce the fuel poverty statistics for England, and long term trends tables have been produced from 2003 using the LIHC indicator³.

The LIHC indicator incorporates equivalisation factors for income and fuel costs and the deduction of housing costs from the income. It is also a relative indicator, comparing households to the median fuel costs and income, as opposed to the absolute nature of the 10% indicator.

In addition, the underlying assumptions used in the modelling of fuel poverty statistics varies for each country, as detailed below.

- In England fuel poverty is modelled from the English Housing Survey (EHS) using the LIHC indicator, and this document explains the methodology underpinning the English calculation.

² <https://www.gov.uk/government/publications/final-report-of-the-fuel-poverty-review>

³ <https://www.gov.uk/government/statistics/fuel-poverty-trends-2003-2013>

- In Scotland, the Scottish Housing Survey is used to model fuel poverty, according to the definition of fuel poverty set out in the Scottish Fuel Poverty Statement 2002 using a 10% indicator. The underlying assumptions are similar to that used in England. The main differences in the Scottish definition are alternative interpretations of a satisfactory heating regime for pensioners, long-term sick and disabled households, meaning the adequate standard of warmth is achieved at a higher temperature for these groups (23 °C compared with English 21 °C) and a different approach to under-occupancy.
- The Living in Wales Survey is used to estimate fuel poverty in Wales under a 10% measure. Figures for Wales are also updated less frequently, as the fuel poverty module of questions are not asked every year. The most recent survey is from 2008.
- The last Housing Condition Survey for Northern Ireland was run in 2011 using a 10% definition from which fuel poverty levels were reported. It should be noted that Northern Ireland has no statutory requirement on fuel poverty.

As a result of both definition and methodological differences in fuel poverty for each devolved nation, the figures are non-additive (i.e. cannot be combined) in relation to a UK total. More details of the devolved surveys and fuel poverty in each of the nations, can be found at the links below:

Scotland:

<http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/TrendFuelPoverty>

<http://www.gov.scot/Topics/Statistics/SHCS>

Wales:

<http://gov.wales/topics/environmentcountryside/energy/fuelpoverty/researchreports/?lang=en>

Northern Ireland:

http://www.dsdni.gov.uk/index/hsdiv-housing/fuel_poverty.htm

http://www.nihe.gov.uk/index/corporate/housing_research/house_condition_survey.htm

2. What are the key data sources for modelling fuel poverty

2.1 The English Housing Survey

The source of data for housing and the household members, essential in modelling fuel requirement, is the English Housing Survey (EHS). The EHS is currently an annual survey, commissioned by the Department of Communities and Local Government (DCLG). It covers all tenures and includes a household interview and a physical inspection of properties by a surveyor. The information obtained through the survey provides an accurate picture of the type and condition of housing in England, the people living there, and their views on housing and their neighbourhoods. The survey is a random sample of housing and householders in England. The sample is clustered with half of England being sampled each survey year, but structured such that any two combined years of the survey provides an unclustered sample.

The two key components of the EHS used in the estimation of fuel poverty are:

- Interview Survey: An interview is conducted with the householder. The interview covers a wide range of topics that include: household characteristics, satisfaction with the home and the area, disability and adaptations to the home and income details; and
- Physical Survey: The interview is followed by a visual inspection of the property, both internally and externally, by a surveyor. Data collected includes the number and type of rooms and facilities contained in the property, the condition of a wide range of aspects of the physical structure, details of the heating systems, approximate age of the property, and assessment of neighbourhood quality;

Currently, each year around 13,300 interviews are conducted with householders, and around 6,200 dwellings (approximately 6,000 households) have a follow up physical survey of their dwelling.

Data from both the interview survey such as householder incomes, occupancy characteristics and the method of payment for gas and electricity provide information of relevance relating to the household. These are then combined with data from the physical survey on items such as the floor area, the types of heating systems in use and other energy efficiency characteristics to calculate the LIHC indicators of fuel poverty. For more information on how the information recorded in the survey is used to model energy requirements, see Chapter 4 of this handbook.

2.2 Energy price information

Fuel prices used in the modelling of fuel poverty are gathered from a variety of sources, including DECC's survey of domestic fuels, the Office for National Statistics (ONS) and Sutherland tables. Fuel price data for different fuel types have different sources:

- Gas and electricity are the fuels predominantly used by most households in England. Prices for gas and electricity come from a survey of energy suppliers to find out what tariffs customers are on. The survey covers around 90 per cent of the market. The survey is conducted quarterly and records specific details of the price of each tariff, and the number of customers on each tariff in each region of the UK, splitting this by tariff and payment type. Prices take the form of unit costs, fixed costs and any discounts that are given (e.g. discount for paperless billing).
- Coal, heating oil and smokeless fuel prices are provided by the ONS to DECC. ONS collects these prices as part of a wider data collection for use in compiling the Consumer Price Index (CPI). The prices are collected monthly and split regionally.
- Prices for other (relatively minor) fuels, including Liquefied Petroleum Gas (LPG) and bottled gas, come from the Sutherland Tables⁴ or data in the table to SAP (the Government's Standard Assessment Procedure for the Energy Rating of dwellings). Fuel prices from the Sutherland Tables are split regionally, and show comparative heating costs across the UK. Prices are available twice a year.

Prices are combined with modelled levels of required energy for each fuel used by the household to estimate the total bill. For gas and electricity, a household's location, fuel mix (gas, standard electricity, economy 7 electricity, heating oils etc.) and fuel payment method (direct debit, standard credit and pre-payment) are matched against the fuel price data to give the cost per unit of fuel required and the standing charge. These are used to produce an estimate of the household's fuel costs. For more information on this methodology, see Chapter 5.

2.3 Household income

Income is collected from the interview survey part of the EHS, via a set of detailed questions that are specific to the survey. The full model for constructing a household's income is explained in Chapter 3 of this document.

The equivalised AHC income is used to define households living in fuel poverty under the LIHC indicator, through both the number of households living in fuel poverty and the fuel poverty gap. It is produced by:

⁴ <http://www.sutherlandtables.co.uk/>

- Adding the personal incomes of every member of the household together plus any benefit payments that the household receives (from private sources, state benefits, and savings). This is the 'Basic household income'.
- Addition of income related directly to housing that includes: housing benefit (HB), Support for Mortgage Interest (SMI), Mortgage Payment Protection Insurance (MPPI), Council Tax Benefit (CTB), and the deduction of Council Tax payable. This is the 'Full household income'.
- Deduction of housing costs (mortgage and rent payments).
- The division by the relevant income equivalisation factor to reflect the fact that different households have different spending requirements.

These steps create the final 'Equivalised AHC income'.

The income is calculated as the sum of the income of the Household Reference Person (HRP)⁵ and any partner, known as the Primary Benefit Unit (PBU), plus any other adult members of the household, known as Other Benefit Units (OBU).

⁵ The Household Reference Person (HRP) is the person in whose name the dwelling is owned or rented or who is otherwise responsible for the accommodation. In the case of joint owners or tenants, the person with the highest income is taken as the HRP. Where incomes are equal, the older occupant is taken as the HRP.

3. How is household income modelled?

This chapter details the income methodology, the calculation of the final fuel poverty income variables, validation of income and changes in the income methodology. A list of the acronyms used in the description of the income methodology can be found in Chapter 12.

3.1 Overview

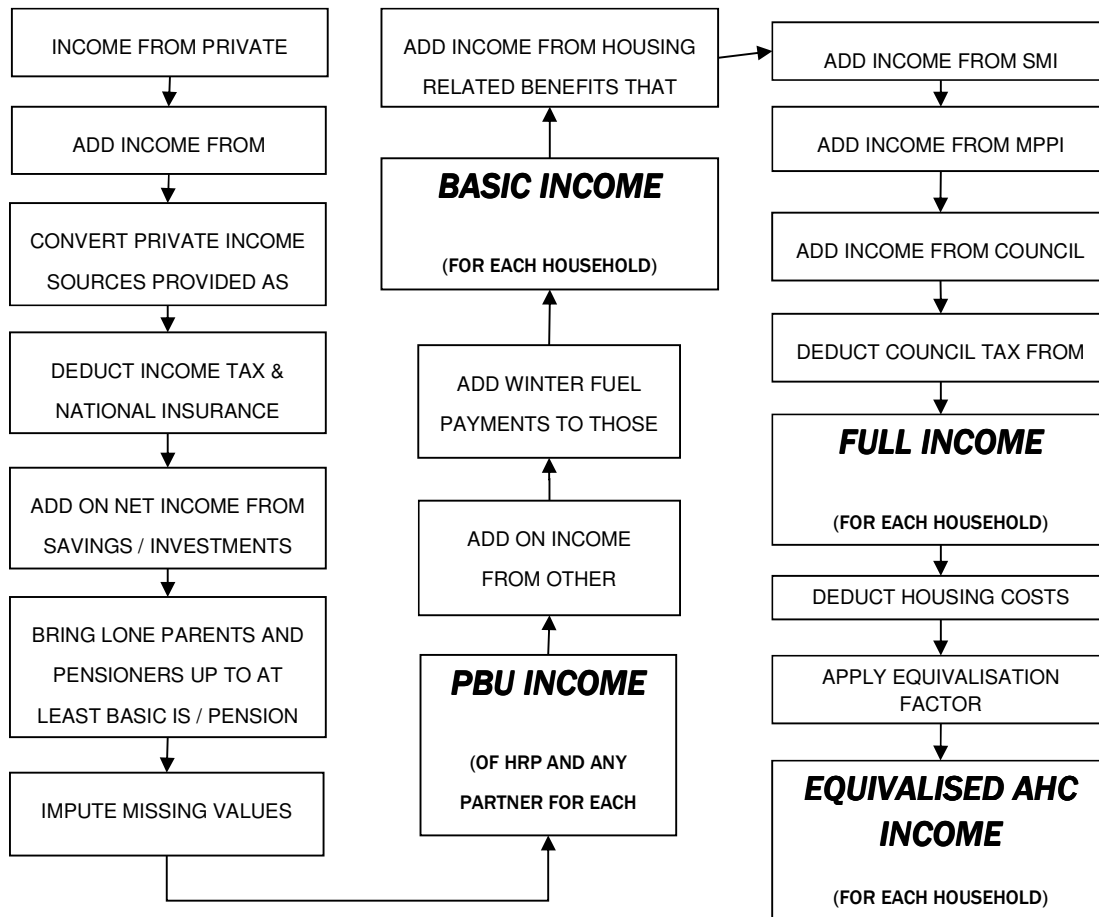
Three different types of income are produced in the calculation of household income for fuel poverty purposes. These are “basic household income”, “full household income” and “equivalised AHC income”(see Section 2.3 above). There are four major steps involved in calculating the full household income. Firstly, the Primary Benefit Unit (PBU) income is calculated for the HRP and partner in each household. The next stage is to produce the fuel poverty basic income for each household, from which the full income is calculated. Finally, housing costs are deducted and an equivalisation factor is applied to produce the equivalised AHC income. Figure 2 outlines the main steps involved in this process and the sections to follow, detail the procedures involved in each step.

The EHS interview survey collects detailed information about the income of the HRP and any partner from different sources (wages, pensions, benefits, savings and investments and other sources, e.g. rent from property). Respondents are asked separately about each source and which, if any, benefits they receive. This information is collated and modelled to produce total net income for the Primary Benefit Unit (HRP and any partner).

Less detailed income information is collected of other household members aged over 16 (who are not the HRP or partner), referred to in this document as ‘Other Benefit Units’. From this information, the income from other benefit units in the household can be derived.

The EHS interview survey also collects information on housing benefit and Council Tax support, Support for Mortgage Interest (SMI) and Mortgage Payment Protection Insurance (MPPI). These are used in the calculation of the full income.

Figure 2: The main steps in calculating equivalised AHC income



3.2 Missing data

The Computer Assisted Personal Interviewing (CAPI) used to conduct the EHS interview survey contains many ‘soft checks’ to clarify values with the householder where extreme amounts were initially provided, particularly around state benefits/allowances and tax credits. Thus, the EHS income calculation method assumes that the details given by the respondent are correct unless there is a strong reason to suggest otherwise (assessed on a case by case basis). A method of imputation is required for these cases, and (more commonly) for cases where information on income sources/amounts is either refused or unknown. Table 1 summarises the type and method of imputations carried out.

3. How is household income modelled?

Table 1: Imputation procedures

Type of income	Type of missing data	Method of imputation
Private incomes	Sources of private income are refused or unknown	Sample median imputed at a later stage
Self-employed	Amounts missing	Uses data from the Annual Survey of Hours and Earnings (ASHE) based on age, gender, part-time/full-time, social economic group and from 2010 data, also geographical location
Regular employment	Amounts missing	
Occupational pension	Amounts missing	Sample median based on gender and social economic group
Private pension	Amounts missing	
Other sources	Amounts missing	Sample median based on working status
State benefits	Benefits received are refused or unknown	Sample median imputed at a later stage
<ul style="list-style-type: none"> - Universal Credit - Income support - Job Seekers Allowance - Pension credit - State pension - Incapacity benefit - Employment and support allowance - Child benefit - Working tax credit* - Child tax credit - Return to work credit - In work credit - Maternity allowance - Widows pension - War disablement pension - Severe disability allowance - Industrial injuries disablement benefit - Attendance allowance - Carers allowance - DLA (mobility component) - DLA (care component) - PIP (mobility component) - PIP (daily living component) - Statutory sick pay 	Benefit amount is refused or unknown	Where the rates vary greatly depending on the situation of the HRP and any partner (notably means tested benefits) individual benefit assessments are carried out. More general methods are used for benefits where fewer rates apply.
Other disability benefit	Benefit amount is refused or unknown	Theoretical amount of DLA (mobility) modelled
Savings	Amount of savings refused or unknown	Imputed using CHAID analysis using various household and dwelling characteristics
Primary Benefit Unit (PBU) income	Overall net household income missing or in households with a partner, HRP only missing/partner only missing	Median sample income imputed based on the HRP and any partner using the variables working status and social economic group or using HRP/partner information only
Other Benefit Units (OBU)	Income amount missing for additional adults (on an individual basis)	Hot-decking based on gender, age, social economic group, working status and from 2010 data, grouped geographical location for additional adults in work.
Winter Fuel Payment (WFP)	No information collected on whether household receives WFP	Modelled based upon eligibility of all household members. The amount depends upon the age profile of the household members.
Housing related benefits that	Amounts missing	Full housing benefit – set as the net rent

3. How is household income modelled?

help pay towards rent		amount Partial housing benefit/don't know if full or partial – individual housing benefit assessment carried out
SMI	Amounts missing	Imputed using mortgage information or from sample median
MPPI	No information given as to amount (applies to all MPPI cases)	Imputed using mortgage information
Council Tax Benefit/Support (CTB)	No information given as to the actual amount (applies to all CTB cases)	Full CTB – set as the Council Tax due Partial CTB/don't know if full or partial – individual CTB assessment carried out

* The child care element is not modelled for Working Tax Credit.

3.3 EHS Primary Benefit Unit (PBU) income methodology

Initial checks on the interview survey input data are carried out to ensure the data are as clean as possible in preparation for the calculations. This involves checking household characteristic data to identify any implausible values and editing where necessary.

After the initial checks, a series of key indicators about the household are created at the person and household level (for example, age/gender of the HRP and any partner, working status of HRP and any partner and the presence and number of dependent children etc.), which are subsequently checked for completeness/plausibility. These indicators are used to compute theoretical entitlement to benefits and are used in the process of imputing missing values and validation.

Income from private sources

Separate calculations are made for the annual income for the HRP and any partner from regular employment (including income from Government training schemes), self-employment, occupational pensions, private pensions and other private sources. For each private income source selected the respondent is asked to provide a banded gross/net amount. If provided, the income is then set at the mid-point of the band.

Where respondents state receipt of private income sources, e.g. employment, self-employment income, but are unable/refuse to specify an amount, then an estimated amount is assigned according to the methods outlined in Table 1.

The same amounts are used to impute regular and self-employed income. For these two private income sources, the amount of income assigned depends upon the number of hours worked. The Annual Survey of Hours and Employment (ASHE) data that is used for imputation is presented on the basis of full time employment therefore, if the hours worked are less than or equal to 15 per week, the amount imputed is one-third of the full-time income amount. Part-time work greater than 15 hours per week is set to two-thirds of the full-time income amount.

Respondents predominantly provide gross private income amounts. However, where net amounts are given for income from private sources, the gross amount for that source is

3. How is household income modelled?

approximated. The net amount is increased by 45% if the individual is under pension age and in receipt of earnings/self-employment income (to replicate tax and National Insurance). Otherwise, 25% is applied (to replicate tax only), unless the combined private net and gross income is less than the tax threshold, in which case it is assumed that no tax is paid and the net amount is set to the gross amount. The total gross private income for the HRP and any partner for all sources is calculated. This is required to enable the total tax amount to be deducted. It is not possible to simply calculate the tax on the gross part and then add the gross-taxed to the net as the rate of tax is dependent on income thresholds. Where imputation has taken place this is recorded against the data. On-going validation of the amounts of income from private sources is carried out throughout the calculation.

Income from state benefits

The EHS interview survey asks about benefits received by the HRP and any partner (combined as a benefit unit) and the amounts and time periods of the payments. Where a partner of the HRP is present in the household, with the exception of state pension, child benefit, income support and universal credit, it is unknown whether it is the HRP and/or partner are in receipt of the selected benefit. As this information is required for the purpose of tax deduction, it is estimated based on the eligibility criteria of each person in the couple. Using this information, benefit amounts for the HRP and any partner are calculated.

Missing benefit amounts are imputed for cases where the respondent has answered 'yes' to receiving a particular benefit but did not provide the amount received. For means tested benefits, such as income support, the rate varies greatly depending on the circumstances of the HRP and any partner and for these benefits individual benefit assessments are carried out. For other benefits based on rates, such as Disability Living Allowance, the prescribed rates are imputed.

Questions were introduced into the EHS 2010 interview survey to ascertain whether the missing benefit amounts were due to the inclusion of the missing amounts with other specified benefits. From 2010 modelling onwards, use of this data has been incorporated into the assessment of missing benefit incomes to avoid double counting of benefit income where it is deemed that the missing benefit income has already been accounted for.

The total benefit income is derived for the HRP and any partner separately, split between taxable and non-taxable benefit income.

Income deductions

The final income variables are presented in terms of net income, which is the income net of tax and National Insurance. At this stage in the income calculation process, the private income is presented in terms of gross income and the benefit income is presented in terms of gross and/or net income depending on the selected benefit receipt.

The private income and taxable benefit income are added together separately for the HRP and any partner. This information is used in conjunction with the rates and allowances for

3. How is household income modelled?

income tax to derive the income tax payable for the HRP and partner. Based on the rates and allowances for National Insurance⁶, Class 1, 2 and 4 contributions are calculated. The total net income for HRP and partner are computed separately by the following formula:

$$\text{Net income} = \text{Non taxable income} + \text{Taxable income} - (\text{National Insurance payable} + \text{Income tax payable})$$

Income from savings and investment

The EHS interview survey asks the HRP and any partner their combined total amount of savings and any income they have invested, which is provided as banded amounts. The mid-point of the reported band is taken as their savings amount.

Where the amount of savings/investment has not been provided, a method based on Chi-squared Automatic Interaction Detection (CHAID) analysis is used to estimate the combined savings/investment of the HRP and any partner. The banded savings question from the interview survey is used as the dependent variable in the analysis and a variety of household and dwelling characteristics such as tenure and age/gender of HRP are used as the predictor variables for estimating the savings amount. Once all the cases have a savings amount, income received from these savings is then calculated using an interest rate of 3% net of tax⁷. This savings amount is added onto the net private and benefit income.

Low incomes

The next stage in the income calculation is the imputation of low incomes. This is where the PBU net private and benefit income, including income from savings, is assessed for certain groups to ascertain if it is below a theoretical minimum amount.

In 2007/2008 this area was the focus for development and was reviewed by the Fuel Poverty Methodology Group (FPMG) who recommended some improvements to imputing low incomes in 2008. Analysis showed that two household groups are more likely to under-report their income: lone parents; and pensioners. For these two groups, if their income is less than a minimum amount, their income is imputed, using a different method for each group.

For lone parents, if their net income is below their theoretical income support entitlement then their income is uplifted to their theoretical income support level (Figure 3a). Where the HRP or any partner are over pension age, if their income is lower than state pension, their income is imputed up to state pension (Figure 3b). If their income is greater than

⁶ National insurance contributions (NICs) fall into a number of classes, the class you pay depends on your employment status and how much you earn.

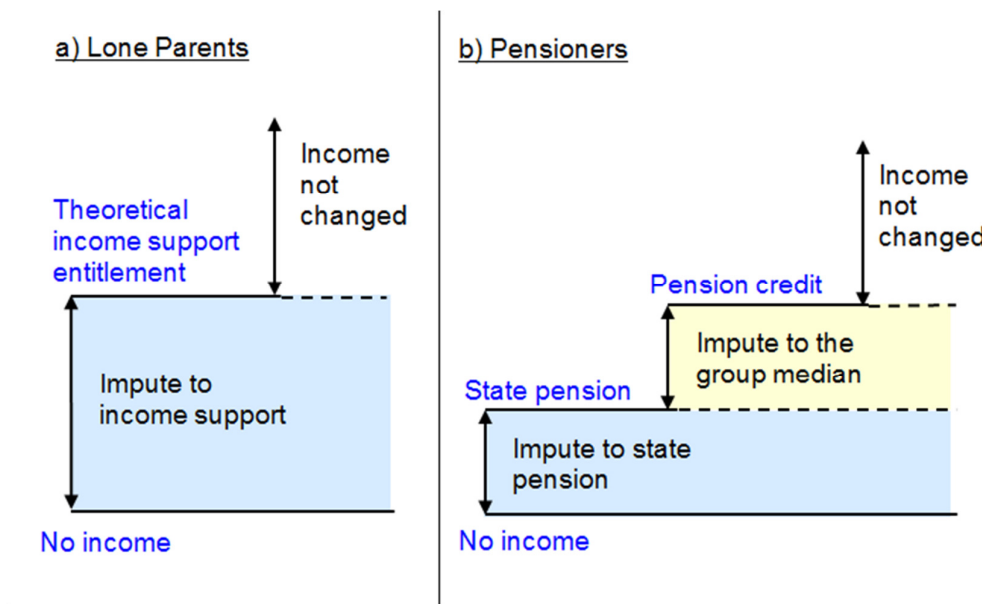
See <https://www.gov.uk/national-insurance/national-insurance-classes>.

⁷ No information is collected on the type of savings account, the term of the account or the rate of interest. A rate of 3% is fixed for all householders and has been used for all years of the fuel poverty calculation regardless of whether interest rates are higher or lower than this.

3. How is household income modelled?

state pension but lower than their pension credit entitlement their income is set to missing and later in the calculation procedure it is imputed to the group median based on working status and social economic group. A flag is created to identify cases which are changed in the low income imputation routine and the original values are kept for later checking.

Figure 3: Imputation of low incomes



Key: Reported income is in blue, the imputed income is in black

Imputing missing income data

At this stage there are three scenarios in which the total PBU income could still be missing:

- i) If the respondent answered 'don't know' or 'refused' at the beginning of the income section for the HRP and any partner;
- ii) If the benefits received are reported as unknown or refused; or
- iii) If, in the case of pensioners, their income is greater than state pension but lower than their pension credit entitlement, their income is set to missing in the low income imputation routine.

Where the HRP has a partner, it is possible that only one of the incomes is unknown or refused. In this situation, or if there is no partner of the HRP, the income of the individual with the missing amount is imputed to the group median based on their working status and socio-economic group. Where the income of both the HRP and partner are missing, their income is imputed to the group median based on a combined employment status and socio-economic group for both HRP and partner.

Output

Each PBU in the dataset has a net private and benefit income, including income from savings/investments.

$$PBU \text{ income} = \text{Net private income} + \text{Net benefit income} + \text{Net Savings / investment}$$

(all based on the HRP and any partner)

3.4 Fuel poverty basic income methodology

The fuel poverty basic income is the household net income, including winter fuel payment (payable only to those eligible).

Other Benefit Units

The PBU is made up of the HRP, their partner (if applicable) and any dependent children. Other Benefit Units are made up of other household members that are not part of the PBU, e.g. a grown-up child living with their parents or two or more people sharing a house. Each Other Benefit Unit can include up to two adults, but only if they are a couple, otherwise each adult makes up its own Other Benefit Unit. For the fuel poverty calculations, the income of these additional adult household members is considered as part of the household income⁸.

Data on the income of other household members aged over 16 (who are not the HRP or partner) are collected at the person level. Household members aged 16 or over that are not in the same benefit unit as the HRP are considered as additional adults and form Other Benefit Units (if the household member is a child of the HRP/partner, aged between 16 and 18 in further education then they will be included in the same benefit unit as the HRP and therefore not considered as an additional adult). If a gross income is provided for the additional adult then this value is used for the income of the household member. If the additional adult has not provided an amount for their income then an income value is imputed based on a 'hot-decking approach'.

The process of hot-decking involves finding cases in the data set that provided an income amount, which are similar in other parts of their responses to the cases with the missing value. For imputing missing additional adult income values, a specification to find similar cases is created for each case based on age (banded), gender, working status, socio-economic group (where applicable) and grouped geographical location for those in work. The case with the missing value has a precise specification and it is matched at random to

⁸ Additional adult household members reported during the EHS interview survey to be living in Halls of Residence are excluded from the analysis and their income is not considered to be part of the household.

3. How is household income modelled?

a case with an income value with the same specification, this income value is then used for the missing case.

Not all missing cases are matched and this occurs in two situations:

- i) If a case with a missing value has a specification which is not matched by a case with a non-missing value; or
- ii) When there are more cases with missing values than with non-missing values of the same specification.

Missing cases that are not matched during the hot-decking process are imputed to a sample median based on working status, and for some working status categories with large samples, age (banded) and gender.

Once all of the additional adults have a gross income assigned, it is converted to a net amount by deducting the applicable income tax and National Insurance. The net income of the additional adults is aggregated up to the household level to provide the total net income from Other Benefit Units in the household.

Winter Fuel Payments

Winter Fuel Payments (WFP), introduced in 1998, are a payment given once a year to help older people with their cost of heating. They are available to households with at least one resident aged over the female state pension age⁹ and paid automatically to an eligible person who receives a state benefit (other than housing benefit, Council Tax benefit or child benefit). Those who do not receive these benefits have to claim the payment. No question is asked in the EHS survey as to whether anyone in a household receives WFP. The applicable amount of WFP for the household is modelled using the age profile of household members and the specified rates and assigned to the household income. Additional one-off payments for household members aged over female state retirement age are sometimes provided alongside WFP. If applicable for the year of the dataset, these payments will also be included in the WFP amount.

Output

The Fuel Poverty Basic Income variable (*fpbasinc*) is created by adding the income from the Other Benefit Units (OBU) in the household and the WFP to the PBU income variable.

$$\text{Fuel poverty basic income (fpbasinc)} = \text{PBU income} + \text{OBU income} + \text{WFP}$$

There are a small proportion of cases with a Fuel Poverty Basic Income of zero. This occurs where:

⁹ A male can claim a Winter Fuel Payment when they reach the state pension age of a woman with the same date of birth.

3. How is household income modelled?

- i) the HRP and any partner select that they have no sources of income, with no savings/investments;
- ii) there is no income from any other additional adult household members; and
- iii) where there are no household members over female state pension age and therefore not in receipt of WFP.

3.5 Fuel poverty full income methodology

The Fuel Poverty Full Income is created by adding the income related to housing costs, housing benefit, Support for Mortgage Interest (SMI), Mortgage Payment Protection Insurance (MPPI) and Council Tax benefit to the basic income variable, and by subtracting the annual Council Tax bill for the household. Income/outgoings relating to housing costs are dealt with in this final step.

Income from Housing Related Benefits that help pay towards rent

Housing benefit, Local Housing Allowance (LHA) and Universal Credit applies only to low income households that rent their home or are in a shared ownership scheme, designed to help people on a low income pay their rent. Housing benefit is derived from the householder's response to the questions in the rent and housing benefit module in the EHS interview survey questionnaire.

Households that receive a housing related benefit that helps pay towards rent but do not provide an amount are imputed in the following ways:

- i) If the household states that they are in receipt of full housing benefit/LHA then the weekly housing benefit is set to their theoretical guide rent amount (net of services included in the rent such as heating, meals, water rates etc.) based on their tenure, number of bedrooms and the English Region in which they live.
- ii) If the household states that they are in receipt of partial housing benefit/LHA, universal credit or if they do not know if their housing benefit/LHA covers all or some of their rent then an amount of housing benefit/LHA is imputed based on their total net rent payable and their theoretical entitlement to housing benefit. From the 2013 modelling of EHS data, the theoretical entitlement to partial housing related benefits includes the modelling of the under occupation charge for working-age social tenants as introduced by Government in April 2013.

Income from Support for Mortgage Interest

Homeowners on certain benefits may be able to get help towards mortgage interest payments called Support for Mortgage Interest (SMI). In the EHS interview survey, applicable households are asked if they receive help towards their mortgage payments through SMI and, if so, whether it covers full/partial payments and the amount/time period of payment. For cases where the amount of SMI is missing, an amount is imputed by applying a Standard Interest Rate (for SMI) to the capital outstanding on the mortgage.

3. How is household income modelled?

However, if their mortgage information is missing, an amount is assigned based on the sample median from those with known amounts.

Income from Mortgage Payment Protection Insurance

Mortgage Payment Protection Insurance (MPPI) promises to make repayments on a householder's mortgage in the event of accident, sickness or unemployment. In the EHS interview survey, applicable households are asked if they are in receipt of contributions towards their mortgage payment under a MPPI policy and, if so, whether it covers full/partial payments. No information is collected on the amount of MPPI. For cases in receipt of MPPI, an amount for MPPI is set to their mortgage payment amount.

Income from Council Tax Benefit/Support

Low income households may be eligible for Council Tax Benefit (CTB), known as Council Tax Support (CTS) from April 2013. The EHS interview survey asks the HRP and any partner liable for paying Council Tax whether they are in receipt of CTS and, if so, whether it covers full/partial payments. For households in receipt of full CTS payments, their CTS is set to the full amount of Council Tax payable for their property. For households in receipt of partial CTS or households that do not know if they are in receipt of CTS, a CTS amount is assigned based on the Council Tax payable for the property and on their theoretical eligibility.

Council Tax Deduction

The Council Tax band for each dwelling is collected via a data matching exercise undertaken by the Valuation Office Agency¹⁰. The amount of Council Tax paid by the household is modelled using the Council Tax band of the dwelling and information about charges in the relevant local authority area. Single person discount is applied where appropriate based on household size and whether the respondent reported receipt of a discount on their Council Tax.

Output

The Fuel Poverty Full Income variable (*fpfullinc*) is created by adding the income related to housing costs; i.e. housing benefit/LHA, SMI, MPPI and Council Tax benefit/support, to the basic income variable (*fpbasinc*) and subtracting the Council Tax payable.

$$\begin{aligned} \text{Fuel poverty full income (fpfullinc)} \\ = \text{fpbasinc} + \text{HB} / \text{LHA} + \text{SMI} + \text{MPPI} + \text{CTB} - \text{council tax payable} \end{aligned}$$

As mentioned in Section 3.4, there are a small proportion of cases with a Fuel Poverty Basic Income of zero. In these situations, this can lead to a negative Fuel Poverty Full Income if the household does not report that they are in receipt of any housing related payments and where they are liable for Council Tax for which a deduction is made from their zero income.

¹⁰ This is achieved by matching postcodes to Council Tax band information in order to feed into modelling undertaken by the survey contractors for the production of statistics only.

3.6 Fuel poverty equivalised after housing costs methodology

The fuel poverty equivalised AHC income, as used in the calculation of the official fuel poverty statistics, is an extension of the fuel poverty full income variable. Housing costs (as published in the EHS derived interview file) are deducted from the full income of the household, and the household income is equivalised to reflect the fact that different households have different spending requirements. The methodology is detailed in Chapter 6.

3.7 Validation of income data

The validation of the input data into the income calculations, through to validation of the final output fuel poverty income variables, is an important process to ensure data quality. This process is outlined below.

Checking of the income data collected begins at the interview stage. The EHS interview survey is collected using a technique called Computer Assisted Personal Interviewing (CAPI) where the interviewer enters the information collected from the respondent directly into a laptop computer. The EHS CAPI has in-built checks to ensure that the respondents answers are as accurate as possible. For certain benefits, if an amount is entered outside a valid range then a check will appear on the computer screen. The CAPI system has cross checks between variables e.g. if housing benefit receipt is selected but not Council Tax benefit. The checks in the CAPI system are routinely reviewed bi-annually and updated as appropriate.

Once in receipt of the interview survey files, before beginning the income calculations, initial checks on the interview survey input data are carried out to ensure they are as clean and complete as possible. This involves checking household characteristic data, which is later used for imputing missing values and validation. Implausible and missing values are identified and editing/imputation takes place where necessary.

Checks are made at each stage of the calculation process to ensure as far as possible that the data are reasonable, and that missing data have been imputed correctly. Implausible values are interrogated and only when we can be as certain as possible that the information is incorrect is an imputation or change made. Any changes made are always noted alongside the data to indicate the nature and extent of any imputation. At the end of each stage additional checks are made to ensure that there are no missing values in the final variables.

Certain parameters are evaluated at the end of each stage of the calculation process and compared to previous EHCS/EHS data. For example, once the benefit section of the calculation process is complete, the take-up proportion of imputed data and average values for each benefit are assessed.

Oddities in the results for the components of the fuel poverty income variables are investigated in detail, concentrating on the difference in the data between the two specific

3. How is household income modelled?

years until the change can be explained. This involves putting the data in context by comparing the components of the fuel poverty income to external administrative sources e.g. DWP/HMRC benefit statistics and data from other surveys e.g. the Annual Survey of Hours and Earnings (ASHE) and the Living Cost and Food Survey (LCFS). From this process it may be deemed that the results are in line with other external sources or the difference attributed to the underlying EHS data or changes to the EHS interview survey.

The internal validation also occurs on the final fuel poverty income variables, comparing the total income measures to data from previous years, looking at the distribution of income across the population and the average income of certain household groups. The main external validation techniques applied to the fuel poverty income measures are trend analysis over time and comparison with specific year income data from other surveys, notably the LCFS and the Family Resources Survey (FRS).

Income data from the LCFS Family Spending publication for the relevant year in question are published around the time that the fuel poverty income measures are being finalised. This information is used to compare the LCFS disposable household income to the fuel poverty basic income (as the two income measures are fairly closely aligned in their definition) by overall households, tenure and income quintiles. Any unexpected divergence in the results between the two income measures is investigated.

The FRS is considered to be the most comprehensive and accurate income survey conducted in this country, and one that is dedicated to measuring incomes. The FRS income data for the comparable year to the fuel poverty full income is not published until after the publication of the fuel poverty statistics. However, the FRS provides the best external income data source for comparison and it is therefore important to compare a variant of the fuel poverty full income to the equivalent FRS income variable on publication of the FRS data, focusing on the comparability of the distribution of incomes in both surveys and the characteristics of households with the lowest incomes.

The FRS data are also the underlying source behind the AHC equivalised income figures presented in the Households Below Average Income (HBAI) series, published by DWP. Again, the comparable year of the HBAI is not published until after the publication of the fuel poverty results but time series charts are produced on availability of the data to compare the HBAI equivalised AHC income to the fuel poverty AHC equivalised income by overall households and income deciles.

Outliers

Outlying cases are identified in the data and validated to ensure that the data modelling processes are being performed correctly. In rare cases where the data are deemed to require modification due to implausible outcomes, modifications to data imputation regimes may be made as appropriate. In the 2014 dataset, an alternative income procedure was employed for one case, due to missing responses to their earnings from amounts. The initial imputation procedure used was considered insufficient to provide whole household income in this circumstance, therefore a more appropriate income imputation routine was chosen, based on supplementary reported information for this case. Moving forward, issues raised by the unusual circumstances of specific outlier cases are fed back into

3. How is household income modelled?

future validation routines, where checks and processes are added to help deal with similar issues in the future.

3.8 Changes in income methodology

Each year, minor modifications may be made to the fuel poverty income calculation methodology as a result of improvements in the treatment of missing data, changes in the benefit and tax system and minor alterations to the EHCS/EHS interview survey. Selected years have also undergone larger methodology changes to the income calculation assumptions which is the focus of this section. For the 2014 statistics there were no significant changes to the methodology used for the calculation of household income.

Fuel poverty incomes were originally calculated for the 1996 statistics and a very similar methodology was followed for the 2001 statistics. Ahead of the production of the 2003 figures, the Department of Trade and Industry (responsible at the time for publishing fuel poverty statistics) commissioned a consultation to discuss proposed changes to the fuel poverty income methodology. This resulted in three initial changes to the calculation of household incomes, all of which came about due to additional information being collected in the EHCS interview survey. This updated method was first used to calculate the 2003 fuel poverty figures. Headline figures for 1996, 1998 and 2001 were also revised to adopt the new methodology. Further changes have taken place as a result of continual review of improvements towards data quality and substantial changes to the interview survey as discussed in more detail below.

Other Benefit Unit income (2003)

Prior to the work on the 2003 EHCS data, incomes from other benefit units (i.e. other adult household members who were not part of the same benefit unit as the HRP) were modelled using a correction factor based on the Expenditure and Food Survey (EFS – now the Living Costs and Food Survey). For the 2003 dataset a new method of computing the income of other benefit units was introduced that used data collected in the EHCS interview survey. Questions were asked of the respondent about any state benefits or income received by each of the Other Benefit Units and these were used to derive the income of Other Benefit Units.

Council Tax Deduction and Council Tax Benefit (2003)

Net Council Tax liability was not included in the fuel poverty Full Income definition prior to the 2003 EHCS data. From 2003, Council Tax payments (net of Council Tax benefit) were deducted from the fuel poverty Full Income. This was in order to be consistent with the Government's official Households Below Average Income (HBAI) measure and to ensure consistency within the income definitions (i.e. for full income, including both the payment of Council Tax, and the benefit received to help pay it; for basic income excluding both the payment and the benefit).

Low Income Imputation (2006)

3. How is household income modelled?

In 2004, alongside and in support of the fuel poverty consultation, an independent review¹¹ of the fuel poverty methodology took place. In the peer review it was recommended that the treatment of very low household incomes on the EHCS should be investigated with the view to possibly amending the methodology to match more closely that of the Family Resources Survey (FRS), a dedicated income survey. The FRS does not impute very low incomes but leaves them on the dataset, including negative income amounts (e.g. a self-employed person who has made a loss in the year concerned), whereas the EHCS (at the time of the review) uplifted all households that were on a low income up to at least their basic income support entitlement.

Following an extensive income review by BRE and the Fuel Poverty Methodology Group (FPMG) a new low income method was decided upon and endorsed by the FPMG. The new method was first adopted for the 2006 fuel poverty calculations, whereby only the household composition categories adults over pension age and lone parents are subject to the low income imputation (see details above).

Housing Benefit (2007)

In the 2007 EHCS interview survey, the Rent and Housing benefit module of the interview survey was extensively revised leading to a more comprehensive set of questions on rent and housing benefit. The 2007 fuel poverty calculations were adjusted to incorporate these interview survey changes. As a result, the housing benefit amount assigned to applicable households changed from being based on theoretical entitlement to the amount provided by the occupant (where available).

Council Tax Benefit (2007)

Also in the 2007 EHCS, the method used for calculating levels of Council Tax benefit was improved due to increased data quality in this area. Prior to 2007, the level of Council Tax benefit assigned to a household was based on theoretical entitlement to this benefit. In 2007, the methodology was improved to allow use of the reported receipt of Council Tax benefit receipt where provided.

Savings/Investment Income (2007)

In the 2007 EHCS interview survey, the questions asked about savings/investment were adjusted to include more detail about savings/investment above £50,000. Questions on the savings of the HRP and partner were asked in banded savings amounts. Prior to 2007, the top savings band was £50,000 or over. For the purposes of fuel poverty income calculations it was assumed that this represented a level of savings of £55,000. In the 2007 EHCS interview survey, the following additional bands were added: a) £50,000-£99,999; b) £100,000-£149,999; and c) £150,000 or over. For the purposes of fuel poverty, the income methodology assumes levels of savings of a) £75,000, b) £125,000 and c) £175,000 respectively.

¹¹ Sefton, T and Chesshire, J. Peer Review of the methodology for calculating the number of households in fuel poverty in England.
<http://webarchive.nationalarchives.gov.uk/20070603164510/http://www.dti.gov.uk/files/file16566.pdf>

Other Benefit Unit income (2008)

In April 2008, the English House Condition Survey (EHCS) merged with the Survey of English Housing (SEH) to create the English Housing Survey (EHS) leading to further changes in the 2008 interview survey. The main change relevant to the fuel poverty income due to the move to the EHS was the way income information is collected for additional adult household members.

Prior to the 2008 survey, there was an income module in the interview survey on Other Benefit Units that collected income and benefit information at the Benefit Unit level on other adult members living within the household (who were not part of the same benefit unit as the HRP). This information was used to compute the income of Other Benefit Units and missing values were imputed via two different methods based on working status. If an adult member of the Other Benefit Unit was working, then income data from ASHE was used to impute an income value based on full-time/part-time, age and sex. If no additional adults in the Other Benefit Unit were working then the income of the Other Benefit Unit was imputed to their theoretical income support entitlement.

In 2008, the Other Benefit Unit income section was removed from the EHS interview survey. The required information was collected differently via questions asked of all household members aged 16 or over. Additional adult incomes can be extracted from these data and the 2008 fuel poverty income methodology was revised to incorporate the additional adult income survey changes. The method of imputing missing values also changed to hot-decking (for more detail see Section 3.4) to capture the variability found in actual income data on additional adults.

Savings Routine (2008)

Prior to 2008, the addition of income from savings/investment was the last step in calculating the Primary Benefit Unit income (that of the HRP and Partner). This changed in 2008 and the routine is now performed before the low income imputation so that the amount of income from savings/investment can be added onto the net private and benefit income of the HRP and any partner before the low income assessment. This change was added as an improvement to the income methodology to ensure that the income of lone parents and pensioners are not imputed in the low income imputation routine if they have sufficient savings/investment to put them above the low income threshold.

Earnings from other work (2008)

Prior to 2008, in the EHCS interview survey in addition to the income category 'Earnings from main job' there was also an income category called 'Earnings from other work'. From the 2008 survey year onwards, the EHCS category 'Earnings from other work' was removed from the survey and the employment income category broadened from applying to the main job only (under the EHCS) to a general 'Earnings from employment' category under the EHS. From 2008 onwards earnings from other work is likely to be recorded under the category 'Earnings from employment' or the category 'Other sources'.

Housing Benefit (2013)

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For the 2013 modelling of EHS data, the theoretical entitlement to partial housing related benefits includes the modelling of the under occupation charge for working-age social tenants (Removal of Spare Room Subsidy) as introduced by Government in April 2013.

Council Tax Support (2013)

In April 2013 Council Tax Support (CTS) replaced Council Tax Benefit (CTB). Across all Local Authorities (LA), support for pensioners remained the same as under the old CTB scheme. Therefore no changes have been made to the calculation of theoretical partial CTS for pensioners in 2013. Different LA's adopted different approaches to the CTS scheme but it is not feasible to model each scheme on the EHS data. Generally, across the majority of Local Authorities, the support for working age claimants was cut compared to the old CTB scheme. For 2013 and subsequent modelling, a blanket factor of 0.85 was applied to reduce the theoretical partial CTS entitlement for working age claimants for all Local Authorities. This factor was derived by simulating theoretical CTS entitlement on EHS 2012 data and matching it to research undertaken on CTS reductions by the JRF (<http://www.jrf.org.uk/sites/files/jrf/council-tax-support-summary.pdf>).

4. How are household energy requirements calculated?

4.1 Overview

The amount of fuel required to provide the energy needs of each household is one of the components of fuel poverty and, combined with fuel prices, produces the modelled fuel bill.

Under the fuel poverty definition, the energy required to heat and power a home includes energy for

- i) Space heating - E_S (GJ).
- ii) Water heating - E_W (GJ).
- iii) Lights and appliances - E_{LA} (GJ).
- iv) Cooking - E_C (GJ).

A BREDEM methodology¹² is used to predict the energy requirements of a household where:

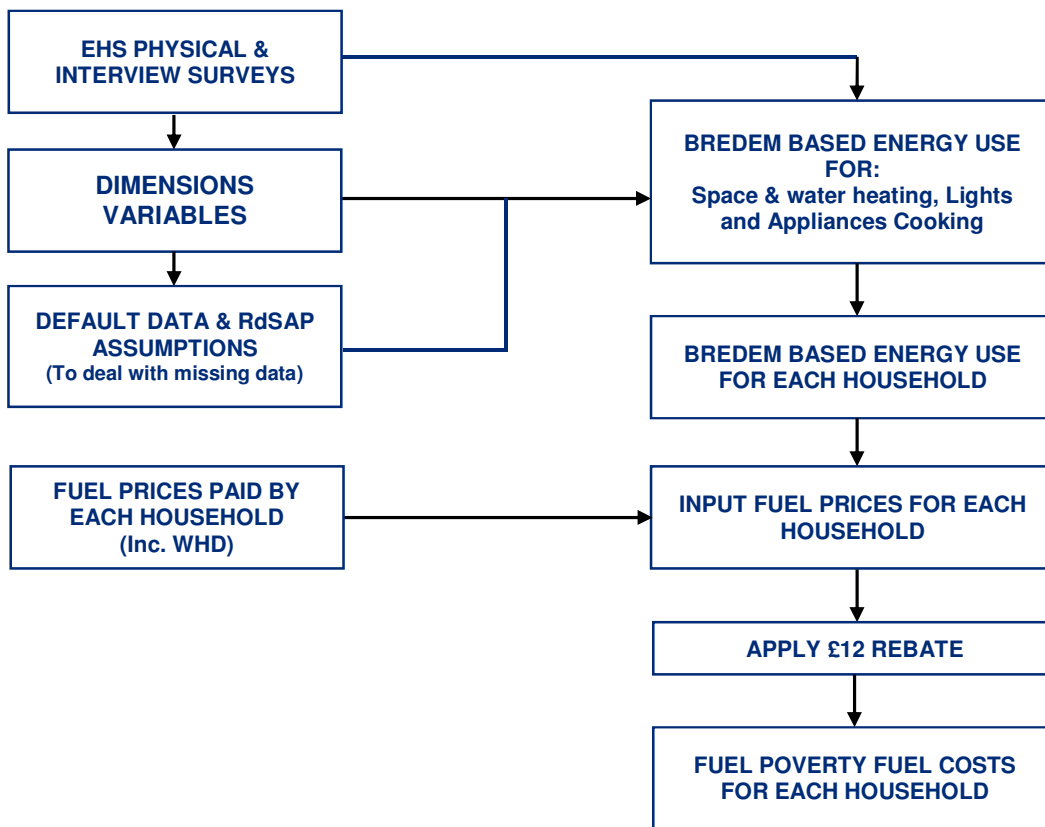
$$\text{Total household fuel requirements} = E_S + E_W + E_{LA} + E_C$$

Total household energy requirements include space and water heating (to meet defined standards) and energy for lights, appliances and cooking. The amount of energy required to heat a dwelling will depend on the building specification such as insulation levels, heating systems, the geographical location of the dwelling, and construction type. A household's demand for energy will depend on the number of people within the household and the lifestyle and habits of these individuals. Information from the EHS is used to provide details about both dwellings and households. The calculation process is

¹² The BREDEM methodology used for the 2014 data, and the 2013 timeseries is described in Henderson J, Hart J, BREDEM 2012 A technical description of the BRE Domestic Energy Model, v1.1, January 2015. <http://www.bre.co.uk/filelibrary/bredem/BREDEM-2012-specification.pdf>

summarised in Figure 4 below. Reduced Data SAP (RdSAP) assumptions can be found in the SAP procedure document¹³.

Figure 4: Calculating household energy requirements and associated fuel costs



The calculation method for each component of household energy requirements are aligned with standard energy models such as the SAP¹⁴ for calculating energy requirements in

¹³ BRE 2012. The Government's Standard Assessment Procedure for energy rating of dwellings: 2012 edition. http://www.bre.co.uk/filelibrary/SAP/2012/SAP-2012_9-92.pdf

¹⁴ BRE 2012. The Government's Standard Assessment Procedure for energy rating of dwellings: 2012 edition.

dwelling and the more general model from which SAP is derived (BRE Domestic Energy Model - BREDEM).

4.2 Dimensions calculation for energy requirements

Data from the EHS physical survey are used to calculate the dimensions of the dwelling and, in particular, the heated volume and heat loss areas. This involves utilising data from many different modules that relate to different parts of the EHS physical survey form. The following information is calculated:

- Internal & external wall areas
- Roof area
- Room specific floor areas
- Habitable floor area and footprint area¹⁵
- Perimeter of building
- Ceiling height
- Window areas
- Number of floors and rooms in a dwelling

Key variables are the width and depth of the main and additional parts of the dwelling, which are directly collected in the EHS physical survey. These are used to determine the area (m²) of each floor. All physical data relating to the dwelling must have a value for the width and depth of the building to be considered part of the main data set. The EHS survey form only has space to include the widths and depths of three levels, so the dimensions of any further levels are imputed. They are assumed to be the same size as the floor below, with the exception of any attics, which are assumed to be half the size of the floor below, and basements, which are assumed to be the same size as the floor above. In general, wherever possible, imputations are based on the case in question, not on stereotypes or on the rest of the data set.

4.3 Dwelling energy requirements

The calculation of energy requirements for fuel poverty requires information from both the physical and interview surveys and the dimensions data to derive the following:

- Heat loss due to conduction from all the external house structure to the external environment, for example heat lost through the walls or roof.
- Heat gain from solar fluxes and other gains such as from lights and appliances and occupants.
- Heat loss due to ventilation.
- Energy required for space and water heating systems.

¹⁵ Footprint area is the area of the dwelling in contact with the ground at ground floor level.

- Heating regime of the inhabitants (the details of which will be developed below).
- Energy required for lights, appliances and cooking.
- Electricity generation from renewable technologies (photovoltaics and micro generation wind turbines).

This information is calculated using data collected from the interview and physical surveys, as outlined in Sections 4.4 to 4.7.

4.4 Space heating and definition of heating regime

The amount of energy required for space heating is estimated using the BREDEM algorithm. The 2014 statistics, and the timeseries produced alongside the 2013 statistics, use version 1.1 of the BREDEM 2012 methodology for the energy calculations¹⁶.

BREDEM requires the geographical location of a dwelling and the specification of a heating regime (that defines an acceptable level of heating). An acceptable level of heating is defined in terms of the temperature of a dwelling, the extent to which the dwelling space is heated and the number of hours that the occupants spend within the dwelling and require heating.

Geographical Location

BREDEM 2012 defines twelve geographical regions for England. These BREDEM regions define average climatic conditions such as temperature, solar flux (i.e. heat gains from the sun) and wind-speed. Each dwelling in the EHS has a geographical identifier that can be used to determine in which BREDEM region the property is located.

Demand Temperature

BREDEM 2012 suggests that (generally) a house can be split into three distinct zones: a primary heated zone, secondary heated zone and unheated zone. For the modelling of fuel poverty, the demand temperature of all dwellings within the primary zone is assumed to be 21 °C, the secondary zone is assumed to be heated to 18 °C and the temperature of the unheated zone relates to the external temperature and therefore varies depending on the local climatic conditions.

Extent of Heating

Some dwellings are considered excessive in size for the number of occupants that live there. In these cases, the house is assumed to be “under-occupied”, that is only a proportion of the dwelling will need heating. In order for a dwelling to be considered under-occupied it must fulfil the criteria that depend on both the number of bedrooms in a dwelling and the total floor area of the dwelling. These criteria are described in more detail below.

¹⁶ Henderson J, Hart J, BREDEM 2012 A technical description of the BRE Domestic Energy Model, v1.1, January 2015, <http://www.bre.co.uk/filelibrary/bredem/BREDEM-2012-specification.pdf>

A dwelling is considered to have surplus bedrooms if there are one or more extra bedrooms than required for homes without dependent children (children under 18 years); or there are two or more extra bedrooms than required for homes with dependent children.

The number of bedrooms required depends on the household constitution. The standard states that a bedroom is required for each couple, children of different sexes below the age of 11 years can share a room, children/adolescents below the age of 21 years of the same sex can share a room.

There is surplus floor area in a property if the floor area of the property is over double that considered to be the “standard” living area required for the number of occupants, as defined by the Parker-Morris Standard¹⁷. This standard is defined as in Table 2 below.

Table 2: Parker Morris Standard

Occupants	Standard living area required (m ²)
1	33.0
2	48.5
3	61.0
4	79.0
5	89.5
6	97.0
7	114.5
8	128.0
9	140.0

For the purposes of fuel poverty, a dwelling is considered to be under-occupied if there are both surplus bedrooms and surplus floor area.

If a dwelling is under-occupied then it is assumed that approximately half of the dwelling is heated, that is:

$$A_{heated} = 0.5 * A$$

Where A is the total floor area of the dwelling.

Heating Regimes

The heating season is defined as the months of October to May, in line with the SAP methodology. The regimes that are applied during the heating season are described below.

A standard heating regime assumes that the occupants are not occupying the dwelling during normal working hours. In this case it is assumed that the occupant heats the

¹⁷ “Homes for today and tomorrow”, Department of the Environment, HMSO 1961.

dwelling for two hours first thing in the morning and then for seven hours from late afternoon. During the weekend it is assumed that the property is heated throughout the day for 16 hours. The SAP methodology also makes this assumption to calculate the energy requirements in a dwelling.

This heating pattern does not apply for large sectors of the population, in particular the vulnerable such as the elderly and those caring for young children. From 2001, the EHS interview survey included a direct question to ask whether anybody within the household occupied the dwelling during the morning or afternoon. This question is directly utilised to approximate the heating pattern. If anybody is in the house in either the morning or afternoon during weekdays, the house is assumed to require all day heating. In these cases all day heating is assumed throughout the week as well as the weekend.

In dwellings that are under occupied, it is assumed that some of the rooms in the dwelling are not heated and a “half-house” heating regime is applied. For example, where a single person occupies a four bedroom house, it would be assumed that some of the bedrooms are not heated.

The following heating regimes are defined and used to calculate the energy requirements of a household:

Table 3: The standard heating regime for the fuel poverty heating calculations

	Details of STANDARD heating regime
Heating Pattern	Weekday 9 hours of heating Weekend 16 hours of heating
Heating Extent	Whole house
Demand Temperature	Primary living zone 21 °C Secondary living zone 18 °C

Table 4: The full heating regime for the fuel poverty heating calculations

	Details of FULL heating regime
Heating Pattern	Weekday 16 hours of heating Weekend 16 hours of heating
Heating Extent	Whole house
Demand Temperature	Primary living zone 21 °C Secondary living zone 18 °C

Table 5: The partial standard heating regime for the fuel poverty heating calculations

	Details of PARTIAL STANDARD heating regime
Heating Pattern	Weekday 9 hours of heating Weekend 16 hours of heating
Heating Extent	Half house
Demand Temperature	Primary living zone 21 °C Secondary living zone 18 °C

Table 6: The partial full heating regime for the fuel poverty heating calculations

	Details of PARTIAL FULL heating regime
Heating Pattern	Weekday 16 hours of heating Weekend 16 hours of heating
Heating Extent	Half house
Demand Temperature	Primary living zone 21 °C Secondary living zone 18 °C

Having defined the heating regime used by each household, the energy requirements for space heating can be approximated using BREDEM, which calculates the energy required to bring each dwelling to the designated temperatures for a set period of time each day and across the year. This calculation incorporates details about the heating systems, applied insulation and dwelling construction and materials.

4.5 Water heating

Energy demand for water heating Q_U is the energy required to heat the volume of water needed for baths, showers and other uses. The detailed equations are presented in the BREDEM 2012 documentation¹⁸.

Most methods of water heating involve energy losses that relate to storing the water in hot water tanks and distribution losses. Therefore, the total water energy demand must satisfy the hot water requirements and account for the energy losses inherently involved in satisfying the supply required. Hot water storage losses are mostly influenced by tank insulation and tank volume.

The energy required for water heating E_w (GJ/yr) is given as:

¹⁸ Henderson J, Hart J, BREDEM 2012 A technical description of the BRE Domestic Energy Model, v1.1, January 2015, <http://www.bre.co.uk/filelibrary/bredem/BREDEM-2012-specification.pdf>

$$E_W = (kQ_U + Q_{Loss} - Q_S)/\varepsilon W$$

Where Q_{Loss} are losses through water storage/distribution, Q_S is solar hot water heating, εW is the efficiency of the water heater and k is a constant.

4.6 Lights and appliance requirements

Energy demand for electricity E_{LA} (GJ/yr) includes lights, appliances, pumps, fans and electric showers, less the electricity generated by renewable electricity sources such as photovoltaics and wind turbines (where applicable). The algorithm for lighting energy requirements includes provision for low energy lighting. The full equations can be found in the BREDEM 2012 documentation.

4.7 Cooking energy requirements

Energy demand for cooking is given as E_K (GJ/yr) and is a function of household size:

$$E_C = f_{gas}(1.7316 + 0.3456N) + f_{electricity}(0.990 + 0.1198N)$$

Where f_{gas} and $f_{electricity}$ are the proportions of demand satisfied from gas or electric cooking, respectively, and N is the number of people in the household.

Where both gas and electricity are present in a dwelling it is assumed that the proportion of gas and electrical energy demanded for cooking is split equally. Consequently, in this case $f_{gas} = 0.5$ and $f_{electricity} = 0.5$.

Where a gas connection is present (i.e. a gas meter is identified by the surveyor), but no gas space or water heating appliances are present, it is assumed that the gas connection is not in use. In these cases 100% of energy demand for cooking is assumed to be met by electricity. No gas standing charge will be applied in the final calculation of fuel cost. The full equations can be found in the BREDEM 2012 documentation.

4.8 Energy costs

Total energy requirements are given as:

$$Total\ energy\ requirements\ (GJ/yr) = E_S + E_W + E_{LA} + E_C$$

Where:

E_S : Energy for space heating;

E_W : Energy for water heating;

E_{LA} : Energy required for lights and appliances;

E_C : Energy required for cooking.

The total number of units required under each of the components of energy use, is multiplied by the unit cost for the fuel used. Each survey case is unique, with the appropriate fuel prices being applied based on the type of fuel given for each component of energy use. In the fuel poverty datasets, standing charges have then been assigned to the most appropriate component of energy cost, as follows:

- **Energy cost for space heating (\pounds_s) includes cost of space heating (units consumed * unit cost) and:**
 - The gas standing charge if gas is present.
 - Standing charges associated with communal systems or other fuels.
 - Standing charges from off-peak electricity tariffs, above the standard rate charge.
- **Energy cost for lights and appliances (\pounds_{LA}) includes the cost of lights and appliances (units consumed * unit cost) and:**
 - The standard electricity charge, not related specifically to heating.
 - The Warm Homes Discount (WHD) rebate if applicable.
 - The £12 Government Electricity Rebate (to all homes in the 2014 half of the dataset).

Due to the simplified way of assigning standing charges to the energy costs, this may result in a few cases where a standing charge is assigned to space heating despite the fuel not being used in this way. For example, households with a gas space heating cost but no gas space heating usage can be due to the standing charge allocated to the space heating costs arising from a gas-based water heating system. Households with an off peak electric tariff, which do not use electric for their space heating, can also show this type of anomaly.

$$\text{Total energy cost } (\pounds) = \pounds_s + \pounds_W + \pounds_{LA} + \pounds_c$$

Where:

\pounds_s : Energy cost for space heating (including standing charges where appropriate);

\pounds_W : Energy cost for water heating;

\pounds_{LA} : Energy cost for lights and appliances (including standing charges, Warm Homes Discount and £12 rebate where appropriate);

\pounds_C : Energy cost for cooking

4.9 Space and water heating systems

Information relating to the heating systems assigned for each dwelling is taken directly from the information collected on the EHS physical survey. The primary heating group, fuel and type are essential for the allocation of the primary heating system and the calculation of energy use for each household. In cases where primary data are missing for the heating systems, information from 'other heating' (secondary heating) is used in its place according to the SAP methodology. System efficiencies are determined from SAP. Heating system boiler efficiencies can also be assigned from the SAP products characterisation database¹⁹ in cases where boiler manufacturer and model details have been completed by the surveyor. SAP efficiencies are used in all other cases.

Information relating to the presence and specification of the water heating system is also obtained from the EHS physical survey. In the majority of cases, the hot water is heated via the space heating system and, where this is the case, the space heating specification will be applied.

4.10 Handling missing values

Alteration to the dwelling data

When performing detailed checks on the outputs, there are cases that are flagged where values recorded on the physical survey form are deemed implausible and require alteration to the raw data within the energy modelling process. Each case is assessed on a case-by-case basis using other information from the survey form in order to apply the appropriate action for the data to be processed correctly.

Missing dwelling data

Most of the data required to calculate the energy requirements of the household are available from the EHS survey. Where there are missing data items, these are dealt with in accordance with RdSAP assumptions for existing buildings as specified in Appendix S of the SAP 2012 booklet. The exception is missing loft insulation where the occupant has access to the loft space. Loft insulation is assigned using the mean value for dwellings of that age and tenure using what is referred to as 'default data'. This data are constructed using national averages from the EHS.

Missing household data

The number of occupants living in a dwelling and the composition of the household is provided in the interview survey. Data are required for each individual household. If this information is not available then the property is considered to be vacant – the dwelling will not be included for fuel poverty calculations and can be ignored.

¹⁹ SAP products characterisations database, <http://www.ncm-pcdb.org.uk/sap/pcdbsearch.jsp?pid=26>

Validation

Validation of the energy requirements and cost outputs is an important process in the delivery of reliable results. The level of validation applied will depend on the level of accuracy quoted, the significance of the indicator, the type of result quoted and the resource provided for the task. Several layers of data validation are applied to the fuel poverty energy use and cost variables. These include cross checking from an independent member of staff, time series analysis, interrogation of important metrics, and comparing results against external data sources such as Citizens Advice Bureau²⁰ for fuel prices and the Digest of UK Energy Statistics (DUKES)²¹ for energy use.

Outliers

Outlying cases are identified in the data and validated to ensure that the data modelling processes is being performed correctly. In rare cases where the data are deemed to require modification, the fuel costs are imputed based on the median value from a group with similar characteristics (grouped according to dwelling type and main heating fuel category).

4.11 The version of the dwelling calculation procedure

The Building Research Establishment Domestic Energy Model (BREDEM) is the calculation procedure used for modelling energy requirements in dwellings for fuel poverty. It was first developed in the early 1980s and has been continuously updated as a result of changes to our understanding of dwelling energy requirements and the use of energy in the national housing stocks.

The latest version of BREDEM 2012, version 1.1²², is used for both years in the combined 2014 dataset, and all of the timeseries data published alongside the 2013 dataset. All data are, therefore, on as comparable methodology as possible to allow comparison between years and assist interpretation of the data.

4.12 Changes in energy modelling methodology

Each year, minor modifications may be made to the fuel poverty energy modelling calculations as a result of improvements in the treatment of the data, changes to the modelling methodology, and alterations to the EHS physical survey data collection. In some years more major methodology changes have been implemented.

²⁰ These data have formerly been produced by EnergyWatch, Consumer Focus and Consumer Futures. Consumer Futures became part of Citizens Advice in 2014.

²¹ DUKES, Digest of United Kingdom Energy Statistics: <https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/digest-of-uk-energy-statistics-dukes>

²² Henderson J, Hart J, BREDEM 2012 A technical description of the BRE Domestic Energy Model, v1.1, January 2015, <http://www.bre.co.uk/filelibrary/bredem/BREDEM-2012-specification.pdf>

In 2014, a small number of minor form changes to the EHS physical survey were incorporated into the fuel poverty energy modelling. These had a very small effect on the overall household energy requirements.

5. How are energy prices calculated?

5.1 Overview

The fuel price element of the fuel poverty calculation produces fuel prices which can readily be combined with household energy requirement outputs to produce fuel costs (see Section 5.2).

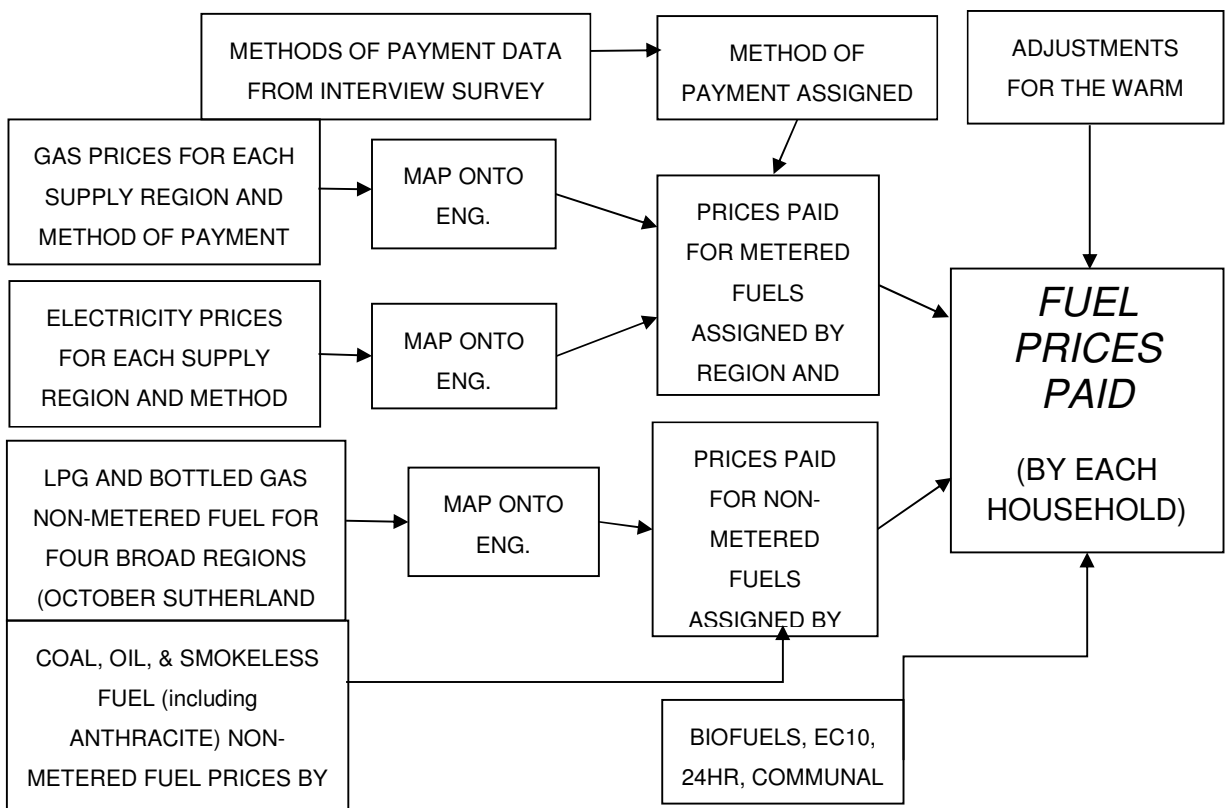
The price each household pays for its fuel depends on four main factors:

- The households location within the country (as fuel prices vary regionally).
- The choice of supplier.
- The choice of tariff.
- The method of payment where relevant, i.e. payment by direct debit, standard credit or pre-payment meter (PPM).

Information on the exact tariff, or the supplier, is not collected in the EHS. The survey does however collect information on the geographical location of each case and on the method of payment for metered fuels (i.e. gas and electricity). Therefore, this allows the application of an average fuel price for each region and method of payment. Fuel prices specific to each household are thus calculated.

The process involved is shown as a flowchart in Figure 5.

Figure 5: Process of calculating energy prices



5.2 Data sources

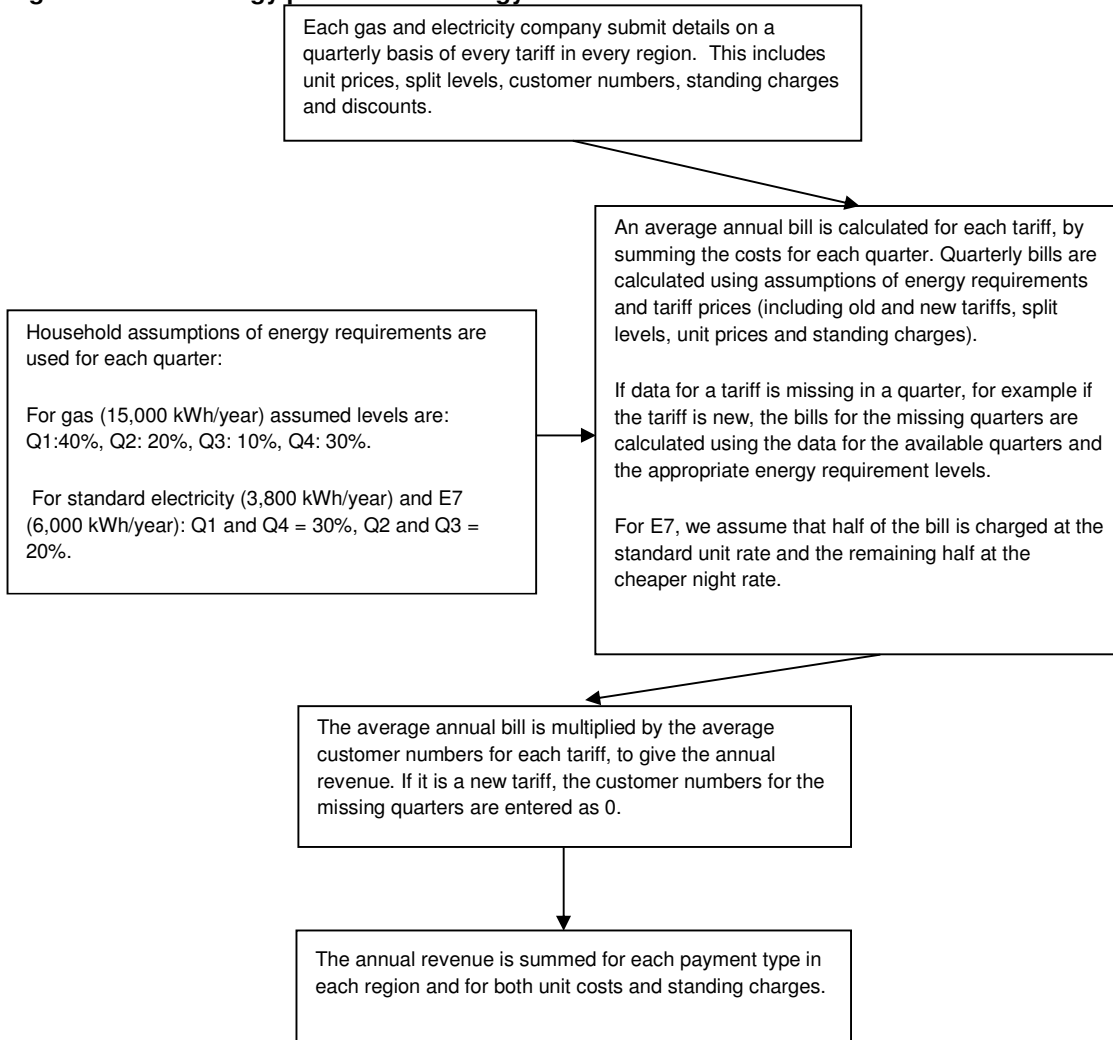
Metered Fuels (Electricity and Gas)

DECC provides average annual prices (on a calendar year basis) for gas, standard electricity and off-peak E7 (Economy 7) electricity²³. All prices are split by electricity supply regions (PESs) for use in the 2014 statistics. Prices are further split by three types of payment (direct debit, standard credit and pre-payment). The prices used to provide initial fuel prices are those excluding any social tariffs (i.e. the Warm Homes Discount legacy tariffs). These tariffs are accounted for later in the modelling (see Section 5.5 on Applying the Warm Homes Discount). The method employed by the DECC to produce their energy prices is outlined in the flowchart in Figure 6.²⁴

²³ The metered fuel price data used in the fuel poverty calculations are derived from the DECC quarterly energy prices: <https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/quarterly-energy-prices>

²⁴ DECC energy prices methodology: <https://www.gov.uk/government/publications/domestic-energy-prices-data-sources-and-methodology>

Figure 6: DECC energy prices methodology



An example of this data can be found in Table 7 below.²⁵

²⁵ Annual domestic energy costs: <https://www.gov.uk/government/statistical-data-sets/annual-domestic-energy-price-statistics>

Table 7: Example of Electricity Average Unit Price and Average Fixed Costs (Standing Charge)

Region	Average Unit Price (p/kWh):			Average fixed costs (p/year):		
	Credit	Direct Debit	PPM	Credit	Direct Debit	PPM
East Midlands	13.71	12.86	13.82	8,418	6,195	8,297
Eastern	13.70	12.84	13.83	8,511	6,275	8,309
London	14.29	13.18	14.36	7,605	6,546	7,635
Merseyside & North Wales	15.45	14.29	15.31	8,632	6,898	8,620
North East	14.63	13.18	14.50	7,150	6,201	7,477
North West	14.48	13.56	14.57	8,321	6,311	8,146
South East	14.29	13.27	14.39	7,846	6,552	7,834
South West	15.22	14.21	15.30	7,731	6,401	7,869
Southern	14.04	13.29	14.15	8,881	6,326	8,786
West Midlands	14.69	13.14	14.52	7,154	6,125	7,527
Yorkshire	14.52	12.93	14.29	7,041	6,122	7,453

The price of Economy 10 and 24 hour electricity are the SAP 2012 prices, inflated to 2013 and 2014 prices using the Consumer Price Index for electricity.

Non-Metered Fuels (e.g. Coal, LPG, Fuel Oil)

The prices paid for LPG and bottled gas (non-metered fuels) are taken from the Sutherland Tables (see: <http://www.sutherlandtables.co.uk/>). These are independently produced reports which provide the average prices paid for fuels, split into four broad geographical regions. The reports are published twice yearly; once in May and once in October.

For fuel poverty calculations the October Sutherland Tables prices are used for the survey year. The prices produced by Sutherland are taken from a sample of prices collected over the preceding six months.

Prices for heating oil, coal and smokeless fuel (including anthracite) are currently obtained from the Consumer Price Index (CPI), produced by the Office for National Statistics. These prices have been split by English Region and represent a 12 month average over the calendar year for each fuel.

Other minor non-metered fuels

The price of wood and other biofuels are based on SAP 2012 prices, which are inflated from 2012 prices using the change in the Consumer Price Index for coal from this date. The price of communal heat is calculated using SAP 2012 communal prices, inflated using the Consumer Price Index for gas.

5.3 Methods of payment data

The methods of payment are collected for gas and electricity only. Each household is asked in the interview survey how they pay for their electricity and gas. For each fuel they have the option of:

- (1) Direct debit (including online direct debit).
- (2) Payment on receipt of bill by post, telephone, online or at bank/post office.
- (3) OPTION 3 IS BLANK²⁶
- (4) Pre-payment (keycard, slot or token) meters
- (5) Included in rent
- (6) Frequent cash payment method (i.e. more frequent than once a month)
- (7) Fuel direct/direct from benefits
- (8) Fixed Annual Bill (however much gas/electricity is used) e.g. StayWarm
- (9) Other (Please specify)
- (88) Not applicable
- (99) Don't know (spontaneous only)

There are more methods of payment collected in the EHS survey than the three methods of payment attached to the prices provided by DECC (see Section 5.1). Therefore assumptions are made in order to assign each household a method of payment. The current assumptions are as follows:

- Those stating 'direct debit', 'included in rent', 'fuel direct/direct from benefits' or 'fixed annual bill (e.g. StayWarm)' are coded as Direct Debit.
- Those stating 'payment on receipt of bill' and 'frequent cash payment method (more than once a month)' are coded as Standard Credit.
- Those stating 'pre-payment (key card or token) meters' are coded as Pre-Payment.

For those coded as 'other', and where a description is provided, the most suitable method of payment is assigned for each fuel.

After this process there may be a small number of cases without a method of payment (i.e. those who have said they don't know or "other" and where the description is missing or insufficient). For these cases standard credit is applied.

²⁶ Prior to the 2011 EHS, option 3 for the method of payment was for a monthly/quarterly bill. When this was removed, option 3 was left blank.

5.4 Mapping the fuel prices of each household

In addition to matching each household to a fuel based on the method of payment, the household must also be assigned a price based on its location within the country. The EHS collects information on which English Region each household is in, however the English Regions do not correspond with the electricity supply regions, gas distribution zones or Sutherland Table regions.

The fuel prices for each supply/distribution/Sutherland region are matched with the English Region using a geographical matching technique. This is based upon estimates of the proportion of each English Region within each supply region or distribution zone, as shown in Table 8.

Table 8. Mapping technique for gas, electricity and non-metered fuels.

EHS boundary		Electricity/gas boundary
North East	Mapped To	North Eastern
Yorkshire & Humberside		(0.48) North Eastern + (0.52) Yorkshire
North West & Merseyside		(0.7) North Western + (0.3) N. Wales and Merseyside
East Midlands		East Midlands
West Midlands		(0.875) West Midlands + (0.125) East Midlands
South West		(0.7) South Western + (0.3) Southern
Eastern		Eastern
South East		(0.55) South Eastern + (0.4) Southern + (0.05) Eastern
London		London
EHS boundary		
North East		(0.95) Northern England + (0.025) Midlands + (0.025)
Yorkshire & Humberside		

North West & Merseyside		Wales and South West
East Midlands		(0.92) Midlands + (0.08) Northern England
West Midlands		
South West		(0.97) Wales and South West + (0.03) Midlands
Eastern		(0.95) South East + (0.05) Midlands
South East		
London		

For example, if a household's English Region lies 40% within one supply region and 60% within another supply region the price applied will be a 40/60 weighted average of the two prices. This approach assumes a uniform population density across England.

The prices of biofuels, Economy 10 electricity, 24hr electricity, communal from boilers and communal from Combined Heat and Power (CHP) are calculated on a national scale so no regional mapping is necessary. Prices for heating oil, coal and smokeless fuel are provided by English Region and therefore do not require mapping.

5.5 Applying the Warm Homes Discount (Legacy Tariffs and Core/Broader group)

The metered fuel prices used in the initial assignment of tariffs to households are the average prices for each region without any element of the Warm Homes Discount (WHD) applied. It is important, however, that the Legacy Tariff and Core/Broader group aspects of these policies are accounted for in the fuel poverty statistics. To achieve this, some final adjustments are made to the dataset which act to reduce the prices or total energy costs for those households considered likely to be in receipt of the WHD. The total number of tariffs applied in this process is set to be equal to the total number of households in receipt of support through these elements of the WHD scheme, as reported by Ofgem.

Information on eligibility for each element of the WHD is also provided by Ofgem to allow the assignment of tariffs. There are, however, more households theoretically eligible for this scheme than actually in receipt of these tariffs. Therefore, a process of repeated sampling from the pool of eligible households, and selection of a representative iteration is undertaken (i.e. through Monte-Carlo type simulation).

The process of assigning the WHD is as follows:

- a) Details of the number of households in receipt of each component of the WHD are provided by Ofgem (for the Legacy Tariffs component, this includes the level of associated discount, split by each method of payment).
- b) Details of eligibility for each element of the WHD are provided by Ofgem, and flags created in the EHS dataset.
- c) A series of runs are made, sampling from the pool of eligible households, which reduces the tariffs for those eligible for Legacy Tariffs, or subtracts the WHD cash amount (i.e. £135 for 2013-14 data and £140 for the 2014-15 data) from the final costs for those in the Core or Broader Groups. The number of households in receipt of each element of the WHD is used to constrain this modelling.
- d) A representative iteration is selected from all runs.

The representative iteration is selected as the run showing the least variation from the average (median) of all runs. This is done by examining the variation of each run from the median level of fuel poverty split by income decile, tenure, region, age of oldest person in household, method of payment for gas and vulnerability.

The WHD has been applied for all years from 2011 to 2014, although for the 2010 single year data, this process was applied to the precursors to the WHD policies – i.e. Social Tariffs and the £80 electricity rebate.

A final adjustment to the final bill, for the 2014 half of the combined dataset, is the assignment of the £12 electricity rebate to all households (which is subtracted from their energy costs). This was not available to households prior to 2014.

5.6 Changes in Prices Methodology

Each year, minor modifications may be made to the fuel poverty fuel price calculation methodology as a result of improvements in the treatment of missing data, alterations or additions to fuels used, and updates and changes to the EHS survey questions or other data sources.

In 2014, new fuel categories were added into the fuel price calculations. This follows the addition of 'Biomass' fuel options for heating on the EHS form, allowing the distinction between wood chips, wood logs and wood pellets, biogas and biooil.

The inclusion of these new categories is in anticipation of the growing prevalence of heating systems which utilise these fuels.

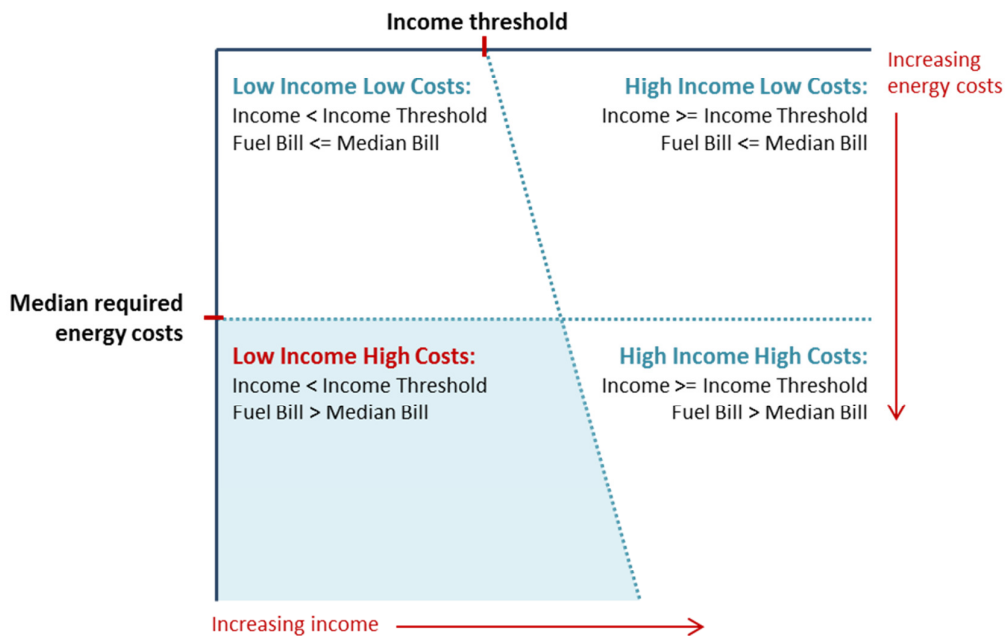
6. Calculating fuel poverty under Low Income High Costs (LIHC)

This chapter describes the method used to identify households living in fuel poverty under the Low Income High Costs (LIHC) indicator. Under this indicator, households are considered to be fuel poor if:

- they have required fuel costs that are above average (the national median level)
- were they to spend that amount, they would be left with a residual income below the official poverty line.

The depth of fuel poverty is defined as the amount by which the assessed energy requirements of fuel poor households exceed the threshold for reasonable costs. This is referred to as the fuel poverty gap. Figure 7 shows the four possible groups a household can fall into under this indicator.

Figure 7: Classifications under the Low Income High Costs matrix



6.1 Calculating the number of households in fuel poverty

The following section describes how to calculate whether a household has a ‘low income’ coupled with ‘high costs’.

Fuel costs threshold

Households with required fuel costs that are above average (the national median level) are calculated by:

1. Taking the required fuel costs for the household from the fuel poverty dataset (the “fuelcost” variable)
2. Applying the corresponding equivalisation factor for each household. These are shown in Table 9 below.

Table 9: Equivalisation factors for fuel costs under the Low Income High Costs indicator

Number of people in the household	Equivalisation factor
One	0.82
Two	1.00
Three	1.07
Four	1.21
Five or more	1.32

3. Dividing the required fuel costs by the equivalisation factor to get the equivalised required fuel costs for that particular household. Equivalising effectively increases the costs of single person households, and decreases the costs of multiple person households, with the aim of making them comparable.
4. To calculate the fuel cost threshold, simply take the weighted median of all of these equivalised required fuel costs.

In other words, half of all households should have “high costs” i.e. above the threshold, and half should have “low costs” i.e. below the threshold.

The threshold for fuel costs is the same for all households.

Fuel cost equivalisation factors

The fuel costs equivalisation factors are not intended to be reviewed on an annual basis. We may, however, consider revisiting them periodically in the future to ensure they do not become dated.

The fuel costs equivalisation factors are based on three years of required fuel cost data from the English Housing Survey (using the 2008, 2009 and 2010 Fuel Poverty datasets). The combined 3 year weights (from the EHS “3yr_weight890” file) were used to arrive at the above set of equivalisation factors.

Median fuel costs for each of the above five household size group from this dataset¹ are calculated. These medians are then indexed to the two-person households.

Note, adults and children are treated equally in the equivalisation of fuel costs - that is, a household with 2 adults and 2 children are treated the same as a household with 4 adults.

¹ Based on the “hhsizex” variable from the EHS interview file.

Household income threshold

Fuel spend leaves the household with a residual income below the official poverty line²⁷.

This is calculated by:

1. Taking the full income for the household from the fuel poverty dataset (the “fpfullinc” variable).
2. Subtracting housing costs from the income to arrive at After Housing Costs (AHC) income. Housing costs consist of:
 - i) Weekly mortgage payments (“mortwkx” variable from the EHS interview file)
 - ii) Weekly rent payments (“rentExS” variable from the EHS interview file). This variable also includes housing benefit. Note, the “rentExS” variable is used rather than the “rentwkx”, as “rentwkx” includes the cost of any services that the household pay alongside their rent. To ensure consistency in reporting only the true housing costs, variable “rentExs” is used.
3. Divide the after housing costs income by the relevant After Housing Costs (AHC) income equivalisation factor. Equivalising effectively increases the incomes of single people, and reduces the incomes of larger households, again with the intention of making them comparable. The equivalisation factors for each person in the household are shown in Table 10 below.

Table 10: After Housing Costs income equivalisation factors for the LIHC indicator

Number of people in the household	After Housing Costs (AHC) income equivalisation factor
First adult in the household	0.58
Subsequent adults (includes partners and children aged 14 or over)	0.42
Children under 14	0.20

4. To calculate the income threshold for each individual household, take the following steps:
 - i) Take the weighted median of all of the AHC, equivalised incomes in the dataset
 - ii) Calculate 60% of this value, to produce the relative low income threshold²⁷.
 - iii) Add on the equivalised required fuel costs of the particular household

²⁷ Relative low income (or poverty) is defined as 60% of the median equivalised disposable income, and is used in official UK statistics. For example:
<https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/articles/persistentpovertyintheukandeu/2014>

The income threshold is therefore higher for households with large costs compared to those with smaller costs. In other words, households with larger costs require a greater level of income to meet this greater cost. As a result, the income threshold will appear as a diagonal line on diagrams of the indicator.

The threshold for income varies by household, depending on the fuel costs of the household.

After Housing Costs (AHC) income equivalisation factors

The AHC income equivalisation factors used are consistent with that used by the DWP in their production of Households Below Average Income (HBAI) statistics. These factors were first devised by the OECD, and are used widely across Europe, including by Eurostat.

Two key elements are needed to derive an individual households equivalisation factor: the number of occupants in the household, and their age (as the OECD scale distinguishes between under and over 14 year olds).

The number of household occupants is taken from the “hhsz” variable (from the EHS “interview file”) and combined with information on the occupants age from the “DVHsz” variable (from the EHS “people” file)¹. The difference in the number of additional adults between “hhsz” and “DVHsz” are assumed to be additional adults who live in halls of residence. These adults are removed from these calculations. The AHC income equivalisation factor therefore, excludes any household members who are living away in halls of residence, making the calculation of AHC income equivalisation factors consistent with fuel costs equivalisation factors, by counting only household members living in the residence.

A worked example of how to arrive at a households AHC income equivalisation factor is given below. Suppose a household consists of the following members:

Household member	Age	Status	AHC equivalisation factors
HRP	54 year old	Lives at home	0.58
HRP partner	52 year old	Lives at home	0.42
Additional adult	21 year old	Lives in halls of residence	0.42
Additional adult	18 year old	Lives in halls of residence	0.42
Additional adult	16 year old	Lives at home	0.42
Child	12 year old	Lives at home	0.20
Total			2.46

Here the:

Hhsz = 4 (excludes the two people living in halls of residence)

DVHsz = 6 (includes the two people living in halls of residence)

The overall equivalisation factor, after accounting for the 2 people living in halls of residence, is given by:

$$\text{AHC income equivalisation factor} = 2.46 - (2 \times 0.42) = 1.62$$

The key assumptions here are:

- i) We assume the difference between the “hhsz” and “DVHsz” is due to people living away in halls of residence; and more crucially
- ii) that all individuals living in halls of residence will be over 14 years old, and so have an equivalisation factor of 0.42 rather than 0.20.

¹ The “hhsz” variable only excludes people living in halls of residence from 2008 onwards, following a change from the EHCS to the EHS. Prior to that, “hhsz” was consistent with “DVHsz”, and so people living in halls of residence were included in our income equivalisation method. There is therefore a small break in the time series between 2007 and 2008.

Summary of income and fuel costs thresholds

Income threshold = 60% of the weighted median for AHC equivalised income, plus the equivalised fuel costs of that household.

Fuel costs threshold = the weighted median for the equivalised fuel costs of all households.

The weighted median equivalised fuel costs and weighted median equivalised AHC income are used to provide averages for all households. The median values are used rather than the mean as the values are not as skewed towards extremes, and as fuel poverty is measured in a relative way, the income and fuel costs are less sensitive to changes across all households using the median values.

Worked example: fuel poverty status

Family composition : lone parent (one adult, one dependent aged >14 years,
one dependent aged <14 years)

Number of people : 3

Fuel costs : £1,601

Total income : £15,596

Housing costs : £96.92 mortgage repayments per week

Equivalised fuel costs = £1,593 / equivalisation factor (1.07)
= £1,497

AHC equivalised income = (income – annual housing costs)/ equivalisation factor
= (£15,596 – 52*£96.92) / (0.58+0.42+0.2)
= £10,555 / 1.2
= £8,797

Here:

Equivalised fuel bill (£1,497) > median fuel costs threshold (£1,239)

ACH equivalised income (£8,797) < income threshold (£12,212 + £1,239 = £13,451)

Therefore the household is considered fuel poor under the LIHC indicator

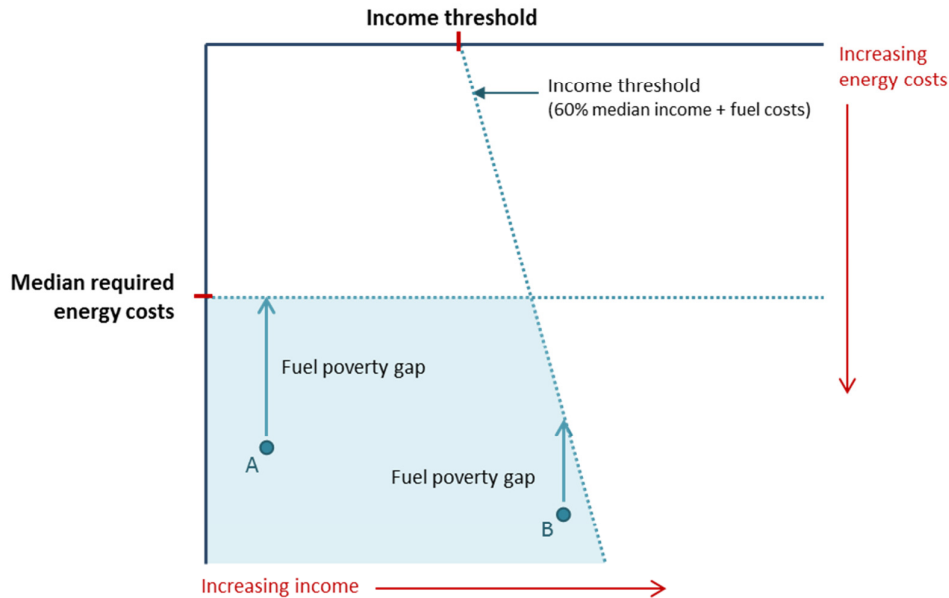
6.2 Calculating the fuel poverty gap

Under the Low Income High Costs indicator of fuel poverty, the depth of fuel poverty is represented by the ‘fuel poverty gap’. This is defined as the amount by which the assessed energy needs of fuel poor households exceed the threshold for reasonable costs.

Figure 8 below shows the overlap between the equivalised AHC household income and the equivalised fuel costs (shaded trapezium area) under which a household is considered

to be fuel poor. The fuel poverty gap for a particular household is the difference between the households required fuel costs and what these fuel costs will need to be for them not to be in fuel poverty. This is shown by the vertical arrows for households A and B below.

Figure 8: Fuel poverty gaps under the Low Income High Costs indicator



Calculating the fuel poverty gap

For fuel poor households, the fuel poverty gap can be generalised as:

$$\text{Fuel poverty gap} = (y - y_m) - \max\{[x - (x_m + y_m)], 0\}$$

Where:

- x = household income
- x_m = 60% of median income
- y = household energy costs
- y_m = median energy costs

From the 2013 fuel poverty dataset:

- 60% of AHC median income = £12,212
- Median required energy costs = £1,239

These are based on the equivalised incomes and equivalised energy costs. For more information on equivalisation, and the factors used for both incomes and energy costs, please see Section 6.1.

Worked example: fuel poverty gap

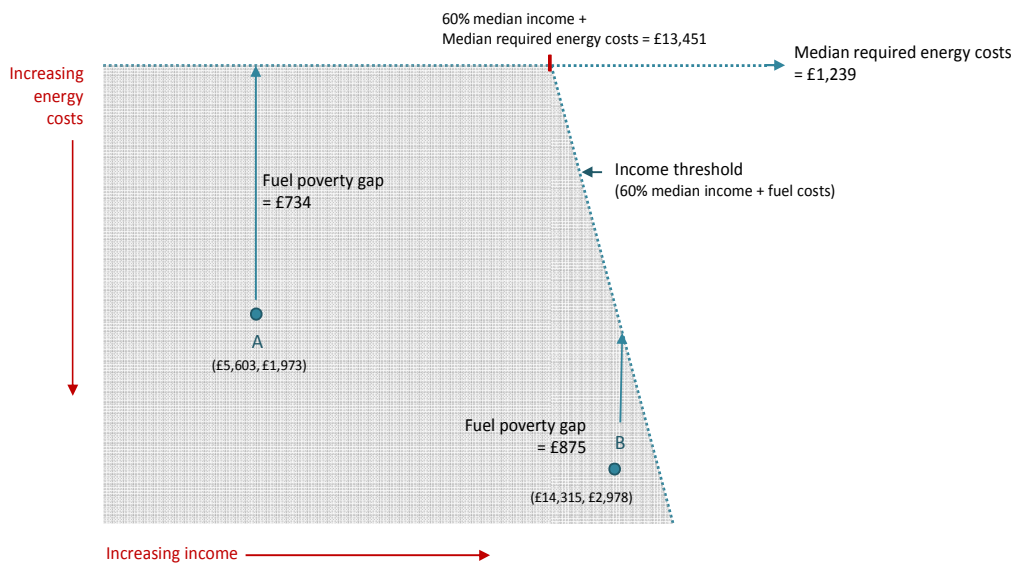
Figure 9 below illustrates the fuel poverty gap calculation for two typical fuel poor households, A and B. Here, household A has an income level below the overall threshold of £13,067 (60% median income + median energy costs); and household B has an income level above this overall threshold. The income (x) and fuel costs (y) for each household is shown in Figure 9 below as (x, y).

The fuel poverty gap for household A is calculated as follows:

$$\begin{aligned} (\text{Fuel poverty gap})_A &= \text{Excess energy costs} \\ &= \text{Household energy costs} - \text{median required energy costs} \\ &= £1,973 - £1,239 = £734 \end{aligned}$$

$$\begin{aligned} (\text{Fuel poverty gap})_B &= \text{Excess energy costs} - \text{Extra income above the overall threshold} \\ &= (\text{Household energy costs} - \text{median required energy costs}) - \\ &\quad [\text{current income} - (60\% \text{ of median income} + \text{median energy costs})] \\ &= (£2,978 - £1,239) - [£14,315 - (£12,212 + £1,239)] = £875 \end{aligned}$$

Figure 9: Worked example: fuel poverty gap calculation



Equivalisation provides a value that allows households of different sizes and composition to be compared, however as such, the fuel poverty gap does not represent an actual value and therefore the energy cost equivalisation factors (Table 9) need to be applied to return the gap to an unequivalised value in pounds (£). This is done through multiplying the equivalised gap by the respective equivalisation factor for the household.

The resulting gap for each individual household is then aggregated across all fuel poor households to produce an overall aggregate fuel poverty gap. This gives a sense of the depth of fuel poverty on a national level. In addition, this aggregate gap can then be divided by the total number of fuel poor households to give an average fuel poverty gap. By examining the average fuel poverty gap for different groups of households, the severity of the problem can be compared.

7. Projections Methodology

7.1 Introduction

The methodology for the fuel poverty projections is split into four sections. There is one section for each area that is projected: household energy efficiency, household income and fuel prices. The final section covers how the projected fuel poverty figures are produced.

7.2 Projecting Energy Efficiency

One of the key drivers of fuel poverty is how efficient the dwelling is, and therefore what the energy requirements are to maintain an adequate standard of warmth. If a dwelling is very poorly insulated, their energy requirements are likely to be high, which is one of the main criteria of fuel poverty. In order to establish if the levels of fuel poverty are likely to increase or decrease in the next two years, the number and type of improvements to the housing stock needs to be modelled.

Number of measures to allocate

There are several different types of measures that can be installed to improve the energy efficiency of a dwelling. For this model, the key measures that have been used are:

- Cavity wall insulation
- Solid wall insulation
- Loft insulation
- Replacement boilers
- Ground source heat pumps
- Air source heat pumps
- Biomass boilers
- Solar photovoltaic panels
- Solar thermal panels
- Condensing boilers

The first step is to establish how many of each of these measures have been installed in each time period that is being projected. Additionally, these measures can be installed under different policies. The number of measures installed under each policy for each year being projected is required so that the measures can be allocated to appropriate properties to model the change in energy requirements.

The Department of Energy and Climate Change publish official statistics on the number of installations by policy area. These are available for the first year that is being projected (2015). This is because the fuel poverty dataset has a two year time lag, therefore the first year that is being projected, has already occurred.

For the second year that is being projected, the number of measures installed under each policy will be unknown. Internal estimates however, are made based on the amount of money available to spend and additional policy information. Estimates of the number of each measure to be installed under each policy are then made. The estimated number of additional measures allocated in 2016 are added to the actual number of measures allocated in 2015 to account for the improvements over both years.

Another area that is important to consider is improvements to the energy efficiency made by dwelling owners not under a Government policy. The largest area is boiler improvements. According to the English Housing Survey, the proportion of households with condensing boilers is increasing each year. In order to estimate how much this will increase for the years of projection, the change between 2013 and 2014 is used as a proxy. In 2014, this was a six per cent increase, therefore it was estimated that in 2015 there would be a six per cent increase in the number of condensing boilers installed, and a further six per cent for the following year.

Allocating measures

Once the number of measures to install for 2015 and 2016 have been estimated, they need to be allocated to households. This is implemented within a SAS²⁸ model that randomly allocates the measures to households, using the 2014 fuel poverty dataset as the base data.

Different types of measures are only available to certain types of households. For example, to receive cavity wall insulation, the house must have *uninsulated* cavity walls. The SAS model starts by creating flags to indicate which rows of data are eligible for each of the different measures. Separate flags are created to indicate if they are eligible for each of the different policies.

In order to allocate the measures within the dataset, the programme begins by creating separate tables for those households that are eligible for a given measure. These are then further separated into tables containing only those households that are eligible for that measure *within* the policy. The households are then sorted into a random order. This is done by ordering the data based on a random number generated in SAS using different seeds for each.

²⁸ <http://support.sas.com/documentation/cdl/en/basess/58133/HTML/default/viewer.htm#a002645411.htm>

Measures are then allocated within the table, starting from the top of the table, working through it, until the number of measures allocated reaches the total number that have been installed (or expected to be installed) in the real world. This is indicated by a flag variable that is simply equal to 1 if allocated. The number of measures allocated is done based on the household weights within the dataset rather than just the rows of data. This is because each row of data has been weighted to represent a certain number of households in the real world.

If a household is eligible for more than one type of measure, they can receive multiple measures, for example loft insulation *and* cavity wall insulation. If a household is eligible under multiple policies for the same measure, they can only receive it under one policy. Allocations are made in order of the introduction of each policy area.

To ensure outputs are representative of how they would be allocated, the programme is run 100 times. The average energy saving from each iteration is compared to the average of all of the iterations. The iteration that is closest to the average is used as the representative run. The final output is a dataset that contains all the characteristics of the dwelling and household, and flags indicating if it has been allocated any energy efficiency measures.

Energy Requirements Calculation

The first step in allocating energy efficiency measures is to model potential improvements to the dwelling. The next step is to model the impacts on a household's energy requirements, and ultimately, energy costs. The combination of measures allocated is created. This could be one measure, multiple measures, or none.

The relevant savings factor is then applied to a household's energy requirement. This is done for each fuel type (e.g. gas) and each type of use (e.g. cooking). This is an estimate of the reduction in energy requirements that each given combination of measures allocated would have on that household. The total energy use by fuel type is then applied to the prices (see Section 7.4 below) to provide a new total energy cost per household. This whole process is completed for each year of the projections, as a different number of measures are likely to be allocated for each year, along with different fuel prices.

7.3 Income

Within the dataset, *sources* of the household income is recorded. This is categorised into income from: earnings, savings, benefits and 'other'. For the 2015 projections, income was updated dependent on its source. The new incomes used for 2015, were then updated

again by any increases estimated for 2016. This is because the base data used is from 2014, so we have to account for increases in income over the next two years. Figures from the Economic and Fiscal Outlook²⁹ which is produced by the Office for Budget responsibility, are used to uprate incomes from: earnings, savings, benefits and 'other' income sources.

Earnings

Each year earnings of the general population may change due to inflation. To capture this, earnings recorded in the dataset are uprated by the percentage increase for average earnings. From 2014 to 2015 this increased by 2.3 per cent. To 2016, this is estimated to increase by a further 2.6 per cent.

Savings

Any income from savings is uprated by GDP. In 2015, this increased by 2.6 per cent from 2014. In 2016, this is expected to increase by 3.1 per cent.

Other

Any income from a source categorised as 'other' was uprated by the Consumer Price Index (CPI). This was an increase of 0.2 per cent in 2015 and then further 0.7 per cent is expected in 2016.

Benefits

Benefits are a broad term for any type of financial support, of which the amount received increases or decrease at different rates, dependent on the type of benefit received. However, for simplicity, they are treated as one type of benefit and are simply inflated by the CPI figures for 2015 and 2016.

7.4 Prices

The main fuel prices considered for the projections are the price of gas and electricity. The changes to average prices is known for 2015 and has been published as part of DECC's quarterly energy prices publication³⁰. This shows the average unit and fixed costs for gas and electricity. In 2015, these decreased for both fuels compared to 2014. The decrease was greatest for gas with an average decrease of five per cent, while the average electricity prices fell by around one per cent.

²⁹ <http://budgetresponsibility.org.uk/efo/economic-fiscal-outlook-march-2016/>

³⁰ <https://www.gov.uk/government/statistical-data-sets/annual-domestic-energy-price-statistics>

For 2016, the price of gas and electricity is unknown. However, it was assumed that gas will continue to fall by a further five per cent compared to 2015 but that electricity will remain constant at 2015 prices.

For heating oil, the prices are known from the CPI for 2015. These figures are used in the 2015 projection. For the 2016 projection, this is kept the same as 2015. For all other fuel types, 2014 prices are used, as there are no better estimates. This will only impact a minority of households which, are not believed to have an impact on the overall fuel poverty projections.

The unit costs of each of these are then multiplied by the new number of units of energy that are required for each year based on the energy efficiency and income calculations. This is done by fuel type and at a household level. Any standing charges associated with each fuel type are added to give a total energy cost per fuel. The total energy costs by fuel are added together to give a total energy cost per household per year.

7.5 Projecting fuel poverty

The final stage of the projections is to use the new energy costs and new incomes for each year to calculate the fuel poverty thresholds and each households relative position to these for both 2015 and 2016. The first threshold is the energy costs which is simply calculated by taking the median of the energy costs. The second threshold is the income threshold and is calculated by taking 60 per cent of the median after housing costs equivalised income, using the same methodology as the main headline figures (see Section 6).

Both thresholds are calculated for each projected year, based on the new income and the new energy costs. For each year, the relative position of each household to the thresholds, and ultimately their fuel poverty status, is then recalculated along with their associated fuel poverty gap. The projected proportion of households in fuel poverty is then calculated along with the aggregate and average fuel poverty gap for both 2015 and 2016.

8. What fuel poverty statistics are available to users?

8.1 Fuel poverty data

DECC publish a large set of detailed tables, as presented in the main report, showing fuel poverty levels and rates by income decile, tenure, dwelling type, household composition and many other factors concerning both the householders and the dwelling itself (e.g. insulation measures). DECC also publish an Excel workbook looking at trends in fuel poverty since 2003 for a range of sub-groups. To allow comparison, these tables show the results, under the LIHC definition and under the consistent (BREDEM 2012 v1.1) timeseries.

Both of these can be found on the DECC website at:

<https://www.gov.uk/government/collections/fuel-poverty-statistics>

The detailed 2014 fuel poverty dataset, along with datasets from previous years, are available via the UK Data Archive. These datasets contain the underlying data used to calculate fuel poverty and the corresponding crosstab variables used within the fuel poverty report and are intended for advanced users of fuel poverty data. Documentation covering variable names and descriptions are also provided alongside the datasets.

Anonymisation techniques are applied to the End User Licence and Special Licence fuel poverty datasets deposited on the UK Data Archive to maintain the confidentiality of respondents. Prior to releasing the data on the UK Data Archive, and in-line with EHS disclosure control, all disclosive variables are removed to maintain the confidentiality of respondents. Some response categories are also condensed, several variables are top coded, and, in a few rare situations, data swapping between cases takes place for disclosure control reasons

The majority of fuel poverty variables are included in the dataset deposited at the UK Data Archive under the standard End User Licence. To comply with the data disclosure control guidance issued by the Government Statistical Service, supplementary fuel poverty variables are released under the more restricted Special Licence on the UK Data Archive.

In addition to this, DECC also publish fuel poverty data at a sub-regional level. Data for Local Authorities, Counties, Parliamentary Constituencies and Lower Super Output Areas (LSOAs) can be found on the DECC website at:

<https://www.gov.uk/government/collections/fuel-poverty-sub-regional-statistics>

8.2 Fuel poverty publications

The 2016 Annual Report on Fuel Poverty Statistics reports the headline fuel poverty statistics for 2014 under the low income high cost indicator of fuel poverty. The report provides an explanation of these figures, and the reasons for change from previous years, by looking at household income, household energy efficiency and energy prices. In addition, the report explores the trends in fuel poverty since 2003 amongst various sub-groups. This publication is available, alongside the reports from previous years, on the DECC website:

<https://www.gov.uk/government/collections/fuel-poverty-statistics>

8.3 Methodology information

Although this document supersedes all previous methodology documents, the methodology documents from previous years are also available from the archive section of the DECC website.

A Technical Annex to the methodology and user manual is published on the DECC website alongside the main user guide handbook. This includes additional details of the fuel cost modelling for fuel poverty, providing more specific details to clarify key technical assumptions when implementing the methodology.

8.4 Consultation

Through the Energy Act 2013, the Government has implemented a new legal framework to monitor fuel poverty in England using the Low Income High Costs Indicator (LIHC). This indicator of fuel poverty was first proposed in Professor Hills' review of Fuel Poverty³¹ and following consultation, the Government confirmed its intention to adopt the indicator in July

³¹ See <https://www.gov.uk/government/publications/final-report-of-the-fuel-poverty-review>

2013³². In the accompanying strategic framework document, 'Fuel Poverty: a framework for future action'³³, Government set out how the new indicator will inform the strategic approach to tackling fuel poverty, including setting a new fuel poverty target which will be underpinned by a new fuel poverty strategy.

A draft strategy and consultation document, 'Cutting the cost of keeping warm' was then published in July 2014. This proposed the creation of an additional indicator known as the Fuel Poverty Energy Efficiency Rating (FPEER) for use in targeting, and a number of targets tied to specific dates. Secondary legislation was put forward in December 2014 for this rating, alongside the LIHC fuel poverty definition, to form the basis of the statutory target for fuel poverty. This requires, as far as reasonably practicable, for all persons living in fuel poverty to have an FPEER of Band C or above by 31st December 2030.

In March 2015 the final Fuel Poverty Strategy was published, confirming the main and interim targets, alongside the responses to the July 2014 consultation.

³² See <https://www.gov.uk/government/consultations/fuel-poverty-changing-the-framework-for-measurement>

³³ See <https://www.gov.uk/government/publications/fuel-poverty-a-framework-for-future-action>

9. How accurate are the fuel poverty statistics?

Fuel poverty in England is published as a point estimate of the number of households affected. A series of models are used to calculate the figure using inputs from a variety of sources, many of which are approximations. Therefore, the modelling process requires numerous assumptions. For example, there is no information on the energy supplier and the tariff that a household uses. Instead, households are assigned an average price depending on the region that they live in and the way in which they pay for their energy (e.g. standard credit, direct debit, etc.).

In 2014, DECC published analysis that estimated the uncertainty around the point estimates of fuel poverty for 2012. This analysis looked specifically at the uncertainty around household incomes, fuel prices and energy requirements, using these to then estimate the levels of uncertainty around the overall national estimates of fuel poverty. This analysis suggests that the addition of uncertainty is likely to increase the levels of fuel poverty observed.

We can interpret this in the context of the distribution of households across the LIHC metric – particularly in terms of how many households can be placed into the LIHC quadrant by the addition of uncertainty, compared to how many can be removed from this quadrant. As just over 10% of households are in fuel poverty, there are more households outside the LIHC quadrant than inside and in particular more households outside the LIHC quadrant close to the income and fuel costs thresholds (in the HIHC and LILC quadrants). Therefore the application of uncertainty is able to move more households into fuel poverty than out of it (i.e. of 10 households, one would be in fuel poverty and nine not fuel poor – so it is more likely to place a number of the nine households into fuel poverty than remove the one household out of fuel poverty). This has the net effect of increasing the average number of fuel poor households, resulting in a slightly higher distribution of possible values for the number that are fuel poor, and so consequently the aggregate gap, after the addition of uncertainty.

These results need to be interpreted with caution. Any analysis of this kind is ultimately dependent on the input distributions used within the modelling, and the majority of the input distributions used are in themselves best estimates of uncertainty in each factor. Further to this, the analysis has been designed with a cautious approach, with conservative assumptions made throughout. As a result, these figures should be treated as indicative of the effect of uncertainty upon the national estimates of fuel poverty, rather than strictly quantitative.

Further detail on this analysis can be found in Chapter 8 of the 2014 main report:

<https://www.gov.uk/government/publications/annual-fuel-poverty-statistics-report-2014>

10. Statistical Assessment

The UK Statistics Authority (UKSA) is an independent body operating at arms-length from the Government as a non-ministerial department, directly accountable to parliament. The UKSA's objective is to promote and safeguard the quality and comprehensiveness of official statistics and to ensure good practice in relation to official statistics.

Between February and July 2010, the UKSA carried out an assessment of DECC's fuel poverty statistics against the Code of Practice for Official Statistics. The Code is structured in terms of 8 principles and 3 protocols, which encompass meeting user needs, impartiality and objectivity, and sound methods, amongst others. If, after an assessment by the UKSA, official statistics are found to comply with the Code, they are designated as National Statistics. This indicates to users that the statistics have been produced in line with the Code. More details of the Code can be found on the UKSA website at:

<http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html>.

In this assessment, the UKSA judged that the fuel poverty statistics are readily accessible, produced according to sound methods and are managed impartially and objectively in the public interest. As a result, the UKSA confirmed that the statistics published in the Annual Report on Fuel Poverty Statistics can be designated as National Statistics.

These statistics have since been re-assessed by the UK Statistics Authority against the Code of Practice for Official Statistics. The Statistics Authority published its report on 12 June 2014:

<http://www.statisticsauthority.gov.uk/assessment/assessment/assessment-reports/index.html>.

The Statistics Authority has determined that these statistics could maintain their designation as National Statistics subject to DECC implementing a small number of requirements across the range of DECC statistics assessed, which were subsequently implemented.

11.Acronyms

Acronym	Definition
ASHE	Annual Survey of Hours and Earnings
AHC	After Housing Cost
BRE	Building Research Establishment
BREDEM	BRE Domestic Energy Model
CAPI	Computer Assisted Personal Interviewing
CHAID	Chi-squared Automatic Interaction Detector
CHP	Combined Heat and Power
CPI	Consumer Price Index
CTB	Council Tax Benefit
CTS	Council Tax Support
DECC	Department of Energy and Climate Change
DCLG	Department of Communities and Local Government
DLA	Disability Living Allowance
DUKES	Digest of UK Energy Statistics
DWP	Department of Work and Pensions
EHCS	English House Condition Survey
EHS	English Housing Survey
FPEER	Fuel Poverty Energy Efficiency Rating
FPMG	Fuel Poverty Methodology Group
FRS	Family Resources Survey
HB	Housing Benefit
HBAI	Households Below Average Income
HRP	Household Reference Person
LA	Local Authority
LCFS	Living Cost and Food Survey
LHA	Local Housing Allowance
LIHC	Low Income High Cost
LPG	Liquefied Petroleum Gas
MPPI	Mortgage Payment Protection Insurance
OBU	Other Benefit Unit
OECD	Organisation for Economic Co-operation and Development
ONS	Office for National Statistics
PBU	Primary Benefit Unit
PIP	Personal Independence Payment
PPM	Pre-Payment Meter
RdSAP	Reduced Data Standard Assessment Procedure
RSL	Registered Social Landlord

Acronyms

SAP	Standard Assessment Procedure
SMI	Support for Mortgage Interest
UKSA	UK Statistics Authority
WFP	Winter Fuel Payment
WHD	Warm Homes Discount

