Welsh Housing Conditions Survey (WHCS) 2017-18
Fuel Poverty Projections for Wales 2021: Methodology Report

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1. Introduction

The Welsh Government has committed to undertake a periodic biennial review of its plan to tackle fuel poverty from 2021 – 2035. To enable this, estimates of fuel poverty levels in 2021 are required to inform the review and to assist in the preparation of interim targets to be added into the plan. Fuel poverty estimates for 2021 have been calculated, and headline results were published in April 2022[1]. Further detailed analysis will be made available in summer 2022.

This methodology report is a guide for all users who wish to learn more about the modelling approaches undertaken to estimate the level of fuel poverty in Wales as at October 2021[2]. Users will find detailed descriptions of the data sources and methods used to predict fuel poverty levels in Wales using the Welsh headline indicator, and alternative measures of fuel poverty as used in England, Northern Ireland, and Scotland.

1.1 What is fuel poverty?

A household is classified as being fuel poor if they are unable to keep their home adequately heated at a reasonable cost. Different definitions of what constitutes Fuel Poverty are used across the UK. These are summarised below, and further details are provided in Section 6.

1.1.1 Wales 10% definition

A household is defined as being fuel poor if they would need to spend more than 10% of their income on the fuel needed to heat their home to a 'reasonable' level. This is calculated using the equation below:

$$Fuel\ Poverty\ Ratio = \frac{Fuel\ Costs}{Income}$$

If the ratio from the above equation is greater than 0.1, the household is defined as fuel poor. The value for total fuel costs for a household is modelled using standard heating regimes that consider how much money each household would need to spend on fuel to reach these established standards for comfort.

1.1.2 Other definitions in Wales

If the ratio to the above equation is greater than 0.2 the household is defined as being severely fuel poor. The Welsh Government also monitors the number of households deemed to be at risk of fuel poverty. This is defined as a household needing to spend between 8 and 10% of their income on the fuel needed to heat their home.

1.1.3 Other definitions in the UK

There are other definitions that are also included in the projection of 2021 fuel poverty levels in Wales; specifically, those definitions used by other UK nations. These include the Low Income Low Energy Efficiency (LILEE) fuel poverty definition used in England, and the use of a residual income measure in Scotland.

[1] Fuel poverty modelled estimates for Wales (headline results): as at October 2021 | GOV.WALES
[2] October 2021 was selected as the reference date, as this is the mid-point of a typical house condition survey year

1.2 How are projections of fuel poverty estimated?

To calculate levels of fuel poverty for any point in time, information is needed on the income of the household, their fuel costs and, in the case of the LILEE definition, the energy efficiency of their home. The 2017-18 Welsh Housing Conditions Survey (WHCS) (and the matching household data from the National Survey for Wales data) is the best source of information available to describe the Welsh housing stock in terms of these key measures. Further information is provided in the 2018 methodology report on how each of the components of fuel poverty were modelled from the 2017-18 survey data[3].

To project fuel poverty to 2021 required new information and data on how income, energy consumption and fuel costs may have changed since the 2017-18 survey, especially through the COVID-19 pandemic. In addition, the models needed to be updated to incorporate the new modelling methodologies and revised fuel poverty component data. The updated key metrics were then used to re-calculate fuel poverty to the 2021 position.

The following sections of this report provide information on the data sources and the methodologies used for each component of the modelling. Section 2 provides information on the base data and weighting approach, Section 3 has details of the full household income measure used in the Wales definition of fuel poverty, as well as information on the After Housing Cost income measures used in the English and Scottish definitions of fuel poverty[4]. Section 4 covers changes to the fuel prices, and Section 5 has details on the energy efficiency upgrades, and heating regimes for each of the fuel poverty definitions. Finally, Section 6 provides further information on the calculation of fuel poverty, with strengths and limitations of the methodology provided in Section 7.

[3] https://gov.wales/sites/default/files/statistics-and-research/2019-12/fuel-poverty-estimates-wales-2018-methodology-report.pdf

[4] The income modelling methodology is the same in Wales and Northern Ireland

2. Base data and household weighting

The household and dwelling data from the National Survey for Wales 2017-18 and the Welsh Housing Conditions Survey 2017-18, respectively, were used as the base data sources for the fuel poverty 2021 projections work. Weighting factors (see section 2.3) were updated to reflect the increase in household numbers in Wales.

2.1 National Survey for Wales 2017-18

The National Survey for Wales (NSW) is an interview survey that involves around 12,000 people each year and covers a wide range of topics. Between July 2017 and March 2018, it collected specific information required for the calculation of fuel poverty in 2018 (income, housing costs, energy payment method etc.). Being an interview survey, the NSW does not collect detailed information about the dwellings in which the responding households reside. Further details on the NSW can be found on the website National Survey for Wales | GOV.WALES.

2.2 Welsh Housing Conditions Survey 2017-18

Accurate and detailed information about the dwelling is crucial for the calculation of fuel poverty and therefore the Welsh Government commissioned the Welsh Housing Conditions Survey (WHCS) 2017-18. This involved a physical inspection of the dwelling by a trained surveyor. The WHCS 2017-18 survey ran from August 2017 until the end of April 2018. The data collected from WHCS provided information to create an accurate representation of the housing stock in Wales in 2018. Eligibility for the WHCS was established at the NSW interview stage and permission was sought by the interviewer. Further details on the Welsh Housing Conditions Survey 2017-18 can be found on the website; www.gov.wales/WHCS

2.3 Household weighting

The WHCS builds a picture of the Welsh housing stock by surveying a sample of dwellings from around the country. A weighting factor needs to be applied to the data to obtain figures that reflect the whole Welsh stock, for dwelling occupants. In 2017/18, there were estimated to be 1.34 million households in Wales. Based on information from StatsWales, household numbers have increased since 2017[5]. Using data on the estimates of household numbers in Wales in 2017 (1,349,911) and 2020 (1,378,226), and assuming a linear trend to 2021, the weighting factors were uniformly adjusted to represent 1.38 million households in Wales in 2021. This does not account for any adjustment in the housing stock, and so caution should be taken with the use and interpretation of household numbers when using the 2021 weighting factor.

[5] https://statswales.gov.wales/Catalogue/Housing/Households/Estimates/households-by-localauthority-year

3. Income model

Household income is a key component that is needed to calculate fuel poverty and is derived using complex modelling from a variety of data sources. This section contains a detailed description of the methodologies used for calculating the final projected 2021 fuel poverty household income variables.

3.1 Overview

The Welsh Government's primary 10% definition of fuel poverty uses an unequivalised[6], before housing costs income measure known as 'full household income'. This is the net income of the whole household which includes income from the Primary Benefit Unit (PBU) and any Additional Benefit Units (ABUs) in the household[7], including housing related benefit payments and net of council tax payments.

Figure 1 below outlines the main steps in the income modelling process in calculating the full household income. A detailed description of the full household income modelling is provided in Section 3 of the previously published 2017-18 methodology report[8].

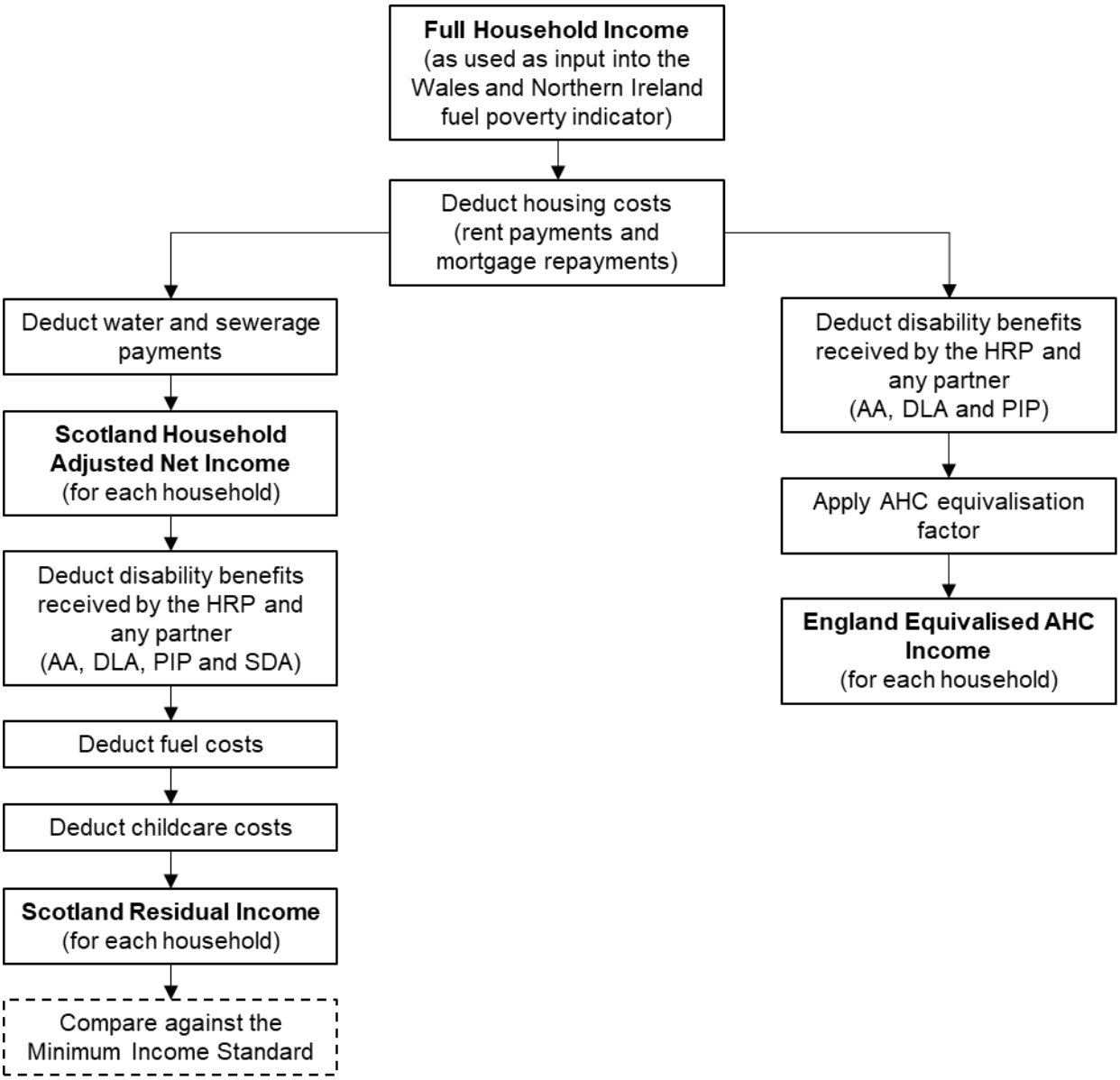
As part of the project requirements, an assessment of the level of fuel poverty based on measures used by other UK Governments was required. The Northern Ireland fuel poverty indicator uses the full household income measure described in Figure 1, but additional income modelling that builds upon the full household income is required to allow the comparison of fuel poverty levels using the LILEE measure (England) and the Scottish fuel poverty indicator, Figure 2.

Figure 1 - Other UK Government income measures (England and Scotland) that build upon the full household income

[6] Income equivalisation is based on the concept that the cost of living varies according to the size and type of household. For example, a household of three people requires a higher income than a one-person household to achieve the same standard of living

[7] The PBU income refers to income of the Household Reference Person (HRP) and any partner of the HRP, the ABU income refers to income from other adult household members who are not the HRP or partner of the HRP

[8] Welsh Housing Conditions Survey (WHCS) 2017-18 Fuel Poverty Estimates for Wales 2018: Methodology Report https://gov.wales/sites/default/files/statistics-and-research/2019-12/fuel-poverty-estimates-wales-2018-methodology-report.pdf



Projection of the full household income measure from a base of 2017-18 to a 2021 position for the Welsh and Northern Ireland fuel poverty indicator is discussed in detail below, followed by a detailed description of the income modelling required for the other UK Government measures.

3.2 Projecting the full household income measure to 2021

A core requirement of the Wales 2021 projections was to establish the change in the full household income measure between 2017-18 (as collected for the NSW 2017-18) and the reference point of October 2021. In March 2020, during the Wales 2017-2021 projection period, there was an outbreak of the coronavirus disease (COVID-19) that meant many businesses had to close. The UK Government implemented a range of measures to help people affected by the coronavirus, such as the Coronavirus Job Retention Scheme and temporary increases to Universal Credit and Working Tax Credit. As these Government schemes came to an end before the October 2021 projection date, they therefore were not incorporated into the income projections.

To carry out the household income projection work, the five derived income variables found on the Wales 2017-18 fuel poverty indicator dataset were used as a base for the modelling. These derived variables 'split' the 2017-18 household income into five individual components:

- EARNINGSx (earnings income)
- BENEFITSx (benefit income including from housing related benefits)
- SAVINGSx (savings and investment income)
- OTHERx (income from all other sources e.g. private pensions, occupational pensions etc, including income from additional household members who are not the HRP or partner of the HRP)
- WFPx (winter fuel payment).

The full income for each household is derived by the sum of the five income split components minus the modelled council tax payable for the property.

For the 2021 full household income projection, using the data sources and factors from Table 1 to Table 5, each component of income (including the council tax payable) was adjusted from the 2017-18 values to a projected October 2021 position. To carry out this task, further breakdown of the benefit income split variable was required to allow for different uplift factors for the range of state benefits (see Table 2).

Once the individual components of income had been uplifted to a 2021 position for each household, the 2021 full household income projection was derived by adding together the five income split variables and deducting the projected 2021 council tax payable for the property. The annual full household income is capped at £100,000 before the calculation of the Wales 2021 fuel poverty figures.

The 2021 fuel poverty dataset also includes the projected 2021 fuel poverty basic household income measure. This was constructed in the same way to the projected full household income by using the uplifted income split variables. However, the basic household income variable does not include income from housing related benefits or deduct the council tax payable from the household income (see Section 3 of the previously published 2017-18 methodology report for more detail on the basic household income). The annual basic household income is capped at £100,000.

Table 1 - Income split: EARNINGSx uplift factor and details

Income Split	Uplift factor (17 - 21)	Data source	Further information
EARNINGSx	1.129	Data source: Average (median) gross weekly earnings by Welsh local areas and year, Annual Survey of Hours and Earnings, Office for National Statistics. Data table downloaded from the StatsWales data tool[9].	Wales average (median) gross weekly income **April 2017 -** £498.30 **April 2021 -** £562.80 These Wales specific values (and the data points in-between) were validated against the Great Britain timeseries trend for the ONS EARN01 Average Weekly Earnings, total pay, April 2017 – October 2021[10]. The percentage rise in earnings as observed in Wales between April 2017 to April 2021 was on trend with the comparison Great Britain statistics.

Table 2 - Income split: BENEFITSx uplift factor and details

BENEFITSx: Income Split subcategory	Uplift factor (17 - 21)	Data source	Further information
Working age benefits (e.g., Universal Credit, income support, tax credits and child-benefit)	1.022	GOV.UK Rates and allowances: tax credits, Child Benefit and Guardian's Allowance[11]. GOV.UK Benefit and pension rates 2021 to 2022[12].	A benefit freeze was in place keeping most working age benefits at the same rate over a four year period between April 2016 and April 2020, hence the low uplift factor for this subcategory.
State pension	1.125		For the data projection period, the state pension benefit amount was protected by the 'triple lock', a government commitment to increase the value of state pension by at least 2.5% every year.
Pension credit	1.111		Pension Credit Guarantee Credit is required to increase at least in line with the previous year's earnings increase and was not subject to the benefit freeze.
Other non-housing related benefits (e.g., DLA, PIP, AA)	1.078		Inflation-linked benefits rise in line with the Consumer Price Index (CPI) rate of inflation using the value for the month of September (the September prior to the year of increase).
Housing related benefit towards rent payments	PRS – 1.088 LA – 1.140 RSL – 1.127	See Table 7	The uplift factors applied for the housing related benefit towards rent payments are aligned to the applicable rent uplift factors used for the Private rented Sector (PRS), Local Authority (LA) housing and Registered Social Landlord (RSL) housing.
Council Tax Support	Range from 1.17 to 1.27	See Table 5	The uplift factor applied for the council tax support benefit payments is aligned to the applicable Unitary Authority council tax payment uplift factor.

[9] https://statswales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/People-and-Work/Earnings/medianweeklyearnings-by-welshlocalareas-year

[10] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/averageweeklyearningsearn01

[11] https://www.gov.uk/government/publications/rates-and-allowances-tax-credits-child-benefit-and-guardians-allowance/tax-credits-child-benefit-and-guardians-allowance

[12] https://www.gov.uk/government/publications/benefit-and-pension-rates-2021-to-2022/benefit-and-pension-rates-2021-to-2022

Table 3 - Income split: SAVINGSx and OTHERx uplift factor and details

Income Split	Uplift factor (17 - 21)	Data source	Further information
SAVINGSx and OTHERx	1.091	Data source: Consumer Price Inflation, UK, ONS[13].	This factor represents the CPI inflation rate from a base of October 2017 to October 2021.

Table 4 - Income split - WFPx uplift factor and details

Income Split	Uplift factor (17 - 21)	Data source	Further information
WFPx	1.000	GOV.UK Winter Fuel Payment[14]	There has been no change in the Winter Fuel Payment (WFP) rates between 2017 and 2021, therefore a factor of 1.00 has been applied i.e., no difference in WFP over the projected period.

Table 5 - Council tax payable uplift factors and details

	Uplift factor (17 - 21)	Data source	Further information
Council tax payable	Range from 1.17 to 1.27 depending on Unitary Authority	Council Tax Level Statistics published on the Welsh Government website[15]. Releases: April 2021 to March 2022 statistics and April 2017 to March 2018 statistics.	The percentage rise in average council tax between 2017 and 2021 was determined for each Unitary Authority. A smoothing methodology was applied to the factors to protect the identity of the Unitary Authority. These factors were applied to the 2017-18 council tax payable values to project 2021-22 levels.

3.3 Lower income households

For the Wales fuel poverty modelling, lower income is defined as being less than 60% of the average relative median household income Before Housing Costs (BHC) as published annually in the Households Below Average Income (HBAI) report[16].

For the 2021 Wales projection work, whether a household is defined as lower income was modelled using the projected 2021 full household income as a base, with the relevant BHC Organisation for Economic Co-operation and Development (OECD) equivalisation factors applied to reflect the fact that different households have different spending requirements. This creates the 'equivalised BHC income'. The BHC equivalisation factor was determined for each household by summing the appropriate factors for each household member as shown in Table 6. The BHC income equivalisation factors used are consistent with those used by the DWP in their production of Households Below Average Income (HBAI) statistics.

Table 6 - Before Housing Costs OECD equivalisation factors

	BHC equivalence scale
First adult in the household	0.67
Subsequent household members aged 14 and above	0.33
Children under 14	0.20

[13] https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/december2021
[14] https://www.gov.uk/winter-fuel-payment
[15] https://gov.wales/council-tax-levels
[16] https://www.gov.uk/government/collections/households-below-average-income-hbai--2

Using the projected 2021 values, the weighted median of all BHC equivalised incomes in the dataset was calculated[17]. Households are defined to be 'lower income' in the 2021 Welsh fuel poverty dataset if their equivalised income is below 60% of the weighted median household income before housing costs are considered.

3.4 LILEE income metric (England)

The England LILEE fuel poverty definition uses an income measure known as 'equivalised After Housing Costs (AHC) income'. The LILEE income is an extension of the household full income measure (see section 3.2). Deduction of income associated with the main disability benefits (Attendance Allowance, Disability Living Allowance and Personal Independence Payment) and deduction of housing costs (net rent payments and mortgage repayments), from the full (uncapped) household income, provides an 'AHC income'. Applying the relevant equivalisation factor to the AHC income to reflect the fact that different households have different spending requirements, creates the final 'equivalised AHC income' used in the LILEE fuel poverty calculations.

The LILEE AHC income is created by subtracting disability benefit income and housing costs from the full household income. Further information on the elements that are deducted from the household full income, how the elements were projected to 2021 values and the equivalisation process are provided below.

Disability benefit income (LILEE)

As noted above, benefit payments made specifically to cover the additional costs of living with a disability including Disability Living Allowance (DLA), Personal Independence Payments (PIP) and Attendance Allowance (AA) are excluded from the income calculation for the LILEE fuel poverty indicator and deducted from the projected 2021 full household income measure. The combined annual amount from these disability benefits is primarily based upon the benefit amount(s) that the householder provided in the National Survey for Wales (NSW) 2017-18 interview survey (and calculated as part of the 2018 fuel poverty statistics), uplifted to 2021 amounts using a factor of 1.078 (see Table 2, row 'other non-housing related benefits' for details on the uplift factor applied). The benefit amount comprises of benefit received by the household reference person and their partner only.

Rent payments

As part of the LILEE after housing costs calculation, rent payments are deducted from the 2021 full household income measure.

The housing costs associated with rent payments were calculated as part of the Wales 2018 fuel poverty statistics (see Section 3.6.1 of the previously published 2017-18 methodology report for details on rent modelling). The rent payments as previously calculated were projected to 2021 values using the data sources and applicable uplift factors (based on tenure) as outlined in Table 7.

[17] To align with HBAI calculations, to achieve the median income that represents the income of the individual in the middle of the distribution, the dataset was weighted by a person proxy weighting (derived by multiplying the household weighting factor by household size)

Table 7 - Rent uplift factors and details

Rented sector	Uplift factor (17 – 21)	Data source	Further information
Local Authority rents	1.140	Social rent data tables downloaded from the StatsWales data tool on the Welsh government website[18]	Selected report 'Average weekly rents in stock at social rent by provider and accommodation'. Applied the filter to select 'self-contained total (including self-contained bedsits)'. Values crossed checked against the 'Social landlord housing stock and rents reports' for the relevant years[19]. **Total stock average weekly rents (self-contained)** LA 2017-18 = £84.65 LA 2021-22 = £96.53 **LA rent total increase 2017-2021 = 14.0%** RSL 2017-18 = £87.10 RSL 2021-22 = £98.17 **RSL rent total increase 2017-2021 = 12.7%**
RSL rents	1.127		
Private sector rents	1.088	Private rent data tables downloaded from the StatsWales data tool on the Welsh government website[20] in conjunction with the ONS Index of Private Housing Rental Prices[21]	Selected report 'Private sector rents by local authority, 1 January to 31 December 2019' to obtain 2017 to 2019 average Wales private rents. There are no current plans for the Welsh Government to publish the 2020 and 2021 private rent statistics, therefore, for 2020 and 2021, the average private rents in Wales were projected by applying the October 2020 and October 2021 Index of Private Housing Rental Prices percentage over 12 months using the category 'UK excluding London'. **Percentage increase in private rents** 2017 to 2018 = 1.7% (Wales specific value) 2018 to 2019 = 2.8% (Wales specific value) 2019 to 2020 = 1.7% (UK excluding London value) 2020 to 2021 = 2.3% (UK excluding London value) **Total cumulative increase 2017-2021 = 8.8%**

Mortgage repayments

Also, as part of the LILEE after housing costs calculation, projected 2021 mortgage repayments are deducted from the 2021 full household income measure.

Information on mortgage repayment amounts were collected on the NSW 2017-18 on a self-reported basis. On the fuel poverty dataset, for owner occupier cases with an outstanding mortgage, 88% of cases (when weighted) provided a useable 2017-18 mortgage repayment amount for use in modelling. For the remaining 12% where repayment amounts were unknown or missing, a 2017-18 value was imputed based upon the monthly mortgage repayment formula (as shown below).

$$\textit{Monthly mortgage repayment} = \frac{\textit{(value of current main mortgage x annual interest rate/12)}}{\textit{(1-1/((1+annual interest rate/12)}^{\textit{(length of main mortgage in months)}}\textit{))}}$$

The required input data into the mortgage repayment formula above was previously calculated as part of the 2017-18 interest-only mortgage payment modelling (see Section 3.6.2 of the previously published 2017-18 methodology report for more details). The derived mortgage repayment amounts based on 2017-18 data were projected to 2021 values using the data source and uplift factor as outlined in Table 8.

[18] https://statswales.gov.wales/Catalogue/Housing/Social-Housing-Stock-and-Rents
[19] https://gov.wales/social-landlord-housing-stock-and-rents-31-march-2021
[20] https://statswales.gov.wales/Catalogue/Housing/Private-Sector-Rents
[21] https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/indexofprivatehousingrentalprices/december2021

Table 8 – Mortgage repayment uplift factor and details

	Uplift factor (17 – 21)	Data source	Further information
Mortgage repayments	1.058	English Housing Survey 2020 to 2021: headline report[22]	Used data from Section 1: households annex tables, Annex Table 1.10: Mean and median mortgage payments, London and England, 2008-09 to 2020-21, to plot the median weekly mortgage amount for England (excluding London) from 2017-18 to 2020-21. A trend line was added to the graph and projected forward one year to 2021-22. Using the trendline equation, the percentage increase between 2017-18 median mortgage amount and the projected 2021-22 amount was determined and applied to the Wales 2017-18 mortgage repayment value (for applicable cases) to uplift the values to 2021-22 amounts.

LILEE Equivalised AHC income

For the 2021 Wales projection work, the LILEE AHC equivalised income was modelled using the projected 2021 fuel poverty uncapped full household income as a base with the deduction of disability benefit and housing costs (both modelled to 2021 amounts), with the relevant AHC OECD equivalisation factors applied to reflect the fact that different households have different spending requirements. This creates the 'equivalised AHC LILEE income'. The AHC equivalisation factor was determined for each household by summing the appropriate factors for each household member as shown in Table 9. The AHC income equivalisation factors used are consistent with that used by the DWP in their production of Households Below Average Income (HBAI) statistics.

Table 9 - After Housing Cost OECD equivalisation factors

	AHC equivalence scale
First adult in the household	0.58
Subsequent household members aged 14 and above	0.42
Children under 14	0.20

The final income variable is capped at £100,000 before the calculation of LILEE fuel poverty figures. Any negative AHC equivalised incomes are set to £0.

3.5 Household's adjusted net income (Scotland)

The Scotland fuel poverty definition uses two income measures in the derivation of their fuel poverty statistics. Details of the income measures are outlined in the Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019[23]. A household is in fuel poverty if:

a. the fuel costs necessary, for the home in which members of the household live, to meet the required conditions are more than 10% of the **household's adjusted net income**, and;

b. after deducting such fuel costs, benefits received for a care need or disability (if any) and the household's childcare costs (if any), the household's **remaining adjusted net income** (referred to as **'residual income'** in this methodology report) is insufficient to maintain an acceptable standard of living for members of the household.

[22] https://www.gov.uk/government/statistics/english-housing-survey-2020-to-2021-headline-report
[23] https://www.legislation.gov.uk/asp/2019/13/contents

The first of these income measures, the household's adjusted net income, is defined as the income of all members of the household, after housing costs. The household's adjusted net income is an extension of the full household income measure (see), calculated by deducting housing costs including rent payment, mortgage repayments and water and sewerage payments from the uncapped full household income[24].

The required 2021 rent payments and 2021 mortgage repayments for the household's adjusted net income (to be deducted from the 2021 projected full household income) are the same as those calculated for the England LILEE income measure (see section 3.4 of this methodology document). The final element required to derive the household's adjusted net income is the deduction of the projected 2021 water and sewerage payments. The modelling behind this element is detailed below.

Water and sewerage payments

Household water and sewerage costs were not collected on the NSW 2017-18, therefore this component was modelled for each household. Using data from the DiscoverWater website[25], the average annual 2021-22 water and sewerage bill was extracted for each water company operating in Wales and the average amounts were mapped to each case on the fuel poverty dataset by the applicable local authority area. The average household amount for water and sewerage assigned to each case was then adjusted by an occupancy factor to reflect that households of varying sizes have different average consumption. The occupancy factor was derived from the 'Assessed Measure Charges' for the main water company operating in Wales, Dwr Cyrmu (Welsh Water), see Table 10.

Table 10 - Water and sewerage occupancy factor

	Average water (£/yr)	**Average sewerage (£/yr)**	**Total (£/yr)**	**Derived occupancy factor to apply to the average bill** (to adjust for household size)
1 occupant - average use	127.40	195.60	323.0	0.75
2 occupant - average use	164.3	238.0	402.4	0.94
3+ occupant - average use	208.1	288.3	496.4	1.16
2.29 occupants (average household size in Wales) – estimated average use, using the above values	-	-	429.6	1.00

The household's adjusted net income is capped at £100,000 before the calculation of the fuel poverty figures.

3.6 Household's residual income (Scotland)

The Scottish residual household income follows on from the uncapped household's adjusted net income measure. Benefits received for a care need or disability are subtracted from the household's adjusted net income, alongside fuel costs and childcare costs to determine the household's residual income. This income measure is then compared against the Minimum Income Standard (MIS) for the purpose of determining if the household's residual income is sufficient to maintain an acceptable standard of living for the second part of the fuel poverty calculation (see section 3.7 on the MIS).

[24] Council tax is also considered as a housing cost, but this housing payment has already been deducted from the full household income.
[25] https://discoverwater.co.uk/annual-bill

Information on the components that are deducted from the household's adjusted net income to calculate the residual income, and how the components were projected to 2021 values are provided below. The household's residual income is capped at £100,000.

Disability benefit income (Scotland)

For the Scottish definition of fuel poverty, the benefits that comprise disability income differ slightly to England (LILEE definition of fuel poverty). Any benefit payments received for a care need or disability including Disability Living Allowance (DLA), Personal Independence Payments (PIP), Attendance Allowance (AA) and Severe Disablement Allowance (SDA)[26] are deducted from the household's net income. The combined annual amount from these disability benefits is primarily based upon the self-reported benefit amount(s) that the householder provided in the NSW 2017-18 interview survey (and calculated as part of the 2018 fuel poverty statistics), uplifted to 2021 amounts using a factor of 1.078 (see Table 2, row 'other non-housing related benefits' for details on the uplift factor applied). The benefit amount comprises of those received by the household reference person and their partner only.

Fuel costs

The fuel cost for each household represents the required expenditure necessary to maintain a reasonable temperature in which the members of the household live. The projected 2021 fuel costs used to deduct from the household's net income (using the Scottish heating regimes) are calculated as described in Section 5 on energy consumption and costs.

Childcare costs

Childcare costs, against which fuel poverty is assessed, means the paid costs incurred for any care or supervised activity provided for a child who is below school age or who is receiving primary education and is additional to that provided during the child's compulsory education, or where the main reason for incurring the costs is the child's participation in the activity. These costs are subtracted from the household's adjusted net income alongside fuel costs and benefits received for a care need or disability.

Childcare costs were not collected on the NSW 2017-18, therefore this component is modelled for each household as applicable. For each household in the dataset, the number of children present in the Primary Benefit Unit (PBU) aged 0-1, 2-4 and of primary school age was determined. This process identified the number of children and the applicable age category of each child that the HRP and any partner are responsible for. Childcare costs for each age category were sought from the 2021 annual budgets produced by the Centre for Research in Social Policy at Loughborough University[27], Table 11.

Table 11 - Weekly 2021 childcare costs by age category (£)

	£/week
0-1 year old	262.10
2-4 year old	135.30
Primary school age	90.10

[26] Whilst disability assistance is deemed a benefit received for a care or disability in Scotland, it is not applicable to the Welsh benefit system.
[27] The Minimum Income Standard for the United Kingdom: https://www.lboro.ac.uk/research/crsp/minimum-income-standard/

The childcare cost for each household (if applicable) was calculated by multiplying the number of PBU children in each age category by the associated childcare cost outlined in Table 11, and by applying the following rules based on household type/working status.

Lone parents:

- if working full time, childcare costs are calculated as 100% of the total value
- if working part time, childcare costs are calculated as 50% of the total value
- if not working, childcare costs are calculated as £0.

Couple parents[28]:

- if both parents are working full time, childcare costs are calculated as 100% of the total value
- if both parents are working, with HRP working part-time, childcare costs are calculated as 50% of the total value
- if at least one parent is not working, childcare costs are calculated as £0.

3.7 Minimum Income Standard (Scotland)

The household residual income as described in section 3.6 is compared against the Minimum Income Standard (MIS) for the purpose of determining if the household's remaining adjusted net income is sufficient to maintain an acceptable standard of living for the second part of the Scottish fuel poverty calculation.

The MIS is the income that people currently need for a minimum socially acceptable standard of living in the UK, based on what members of the public think. It is calculated by specifying baskets of goods and services required by different types of households to meet these needs, and to participate in society.

The 2021 UK MIS thresholds used in the calculation of the Scottish fuel poverty measure (using the Welsh data) were obtained from annual budgets produced by the Centre for Research in Social Policy at Loughborough University. However, the Loughborough University Minimum Income Calculator[29] is only able to provide annual budgets for households comprising a single benefit unit, i.e., a single adult or couple plus any dependent children. The research underpinning the MIS does not cover the needs of very large families or of families in which people live with adults who are not their partner (including related people over the age of 18 living in the same household). There are many households in the fuel poverty dataset that consist of more than one single benefit unit, therefore, to enable the creation of an annual budget covering all household members, some simplified assumptions about additional household members were made based on guidance from previous research by Loughborough University (as detailed further below).

Primary Benefit Unit budget

Based on household characteristic information collected in the NSW 2017-18, the households in the Wales fuel poverty dataset were categorised into 59 different PBU household types (see Table 12). Using the

[28] For couples, it was unknown from the survey data if the partner of the respondent was working full time or part time. The assumption was made that if the partner was working, they were working full time.
[29] https://www.minimumincome.org.uk/

Minimum Income Calculator, the corresponding 2021 MIS values were determined for each household type, deducting from the budget total, the notional costs allocated to council tax, water and sewerage charges, rent costs, childcare costs, and fuel costs in accordance with the methodology outlined in the Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019. Each PBU on the fuel poverty dataset was allocated an annual budget.

There are some PBU household types that the MIS calculator does not cover. The MIS calculator does not extend to: a couple comprised of a pensioner and a non-pensioner; one or more parents of dependent children that are pensioners; a lone parent that has more than three dependent children; or a couple that has more than four dependent children. A set of assumptions outlined in Annex A of the report 'A poverty indicator based on a minimum income standard'[30] was used to estimate a budget for each of these excluded household type categories.

Table 12 - PBU weekly 2021 MIS budget for each PBU household type (59 categories)

	Family Type (PBU)	Weekly budget (£)		Family Type (PBU)	Weekly budget (£)
1	1 adult, working age	193.1	**31**	couple, 1 primary	396.1
2	1 adult, pension age	173.9	**32**	couple, 1 primary 1 secondary	507.2
3	2 adults, both working age	333.3	**33**	couple, 1 primary 2 secondary	638.7
4	2 adults, both pension age	275.7	**34**	couple, 2 primary	466.5
5	2 adults, 1 working age and 1 pension age	304.5	**35**	couple, 2 primary 1 secondary	601.7
6	lone parent, 1 secondary age child	343.2	**36**	couple, 2 primary 2 secondary	712.5
7	lone parent, 2 secondary age children	454.2	**37**	couple, 3 primary	563.2
8	lone parent, 3 secondary age children	562.5	**38**	couple, 3 primary 1 secondary	675.5
9*	lone parent, 6 secondary age children	887.4	**39***	couple, 3 primary 2 secondary	803.5
10	lone parent, 1 primary age child	302.5	**40***	couple, 4 primary 2 secondary	893.0
11	lone parent, 1 primary age child 1 secondary child	415.0	**41***	couple, 5 primary 1 secondary	838.8
12	lone parent, 1 primary 2 secondary	523.3	**42**	couple, 1 under	374.2
13	lone parent, 2 primary	374.3	**43**	couple, 1 under 1 secondary	491.4
14	lone parent, 2 primary 1 secondary	484.1	**44**	couple, 1 under 2 secondary	620.5
15	lone parent, 3 primary	466.8	**45**	couple, 1 under 1 primary	452.2
16*	lone parent, 3 primary 1 secondary	575.1	**46**	couple, 1 under 1 primary 1 secondary	583.5
17	lone parent, 1 under	280.5	**47**	couple, 1 under 1 primary 2 secondary	694.3
18	lone parent, 1 under 1 secondary	399.2	**48**	couple, 1 under 2 primary	546.5
19	lone parent, 1 under 2 secondary	506.3	**49**	couple, 1 under 2 primary 1 secondary	657.3
20	lone parent, 1 under 1 primary	360.0	**50**	couple, 1 under 3 primary	620.3
21	lone parent, 1 under 1 primary 1 secondary	467.1	**51***	couple, 1 under 4 primary	694.0
22*	lone parent, 1 under 1 primary 2 secondary	575.5	**52***	couple, 1 under 6 primary 2 secondary	1097.7
23	lone parent, 1 under 2 primary	450.1	**53**	couple, 2 under	428.6
24	lone parent, 2 under	336.4	**54**	couple, 2 under 2 secondary	677.9
25	lone parent, 2 under 1 secondary	453.0	**55**	couple, 2 under 1 primary	531.1
26	lone parent, 2 under 1 primary	434.7	**56***	couple, 2 under 1 primary 2 secondary	768.9
27*	lone parent, 2 under 2 primary	527.2	**57**	couple, 2 under 2 primary	603.9
28	couple, 1 secondary	436.8	**58***	couple, 2 under 2 primary 3 secondary	988.0
29	couple, 2 secondary	546.4	**59**	couple, 3 under	503.8
30	couple, 3 secondary	658.4			

* The MIS calculator only covers up to 3 children in a family with a lone parent and only covers up to 4 children in a family with two parents. Therefore, for certain household type categories the budget was amended to incorporate the cost of extra dependent children in the household using the following amounts per week; a lone parent's extra primary age child £92.53, a lone parent's extra secondary age child £108.31, a couple's extra primary age child £73.78 and a couple's extra secondary age child £128.04.

[30] Hirsch, D, Padley, M and Valadez, L (2016) Poverty Indicator Based on a Minimum Income Standard. Loughborough: Centre for Research in Social Policy https://repository.lboro.ac.uk/articles/report/A_poverty_indicator_based_on_a_minimum_income_standard/9598502

Budget allocated to additional household members

As mentioned above, the MIS calculator does not extend to all PBU household types, but also, the MIS calculator is only able to provide annual budgets for households comprising a single benefit unit. Therefore, MIS budgets had to be assigned to additional household members outside of the PBU i.e., 'bolt on' budgets to cover 'extended family units', sharers, and additional family units. Again, these budgets were derived by following the assumptions outlined in Annex A of the report 'A poverty indicator based on a minimum income standard', as noted in the above section[31]. The extended family unit budgets were also adjusted to deduct the notional costs allocated to council tax, water and sewerage charges, rent costs, childcare costs, and fuel costs.

Total household budget

A total household MIS budget was calculated for each case in the fuel poverty dataset by adding the allocated PBU budget with any applicable budget assigned to additional household members outside of the PBU.

For the household to be considered as having an acceptable standard of living, the household residual income (as calculated in section 3.6) must be at least 90% of the assigned total household MIS budget. If the household residual income is less than 90% of the assigned total household MIS budget, then the household income is deemed insufficient to maintain an acceptable standard of living for members of the household.

[31] Hirsch, D, Padley, M and Valadez, L (2016) Poverty Indicator Based on a Minimum Income Standard. Loughborough: Centre for Research in Social Policy https://repository.lboro.ac.uk/articles/report/A_poverty_indicator_based_on_a_minimum_income_standard/9598502

4. Fuel prices

4.1 Overview

Fuel price is another component needed to calculate fuel poverty. The fuel price component of the fuel poverty model generates an output that is fed into the energy consumption model to produce the final fuel costs (see Section 5). Fuel prices used in the modelling of the 2021 fuel poverty figures were produced using information extracted from a variety of external sources, following a similar approach to the methodology used to calculate the 2018 fuel prices[32].

4.2 Data sources

4.2.1 Metered fuels (Electricity and Gas)

The average annual fuel prices for metered fuels are provided by BEIS on a calendar year basis as part of the Quarterly Energy Prices (QEP) publication[33]. The data provided by BEIS contains mains gas and electricity 'average unit price' and 'average fixed costs' (standing charges) for energy supply regions across the UK. Specifically, the prices are published within the following BEIS published tables:

- *Average variable unit costs and fixed costs for electricity for UK regions (QEP 2.2.4); and*
- *Average variable unit cost and fixed cost for gas for regions in Great Britain (QEP 2.3.4).*

The QEP data divides Wales into two regions, namely 'South Wales' and 'Merseyside and North Wales'. The fuel prices for Wales were calculated on the assumption that 74% of households are in South Wales and 26% of households are in Merseyside & North Wales. This assumption was based on analysis of the populations in each energy supply region.

The data for the 'average unit price' and 'average fixed costs' for energy supply regions in Wales are subdivided into three types of payment (direct debit, standard credit and pre-payment) so that the method of payment identified in the survey can be taken into account when assigning fuel prices to households. These are shown in Table 13.

Table 13 - Fuel prices for 2021, unit charges (£/kWh) and standing charge (£/year) from QEP tables 2.2.4 and 2.3.4

	Standard credit			**Direct debit**			**Pre-payment**		
	On peak	Off peak	Standing charge	On peak	Off peak	Standing charge	On peak	Off peak	Standing charge
Gas	£0.039		£112.64	£0.035		£91.95	£0.035		£97.43
Standard electricity	£0.211		£102.88	£0.192		£83.52	£0.202		£79.12
Economy 7	£0.241	£0.139	£103.55	£0.224	£0.118	£86.09	£0.225	£0.129	£93.41

[32] https://gov.wales/sites/default/files/statistics-and-research/2019-12/fuel-poverty-estimates-wales-2018-methodology-report.pdf
[33] https://www.gov.uk/government/collections/quarterly-energy-prices

4.2.2 Non-metered fuels except wood (e.g. coal, LPG, fuel oil)

The Sutherland Tables[34] provide fuel price data for Liquefied Petroleum Gas (LPG) and bottled gas. Fuel prices from the Sutherland Tables are available quarterly and are split regionally to show comparative heating costs across the UK. The Sutherland Tables published in October 2021 were used as this reflects the time of year of high fuel demand and prices, so the methodology does not underestimate costs. The prices produced by Sutherland were taken from a sample of prices collected over the preceding three months.

Prices for heating oil, coal and smokeless fuel (including anthracite) were obtained directly from BEIS, split by region and representing a 12-month average over the 2020 calendar year. These figures were then inflated using the Consumer Price Index (CPI)[35] values for solid and liquid fuels (QEP 2.1.3) to obtain estimates for 2021. The unit cost of heating oil for 2021 in Wales was £14.067/GJ.

4.2.3 Wood, Economy 10 Electricity, 24hr Tariff Electricity, Communal Heat From Boilers and Communal Heat from CHP

SAP 2012 fuel prices (from the Government's Standard Assessment Procedure for the energy rating of dwellings) were used for other fuels and tariffs (where their use is relatively minor), including biofuels, communal heating, and Economy 10 and 24 electricity tariffs. The price of Economy 10 and 24 hour electricity were set as the SAP 2012 prices[36], inflated to October 2021 prices using the CPI for electricity. The prices of wood and other biofuels were also based on SAP 2012 prices, and inflated from 2012 prices using the change in the CPI for solid fuels from this date. The price of communal heat was calculated using SAP 2012 communal prices, inflated using the CPI for gas for October 2021.

[34] http://www.sutherlandtables.co.uk/
[35] https://data.gov.uk/dataset/consumer_price_indices
[36] http://www.bre.co.uk/filelibrary/SAP/2012/SAP-2012_9-92.pdf

5. Energy consumption and costs

5.1 Overview

The last component needed for the calculation of fuel poverty is the amount of fuel consumed to provide the energy needs of the household. A detailed description of the energy consumption modelling is provided in Section 5 of the previously published 2017-18 methodology report. The energy consumption projections for 2021 used the same underlying BREDEM 2012 energy calculation, although the model has had some updates since the 2018 indicator was produced, the most notable being that the modelling of ventilation from chimneys, fans and flues was updated to align more closely with RdSAP. The dimensions used in the calculation for energy requirements remained unchanged from 2018[37], however, the modelling of a 'satisfactory heating regime' had been updated since the 2018 fuel poverty estimates were produced and this new heating regime was used for the 2021 projections, as detailed in section 5.3 below.

5.2 Energy efficiency upgrades

Energy efficiency upgrades have been applied in line with the measures installed in the housing stock. This data was collected from a variety of sources including Energy Company Obligation (ECO), Renewable Heat Incentive (RHI), Photovoltaic (PV) deployment and from using trends in the Wales national housing survey data (2008-2017). Data from the English Housing Survey (EHS) (2008-2019), was used to estimate the rate of addition of energy efficiency measures from 2017 to 2019 for some measures.

All households that were eligible to receive any of the upgrades were flagged as such. In addition, an ECO eligibility flag was derived from the household interview data, to enable ECO targeting of households for certain measures. The following have been modelled to identify households that qualify for ECO3 funding, based on criteria outlined in the Ofgem Energy Company Obligation (ECO3) Guidance[38]:

- Private sector households who receive specific benefits, known as the 'help to heat group' (HTHG)
- Private sector households who are fuel poor, or are vulnerable low-income households
- Social rented households, in a dwelling with an EPC rating of E, F or G

Information on the total number of upgrades applied in the stock, the basis of these estimates, and the proportion targeted at ECO eligible households are shown in Table 14.

Table 14 - Estimated improvement measure installations in Wales, between 2017 and 2021

[37] Section 5.2 of Welsh Housing Conditions Survey (WHCS) 2017-18 Fuel Poverty Estimates for Wales 2018: Methodology Report

[38] Ofgem Energy Company Obligation (ECO3) Guidance: Delivery Version 1.7

	Number of upgrades applied (rounded to nearest thousand)	Basis of estimate	Percentage targeted at ECO eligibility[39]
Loft insulation	47,000	Change in base data 2008-17[40], adjusted using EHS 2017-19[41]. Includes adjustment for new builds[42]	10%
Cavity wall insulation	10,000	ECO[43]	100%
Solid wall insulation	14,000	Change in base data 2008-17, adjusted using EHS 2017-19.	20%
Hot water cylinder insulation	14,000	Change in base data 2008-17	0%
Double glazing	35,000	Change in base data 2008-17, adjusted using EHS 2017-19. Includes adjustment for new builds	0%
Solar hot water	0	RHI[44]	N/A
Condensing boiler	196,000	Change in base data 2008-17, adjusted using EHS 2017-19. Includes adjustment for new builds and double counting from CH installations	10%
Central heating	1,000	ECO	100%
Air source heat pump	2,000	RHI	0%
Solar PV	7,000	PV deployment for installations of up to 4kW[45]	0%
Storage heater	2,000	ECO	100%

Measures were randomly applied to eligible households, prioritising ECO eligible households, so that the number of measures applied were as close as possible to the target numbers. This was repeated 100 times and the following run was selected:

- the run that closely matched the average for all runs, in terms of the proportion of households in fuel poverty for all households and when split by tenure; **and**
- most accurately represented the required number of improvements

Alterations were made to the base data, in line with the measures applied to households, and the data was then input into the BREDEM energy model to calculate energy consumption and costs for each household following the 'satisfactory heating regime' requirements, as detailed in the next section.

[39] ECO table 2.7 and 2.8: Household Energy Efficiency Statistics, headline release December 2021 - GOV.UK (www.gov.uk)
[40] Living in Wales survey: 2008; Living in Wales survey: 2008 | GOV.WALES. Welsh Housing Conditions Survey 2017-18 Welsh Housing Conditions Survey | GOV.WALES
[41] EHS Headline report, Housing Stock. AT2.13 and DA6201. English Housing Survey - GOV.UK (www.gov.uk)
[42] A component of the trend in high levels of loft insulation will be due to newly built stock; to obtain the trendline for retrofit upgrades only, an estimation of the number of new build installations for relevant measures was made using data from StatsWales and the LiW 2017 data.
[43] ECO Tables 2.7 and 2.8 (as above)
[44] RHI October 2017 and October 2021, Table 2.3 Renewable Heat Incentive statistics - GOV.UK (www.gov.uk)
[45] Solar photovoltaics deployment: table 1 capacity Solar photovoltaics deployment - GOV.UK (www.gov.uk)

5.3 Heating regimes

5.3.1 Satisfactory heating regime

The updated definition of a satisfactory heating regime has been used for the 2021 projections, as described in the 'Tackling fuel poverty 2021 to 2035' policy document[46]. Under this definition, for vulnerable households with older (a person aged 60 and over) or disabled (a person living with a long-term limiting illness or who is disabled) people, an internal demand temperature of 23°C in the living room and 18°C in other rooms is required for 16 hours in a 24-hour period in households. For all other households, 21°C in the living room and 18°C in other rooms is required for nine hours in every 24-hour period on weekdays, and 16 hours in a 24-hour period on weekends. The original definition, as used in the calculation of fuel poverty in 2018, is detailed in section 5.3.4.

5.3.2 Extent of Heating/under-occupancy

Some dwellings are considered excessive in size for the number of occupants that live there; these are labelled as "under-occupied". In under-occupied dwellings only a portion of the dwelling will need heating. The same methodology for determining the extent of heating was used for the 2021 projections as for the 2018 fuel poverty statistics.

5.3.3 Impact of Covid-19 on heating regimes

The impact of the Covid-19 pandemic was observed in the increased number of people working from home, which persisted to some degree to the October 2021 reference point. The Understanding Society COVID-19 Study, 2020-2021 showed that the proportion of adults working from home "always" or "often" increased from 11% in Jan/Feb 2020 to 30% in Sept 2021[47]. Based on this, an additional 19% of working people were randomly assigned to be in all day, to bridge the gap between pre-pandemic home working and home working in October 2021. At the household level this increased the proportion of households with someone in all day from 57% of households in 2017 to 69% in 2021. Where someone was classed as home working and not vulnerable, for the purposes of energy modelling, households were assigned a full heating regime (16 hours in a 24-hour period), with temperatures of 21°C in the living room and 18°C in other rooms.

Those additional households that were modelled to be in all day saw an increase in their household energy consumption but overall, it resulted in no change to the numbers of households in fuel poverty. The increased heating hours does not result in a proportional increase in space heating energy consumption as it is dependent on the thermal characteristics of the dwelling. However, the main factor contributing to the lack of movement was that the household incomes for these (working) households were sufficient to avoid them being pushed over the fuel poverty threshold.

5.3.4 Satisfactory heating regime (England and Northern Ireland method)

A satisfactory heating regime in England and Northern Ireland is defined as 21°C in the living room and 18°C in other rooms, for 16 hours in a 24-hour period in households for people in during the day. For all other households, 21°C in the living room and 18°C in other rooms is required for nine hours in every 24-

[46] https://gov.wales/tackling-fuel-poverty-2021-2035-html
[47] COVID-19 | Understanding Society

hour period on weekdays, and 16 hours in a 24-hour period on weekends. This is the original definition as used in the calculation of fuel poverty using the Wales 10% measure in 2018 and 2008.

5.3.5 Scottish heating regimes (Scotland method)

The Fuel Poverty (Enhanced Heating) (Scotland) Regulations 2020[48] sets out four heating regimes which have been emulated in order to produce the fuel poverty estimates for 2021 using the Scotland methodology. The four new heating regimes are:

- Enhanced heating regime 1, where living rooms (zone 1) are heated to 23°C and the rest of the dwelling (zone 2) is heated to 20°C for 16 hours every day. This is applied to households where the dwelling is frequently occupied and at least one member of the household: is aged 75 or over, or has a long-term sickness or disability, or is in receipt of benefits received for a care need or disability.
- Enhanced heating regime 2, where living rooms (zone 1) are heated to 23°C and the rest of the dwelling (zone 2) is heated to 20°C for 9 hours during weekdays and 16 hours on weekends. This is applied to households where the dwelling is not frequently occupied and at least one member of the household: is aged 75 or over, or has a long-term sickness or disability, or is in receipt of benefits received for a care need or disability.
- Enhanced heating regime 3, where living rooms (zone 1) are heated to 21°C and the rest of the dwelling (zone 2) is heated to 18°C for 16 hours every day. This is applied to households where the dwelling is frequently occupied and at least one member of the household is aged 5 or under.
- Standard heating regime, where living rooms (zone 1) are heated to 21°C and the rest of the dwelling (zone 2) is heated to 18°C for 9 hours during weekdays and 16 hours on weekends. This is applied to all other households.

Where a household fits the criteria for applying enhanced heating regime 1 and enhanced heating regime 3, for example if a member of the household is aged 75 or over and another member is aged 5 or under, enhanced heating regime 1 is applied.

5.4 Fuel costs

Energy costs for the household, were then calculated based on the fabric and requirements for each household, in line with the method used in 2018. After energy costs have been modelled, the £140 Warm Home Discount (WHD) was applied to eligible households, for the purposes of calculating fuel poverty using the Wales headline indicators, the England method, and the Scotland method[49]. The same households selected to receive this rebate for the calculation of fuel poverty in 2018 were used in the 2021 estimates. Further information on the methodology and the percentage of households selected can be found in the 2018 methodology report[50].

[48] The Fuel Poverty (Enhanced Heating) (Scotland) Regulations 2020 (legislation.gov.uk)
[49] The WHD scheme is not available in Northern Ireland, hence the methodology excludes the £140 rebate.
[50] https://gov.wales/sites/default/files/statistics-and-research/2019-12/fuel-poverty-estimates-wales-2018-methodology-report.pdf

For the calculation of fuel poverty estimates following the England method (Low Income Low Energy Efficiency, or LILEE), fuel costs were further equivalised for use in the fuel poverty calculation. These were applied to reflect the fact that different households have different spending requirements. The equivalisation factors used to adjust the fuel costs for England, are shown in Table 15.

Table 15 – Fuel cost equivalisation factors

Number of people in the household	Equivalisation factor
1	0.82
2	1.00
3	1.07
4	1.21
5+	1.32

5.5 Household energy efficiency rating

The Fuel Poverty Energy Efficiency Rating (FPEER) is a measure of the energy efficiency of a property, and is used in the calculation of fuel poverty using the England method (Low Income Low Energy Efficiency method, or LILEE). The FPEER is calculated based on the Standard Assessment Procedure (SAP) but accounts for policies that directly affect the cost of energy (e.g. the WHD). Similar to SAP, the FPEER methodology generates a rating of energy efficiency between 1 (low) and 100 (high). This is used to monitor energy efficiency improvements specifically for fuel poverty reporting and monitoring. Further details of the derivation of this variable can be found in the Fuel Poverty Energy Efficiency Rating Methodology document[51].

51 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/332236/fpeer_methodology.pdf

6. Fuel poverty indicators

This section details the method used to calculate the Wales fuel poverty indicators, for the Wales headline figures, as well as the alternative measures of fuel poverty as used in England, Northern Ireland and Scotland.

6.1 Wales headline indicators

In Wales, a household is defined as fuel poor if they need to spend more than 10% of their income on fuel to maintain an adequate level of warmth. This is referred to as the 10% measure and is calculated using the 'fuel poverty ratio'. This calculation has three components – fuel prices (unit and standing charges), fuel consumption and income. The equation takes the following simplified form:

$$Fuel\ Poverty\ Ratio = \frac{Fuel\ Costs}{Income}$$

Or the following more detailed form:

$$Fuel\ Poverty\ Ratio = \frac{\sum(Unit\ Fuel\ Price * Fuel\ Consumption) + \sum Standing\ Charge}{Income}$$

Where for each household the following applies:

- The unit fuel price (£/kWh) is applied to each fuel type
- Fuel consumption (kWh) is the energy use for each fuel type
- Standing charges (£) are applied where applicable for each fuel type and
- Income (£) is the annual full income of the whole household.

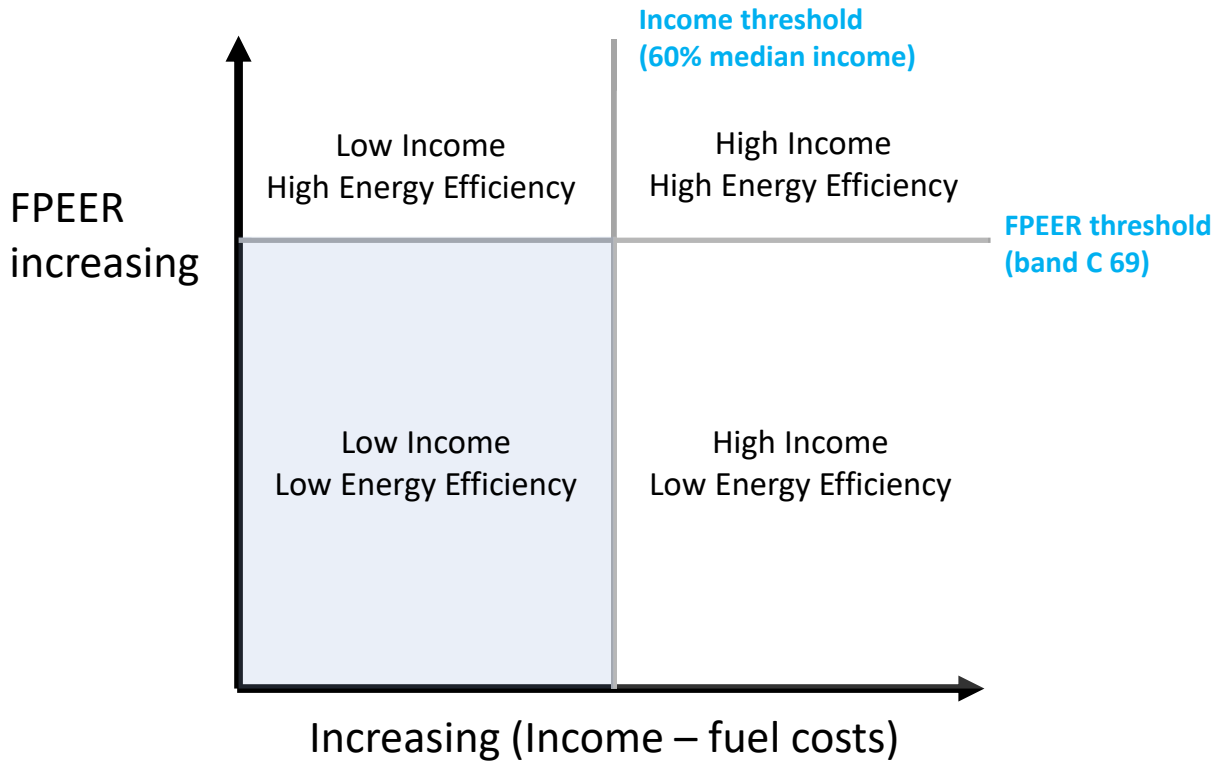
An adequate level of warmth is defined using a 'satisfactory heating regime' as outlined in section 5.3. For every household, all applicable use and cost values are summed for each fuel type, and then the WHD is deducted from the total fuel costs for selected households.

If the fuel poverty ratio is greater than 0.1 (i.e. a household spends more than 10% of their income on fuel) then the household is considered to be fuel poor. If the ratio is greater than 0.2 then the household is severely fuel poor (known as the 20% measure), while if the ratio is greater than 0.08 and less than 0.1, the household is at risk of fuel poverty.

6.2 England method (LILEE)

Fuel poverty in England is measured using the Low Income Low Energy Efficiency (LILEE) indicator. A household in England is considered fuel poor if they have a Fuel Poverty Energy Efficiency Rating (FPEER) of band D or below, and if they were to spend their modelled energy costs required to maintain a satisfactory heating regime, they would be left with a residual income below the official poverty line. Figure 3 shows the four possible groups a household can fall into under this indicator.

Figure 2 - LILEE fuel poverty indicator



The LILEE indicator is a dual indicator; the fuel poverty gap is also provided which indicates the depth of fuel poverty. This is defined as the amount by which the assessed energy requirements of fuel poor households exceed the threshold for reasonable costs (i.e. how much fuel costs need to be reduced for the household to no longer be in fuel poverty). This is calculated as the lowest cost difference of the following: the reduction in fuel costs associated with improvement to FPEER band C; or the reduction in fuel costs to increase the disposable income to a level where the household is no longer in income poverty.

To determine if a household is low income, firstly equivalised fuel costs (section 5.4) as modelled using the England satisfactory heating regime (section 5.3) are deducted from the AHC equivalised income (section 3.4). If the household income minus fuel costs is less than 60% of the median AHC equivalised income for all households, the household is classed as 'low income' for the purposes of the fuel poverty calculation. A household is classed as having 'low energy efficiency' if their FPEER rating (section 5.5) is band D or below.

Further details on the LILEE methodology can be found in the England fuel poverty methodology handbook 2022[52].

6.3 Northern Ireland method (10% measure)

Fuel poverty in Northern Ireland is calculated using the 10% measure, following the same method for Wales with the following exceptions: firstly, the satisfactory heating regime follows the original method used by Wales in the calculation of fuel poverty in 2018 (section 5.3), and secondly the WHD is not applicable to households in Northern Ireland, and therefore has not been applied when calculating fuel poverty levels in Wales using the Northern Ireland 10% measure. Further information on the latest Northern

[52] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1056802/fuel-poverty-methodology-handbook-2022-lilee-with-projection.pdf

Ireland fuel poverty methodology can be found in the Northern Ireland House Condition Survey Main Report 2016[53].

6.4 Scotland method

Fuel poverty in Scotland is calculated using a modified version of the 10% measure, where a household is classed as being fuel poor if it meets two conditions:

- Firstly, if the household fuel costs to meet the required conditions are more than 10% of the household's adjusted net income, and
- Secondly, if after deducting fuel costs, benefits received for a care need or disability, and childcare costs, the residual income (or household's remaining adjusted net income) is insufficient to maintain an acceptable standard of living.

Fuel poverty calculated using the Scotland method defines four different heating regimes, dependent on the household type and occupancy patterns, as detailed in section 5.3. In addition, no adjustment to the extent of heating for households that are under-occupying is made in Scotland. The different definitions of household income are detailed in section 3.5 to 3.7. Further information on the Scotland fuel poverty definition can be found in the Fuel Poverty (Scotland) Act 2019[54].

[53] https://www.nihe.gov.uk/Documents/Research/HCS-2016-Main-Reports/HCS-Main-Report-2016.aspx
[54] https://www.legislation.gov.uk/asp/2019/13/contents

7. Strengths and limitations

Detailed information on the strengths and limitations of the WHCS is provided in Section 3.1 (Relevance) of the Quality Report, available on the Survey website: www.gov.wales/whcs.

Specific strengths of the fuel poverty analysis were:

1) Established processes and procedures, which have been used for multiple years and across multiple datasets both in Wales and across other nations of the UK
2) Use of high-quality input data, primarily of National Statistics quality for interview and physical survey data
3) Robustness of the survey approach, sample size and weighting process, as provided for the 2017-18 base data.
4) External data, used in the projections of each fuel poverty component, were based on large scale and high-quality statistics
5) Models have been updated to the most up-to-date versions, and methodologies all use the latest definitions
6) Comprehensive quality assurance processes were undertaken as part of the modelling.

Limitations which we have identified were:

1) Data is from a sample survey so subject to sampling errors
2) Detail collected by both physical and interview surveys is limited by time available and access to elements of the property (physical survey is non-intrusive). No documentary evidence for income sources is required
3) Due to changes in the methodology for calculating fuel poverty in Wales in 2021, results cannot be directly compared over time
4) Data on the number of energy efficiency upgrades between 2017 and 2021 is limited, and some information had to be inferred
5) The impact of COVID-19 on fuel poverty was assessed by altering the heating regime in line with an increase in households assumed to be in during the day. Compositional or income changes were not investigated further due to lack of external evidence of these
6) No attempt has been made to include the effect of demographic or compositional changes within the household weighting over this period. This effect should be relatively small due to the short time period modelled.

Further details

The document is available at: www.gov.wales/whcs

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