Appendix D: Technical Appendix – Results for selected measures of energy hardship

Disclaimer

Access to the data used in this study was provided by Stats NZ under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the author, not Stats NZ or individual data suppliers.

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/.

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Purpose

This Technical Appendix is a supporting document to *Defining Energy Hardship - A discussion document on defining and measuring energy wellbeing and hardship in Aotearoa* ('the discussion document').

The discussion document proposes that energy hardship is on the opposite end of a spectrum from energy wellbeing. It proposes a conceptual definition of energy wellbeing: *When individuals, households and whānau are able to access and afford adequate energy services to support their wellbeing in their home or kāinga*. The document also proposes a number of ways we could measure levels of energy hardship in Aotearoa.

The Ministry of Business, Innovation and Employment (MBIE) has updated parts of the analysis in Stats NZ's 2017 report *Investigating different measures of energy hardship in New Zealand*[1], incorporating the results from the 2018/2019 Household Economic Survey (HES)[2]. The purpose of this research is to see how selected measures of energy hardship have changed over time, and provide more up to date statistics to inform MBIE's consultation on a proposed energy hardship definition.

As is discussed in the main body of the discussion document, a single measure alone cannot capture the levels of energy hardship in Aotearoa. It is for this reason that MBIE is proposing a suite of measures. The results in this Appendix are useful to understand certain measures and their overlap, but without a generally agreed suite of measures, it is currently not possible to draw official conclusions about the prevalence of energy hardship in Aotearoa.

This Appendix presents results from initial analysis. Measures included in this analysis will not necessarily be included in MBIE's recommended suite of measures. Equally, if a measure is not included in this analysis that does not mean it is excluded from consideration by MBIE for the final recommended suite of measures.

Definitions of terms used

Housing costs	Expenditure on rent and mortgages (both principal and interest repayments), property rates, and building-related insurance[3]

List of abbreviations

AHC	After Housing Costs
BHC	Before Housing Costs
HES	Household Economic Survey
IDI	Integrated Data Infrastructure

[1] Stats NZ, 2017.
[2] HES years refer to year ended June – i.e. 2018/19 refers to year ended June 2019.
[3] Stats NZ, 2020a.

We've produced the latest results for a range of energy hardship measures

Stats NZ's 2017 report *Investigating different measures of energy hardship in New Zealand* (referred to in this Technical Appendix as the 'Stats NZ 2017 report') explored a number of potential measures of energy hardship using data in the Household Economic Survey (HES), as well as the 2013 Census of Population and Dwellings. The HES expenditure results presented in the report were from the HES 2012/13 and 2015/16. While the report looked at a range of measures, it identified five measures as being the most useful for measuring energy hardship, particularly when combining indicators:

- whether a household spent twice the median or more of their AHC income on energy
- whether an individual put up with feeling cold a lot
- whether there was a major problem with heating and/or keeping the dwelling warm in winter
- whether the dwelling had a major problem with dampness and/or mould
- whether they had trouble paying utility bills on time more than once.

Since the Stats NZ 2017 report was published, another HES expenditure survey – HES 2018/19 has been collected, and the data made available for research. We have produced updated results for selected measures from the Stats NZ 2017 report here using the latest data available from the HES 2018/19 survey. Note that figures for 2015/16 may vary from the earlier published report as the weights were updated after that report was published[4].

While there has also been another Census (2018) undertaken since the Stats NZ 2017 report, this Appendix presents results from the HES only. HES was the main source of data for the Stats NZ 2017 report.

The Household Economic Survey

HES is an annual survey designed to measure the economic wellbeing of New Zealanders. HES has three components: HES income, HES expenditure, and HES net worth[5].

- HES income is the main vehicle, and it is run every year. The survey is conducted over a 12-month period, from July to June. It includes household income, housing costs, and material wellbeing – this is 'core' HES.
- HES expenditure includes additional components – an expenditure diary and an expanded household expenditure questionnaire. It runs every three years.
- HES net worth includes additional questions on household assets and liabilities. It also runs every three years.

Collection timelines mean a significant lag in data reporting. Official child poverty reporting also draws on the HES, and the Child Wellbeing and Poverty Reduction Group website provides some more information on the timing of HES surveys and data release, and the lag between policy changes taking effect and their impact showing up in official reporting[6].

[4] The HES is a sample survey that uses several steps to rate up, or weight, the data from the sampled households to represent the population of Aotearoa.

[5] https://www.stats.govt.nz/methods/changes-to-the-household-economic-survey-201819

[6] *Timeframes for Stats NZ data and reporting* can be found at https://dpmc.govt.nz/our-programmes/reducing-child-poverty/child-poverty-measures-targets-and-indicators

HES 2018/19, which ran from July 2018 to June 2019, collected the HES expenditure component, in addition to the core HES income component. The next HES expenditure component will be collected in 2021/22.

A range of objective and subjective measures analysed

Measures used in the Stats NZ 2017 report

We have updated results for selected measures of energy hardship that were based on HES data in the Stats NZ 2017 report. These are:

- Objective measures – comparing spending on energy with income or total household spending
    - Households that spent twice the median proportion or more of their income on domestic energy (income both before and after housing costs considered)
    - Households that paid 10 per cent or more of their income on domestic energy, before (income both before and after housing costs considered)
    - Households where domestic energy costs are in the highest quartile as a proportion of all expenditure
- Subjective measures – households providing insight into their experiences
    - Households who were unable to pay their utility bills (electricity, gas, water, or rates) on time more than once in the last 12 months due to a shortage of money
    - Households who have a major problem with heating their accommodation and/or keeping warm in winter
    - Households whose accommodation has a major problem with dampness or mould
    - Households who put up with feeling cold a lot to keep costs down

A new measure from the HES 2018/19

In addition to the above measures that were included in the Stats NZ 2017 report, the 2018/19 HES included a new material wellbeing question related to energy wellbeing.

This question asks "Can [You/ Your Household] afford to keep the [Dwelling] adequately warm?" This question has a yes/no response option, although it should be noted that households can also respond that they do not know. While this question has been asked from a wellbeing perspective, the inverse of this question (i.e. whether households *cannot* afford to keep their accommodation adequately warm) has been analysed by MBIE to align with the other subjective measures of energy hardship analysed here. This is a useful question as it shows some of the key elements of energy hardship – the affordability of energy ("cannot afford"), and ability to keep warm ("keep warm"). Keeping warm can be seen as a proxy for the thermal performance of a dwelling, as a well-insulated dwelling that meets high energy standards may require little or no heating in winter (or cooling in summer).

Therefore the final subjective measure of energy hardship presented in this report is:

- Households that cannot afford to keep their accommodation adequately warm.

Note: all figures in this appendix refer to the number or proportion of **households**. MBIE will be undertaking further research to look at the number or proportion of **individuals** being impacted.

Similarities with the Child Poverty Reduction Act

The official measures of child poverty are a combination of income and non-income based measures.

"Using non-income measures provides a direct measure of the actual day-to-day living conditions of households – the basics of food, clothing, accommodation, heating, and transport, and their ability to afford other items that most people would regard as essential"[7].

Using subjective measures for energy hardship follows the same principles.

The material hardship measure of child poverty is defined using the DEP-17 index, which looks at the number of deprivations a respondent experiences based on 17 questions. These questions are asked annually in the Material Wellbeing section of the HES.

Two of the subjective measures of energy hardship we have considered here are from DEP-17 questions:

- Households that paid utility bills late more than once in the last 12 months
- Households that put up with feeling cold a lot in order to keep costs down

Additionally, one of the subjective measures of energy hardship we have considered here is based off the same HES response as one of the five Government-identified child poverty related indicators:

- Households whose accommodation has a major problem with dampness or mould

Material wellbeing questions in the HES include a range of response options, such as whether the individual/household put up with being cold to keep costs down "not at all", "a little", or "a lot". As with child poverty measurement, for the measures of energy hardship in this analysis the most extreme response has been used (e.g. "a lot", or "major" problem)[8].

[7] Stats NZ, 2019b.

[8] Stats NZ, 2019b.

Things to consider when looking at these results

Comparability with analysis in the Stats NZ 2017 report

Care needs to be taken when comparing the results of this analysis with those presented in the Stats NZ 2017 report due to several changes that have taken place in the intervening years.

Representative weights for 2015/16 HES have been updated

The HES is a sample survey that uses several steps to rate up, or weight, the data from the sampled households to represent the population of Aotearoa. The weights for the 2015/16 HES were recalculated, and new weights were applied in 2018[9]. As a result the numbers and percentages for energy hardship measures for the 2015/16 HES in this paper will differ slightly from those published in 2017.

Sample changes in 2018 to support development of child poverty measures

The subjective measures used here are based on a subset of material wellbeing questions collected annually in the core Household Economic Survey (HES). In Budget 2018, Stats NZ received additional funding for improving the HES to better meet the requirements of the Child Poverty Reduction Act. These improvements included a significant increase in the sample size for these material wellbeing questions to include at least 20,000 households, and modifications to the survey design to ensure good representation of low-income households[10]. These material wellbeing questions are used in official child poverty measurement. The larger sample size and improved sample design has reduced sampling errors for the 2018/19 'core' HES.

New subjective measure for 2018/19

As noted above, we have included in this analysis the results of a new question introduced in the 2018/19 HES. As this question was not previously asked, there are no results for this question for years prior to 2018/19.

Caveats and other things to note

Only HES expenditure years analysed

Measures in this Technical Appendix have been calculated for 2012/13, 2015/16, and 2018/19, which are all HES expenditure years. In the future we can revisit the intervening years to look at the selected subjective measures over time, as material wellbeing questions have been asked annually with each HES. However, at the time of analysis, data needed to calculate sampling errors was not available and we have produced the measures for HES expenditure years only.

Income is not equivalised

Annual household income, derived by summing annual personal income for all household members, provides basic information about household standard of living. However, as an indicator of relative standard of living, median annual household income is inadequate. For example, a one-adult

[9] https://www.stats.govt.nz/news/corrections-to-household-expenditure-statistics-year-ended-june-2016-and-household-income-and-housing-cost-statistics-year-ended-june-2017

[10] Sample size was increased for HES income – questions covering household income, housing costs, material wellbeing, and child material wellbeing. Stats NZ, 2019a.

household with an annual household income of $80,000 is likely to be able to access a higher standard of living than a household of 10 people with that income.

To allow household income to be compared across household types, a scale can be used to equivalise annual household income for household composition. Equivalised income is a ranked measure of income[11].

In this analysis of measures of energy hardship we have not used equivalised income for the most part, due to time constraints. We plan to investigate this in future analysis.

Moving-line vs fixed-line threshold measures

The official child poverty measures include two methods for using thresholds in measures[12]. We plan to apply this methodology to energy hardship measurement:

- *Fixed-line measures*, where an "anchor point" is chosen as the base/reference period for which the threshold is derived and applied to all years. For example the 'proportion of households whose AHC income spent on domestic energy is twice the 2012/13 median or more' – using the median value from 2012/13.
- *Moving-line measures*, where the threshold value changes from year to year. That is, a household's energy costs and income are compared to a threshold that changes over time. For example the 'proportion of households whose AHC income spent on domestic energy is twice the median or more' – using the value of the median in each year.

For all threshold measures in this analysis we have used a moving-line threshold when looking across different years[13]. MBIE will be undertaking further analysis to examine the use of both fixed-line and moving-line measures.

Number vs proportion of households

We have presented information here on the **number** and **proportion** of households experiencing these measures. However, when comparing measures over time, only **proportions** should be used. This is because the number of households in Aotearoa has grown over time as the population increases.

[11] Stats NZ, 2017, p52.

[12] Stats NZ, 2019c.

[13] Excluding the '10 per cent' measure, where the threshold value is fixed at 10 per cent.

Rationale for each measure

The following section presents each measure and how it contributes to our understanding of energy hardship.

Objective measures

Table 1 Rationale for objective measures

What are we measuring?	How do we measure it?	What might it tell us?
Households paying a large amount of their income/residual income on energy costs	Households spending twice the national median proportion of household income on domestic energy costs, or more (BHC and AHC income)	Indicates that the dwelling and appliances are unlikely to be energy efficient, indicates financial pressure, and potentially difficulty paying bills
Households paying a large amount of their income/residual income on energy costs	Households spending 10 per cent or more of their income on domestic energy before and after housing costs (BHC and AHC income)	Indicates that the dwelling and appliances are unlikely to be energy efficient, indicates financial pressure, and potentially difficulty paying bills
Households with high proportion of expenditure on energy costs	Households where domestic energy costs are in the highest quartile as a proportion of all expenditure	Indicates that the dwelling and appliances are unlikely to be energy efficient, indicates financial pressure, and potentially difficulty paying bills

Subjective measures

Table 2 Rationale for subjective measures

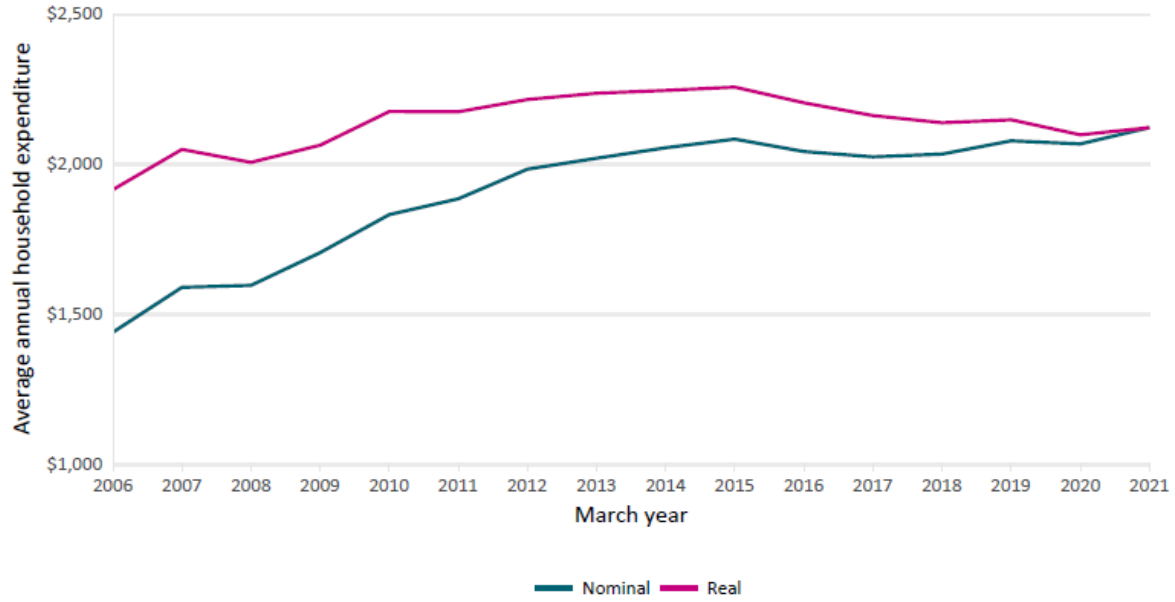
What are we measuring?	How do we measure it?	What might it tell us?
Poor quality housing and energy rationing	Households that put up with feeling cold a lot to keep costs down in the last 12 months	Difficulty affording bills, poor quality housing, rationing energy use to pay for other essentials
Poor quality housing and energy rationing	Households that cannot afford to keep their accommodation adequately warm	Difficulty affording bills, poor quality housing, inadequate heating, rationing energy use to pay for other essentials
Poor quality housing	Households that have a major problem with dampness and/or mould	Poor housing quality, ventilation adequacy, risks to health
Poor quality housing	Households whose accommodation has a major problem with heating and/or keeping it warm in winter	Poor housing quality, Inadequate heating types, difficulty affording bills

What are we measuring?	How do we measure it?	What might it tell us?
How many households have recurrent issues with paying essential bills on time	Households that have not been able to pay electricity, gas, rates or water bills because of a shortage of money more than once in the last 12 months	Lack of financial resilience, vulnerability to debt

Objective measures results

Energy costs are a larger proportion of spending for lower income households

Figure 1 Average residential expenditure on electricity per annum



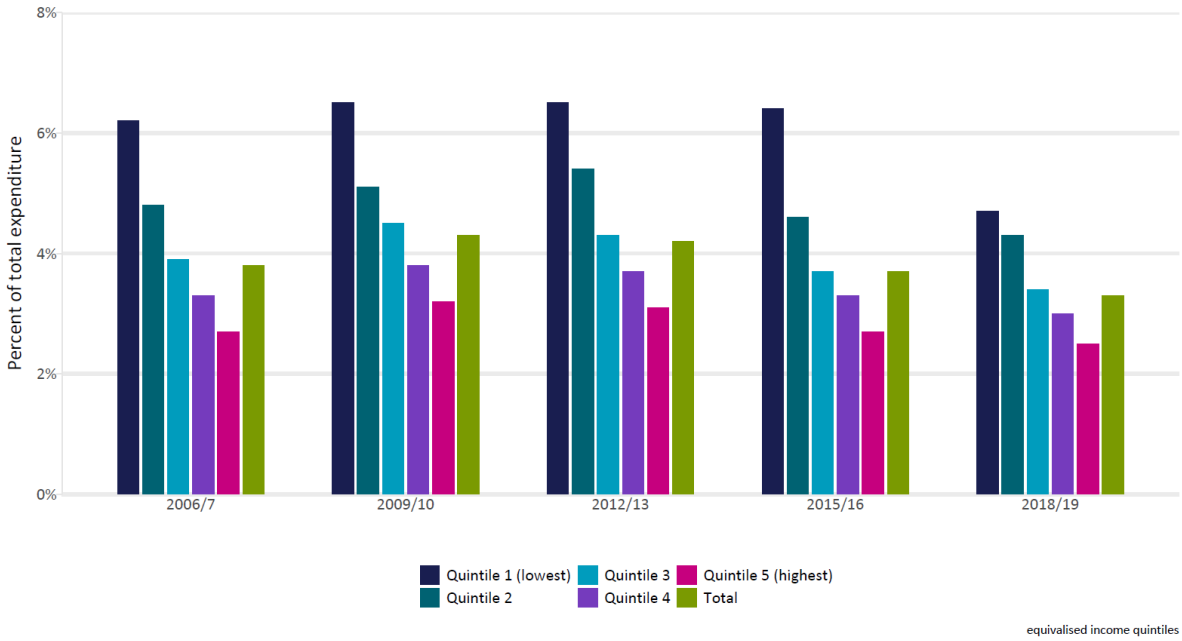
While most of the information in this Appendix comes from the Household Economic Survey, MBIE also collects some information on domestic energy expenditure on electricity through sales-based electricity cost data. This does not include other forms of energy such as gas or firewood, but it provides a useful picture of household consumption at an aggregate level.

Figure 1 shows that, when adjusted for inflation (the 'Real' series), annual average residential expenditure on electricity increased from 2006 to 2013 but has since fallen slightly. The latest year for which we have this data is the year ending 31st March 2021, when average residential electricity expenditure per household was $2,121 per annum. Between 2010 and 2020, average household consumption of electricity followed a downward trend, falling from 7,903 kWh per annum to 7,099 kWh per annum[14,15]. Adjusted for inflation, the average cost per unit has gradually been falling after reaching a peak in the year ending 31st March 2015. However average household expenditure and consumption do not tell us about variation by household income, or the extent that domestic energy expenditure is a burden on households.

[14] https://www.mbie.govt.nz/assets/Data-Files/Energy/nz-energy-quarterly-and-energy-in-nz/QRSS-December-2020.xlsx

[15] Demand for the year ending 31st March 2021 deviated from this trend as people spent more time at home due to restrictions on activities and movements as part of New Zealand's response to the coronavirus (COVID-19) pandemic. This saw electricity use by households increase.

Figure 2 Proportion of total expenditure spent on domestic energy by household equivalised disposable income quintile



All of the objective measures presented in this Appendix look at a household's spend on domestic energy compared to its income (both AHC and BHC), or its total expenditure. Figure 2 shows the proportion of total domestic energy expenditure as a percentage of household income by equivalised disposable income quintile[16], from HES expenditure surveys since 2006/7.

Households in the lowest income quintile spend a higher proportion of total expenditure on energy, compared to households in higher income quintiles. As income increases, the proportion of total expenditure that is spent on energy decreases. As well as having more income to spend, it is also likely that higher income households can afford to live in houses with a higher quality thermal envelope and therefore need to spend less on energy. Lower income households may also ration their energy use, and previous research has shown that they were more likely to put with feeling cold a lot to keep costs down[17]. Data from the General Social Survey and the Census of Population and Dwellings show that lower income households are more likely to experience damp, and mould in their homes, and put up with feeling cold[18].

The proportion of total expenditure spent on energy across all households (the 'Total' series) has fallen since the 2009/10 HES. There is also a noticeable decrease in the proportion spent on energy for households in the lowest income quintile between the 2015/16 and 2018/19 HES. Further investigation is required to understand the reason for this.

[16] Disposable household income is income after tax. This income is then equivalised using the OECD modified scale. NB: This figure is the only analysis in this Appendix where income has been equivalised.
For this the base is a one person household, factor = 1. For each additional person aged 14 or over add another 0.5 to the factor, for each person under 14 add 0.3 to the factor. See also https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Equivalised_disposable_income
[17] Stats NZ, 2017.
[18] Stats NZ, 2020c.

Median spend on energy as a proportion of income has decreased over time

Two of the objective measures of energy hardship analysed in this Appendix compare the proportion of income a household spent on energy compared to the national *median* proportion of household income spent on energy:

- Households that spent twice the median proportion or more of their *income before housing costs* on domestic energy *(BHC income)*
- Households that spent twice the median proportion or more of their *income after housing costs* on domestic energy (*AHC income)*

Since the 2012/13 HES, the median spend on energy as a proportion of income (both AHC and BHC) has decreased.

Table 3 Median and twice median share of energy expenditure out of AHC income

	2012/13	2015/16	2018/19
Median share of energy expenditure as a proportion of AHC income (across all households)	3.7%	3.4%	3.1%
Twice the median share of energy expenditure as a proportion of AHC income (across all households)[19]	7.5%	6.7%	6.3%

Table 3**Error! Reference source not found.** shows how the value of the median has changed over time, and so how the threshold value of *twice the median share of energy expenditure as a proportion of household income* has changed also. In 2018/19 the median proportion of AHC income spent on energy was 3.1 per cent, and twice the median was 6.3 per cent. So in 2018/19 households that met the 'twice median AHC income' measure were those households that spent 6.3 per cent or more of their AHC income on domestic energy.

The twice median share has decreased from 7.5 per cent in 2012/13 to 6.3 per cent in 2018/19. There could be a number of factors driving this decrease in the median. We have not yet done analysis to investigate this.

[19] Note that the values for the 'twice the median' threshold have been derived from the raw, unrounded values for the median.

Energy hardship affects between 1 in 5 and 1 in 17 households depending on which objective measure is used

Figure 3 Proportion of households that meet objective measures

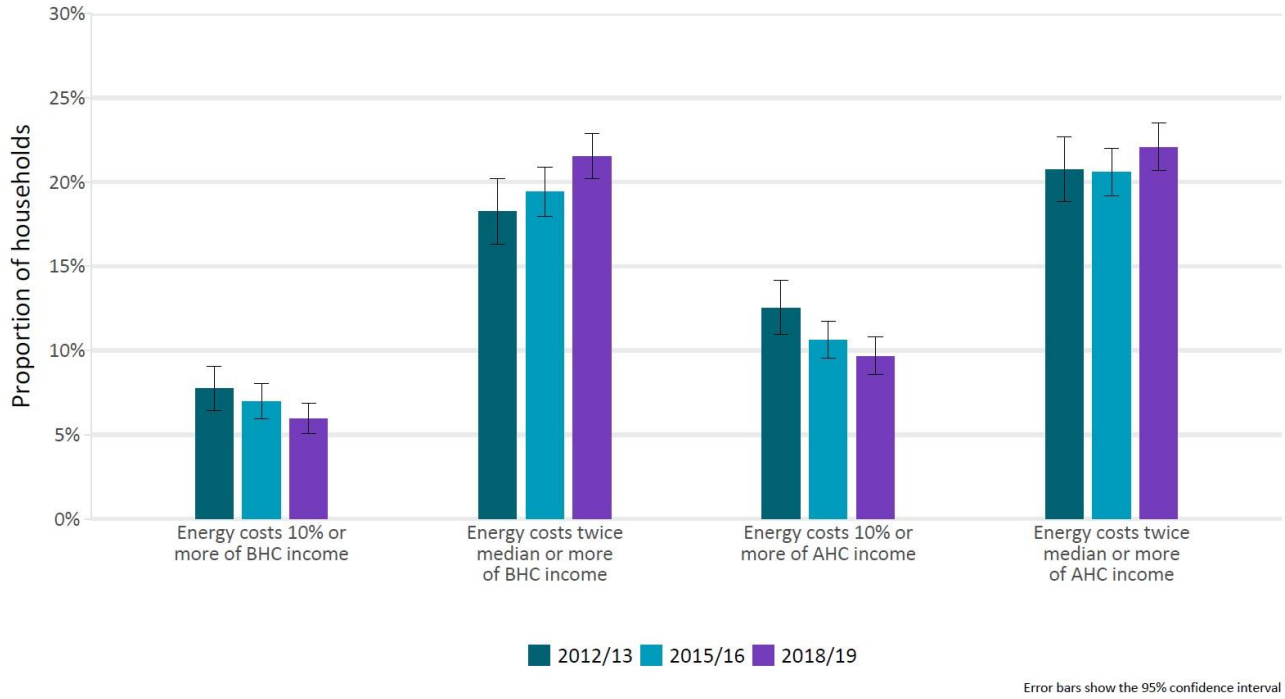


Figure 3 shows the proportion of households meeting the different objective measures of energy hardship over the three HES expenditure surveys analysed. There is considerable variation in levels depending on which measure is used.

In the 2018/19 HES, around 1 in 5 households (22 per cent) in Aotearoa were spending a proportion of their AHC income on energy that was twice the median or more (in 2018/19 this was at least 6.3 per cent of their AHC income).

More households are defined as experiencing energy hardship using the twice median threshold than the measures using 10 per cent as a threshold. This is because the twice median value has consistently been lower than 10 per cent. In 2018/19, 9.7 per cent of households paid 10 per cent or more of their AHC income on domestic energy.

The proportion of households meeting the twice median measures appears to have grown since 2012/13, while the proportion meeting the 10 per cent threshold measures appears to have fallen.

Choice of threshold matters

The choice of threshold for these expenditure measures has a large impact on the number of households considered to be in energy hardship.

All of the expenditure measures in Figure 3 consider the amount a household spends on domestic energy as a share of their income (either BHC or AHC). Whether a household is considered in energy hardship or not for each measure depends on different thresholds for the ratio of spend to income (either BHC or AHC). It is important to understand the reasoning behind different thresholds when determining which is most suitable for our context. Additionally, these measures consider the actual

expenditure of a household, rather than what they would need to spend to adequately support their wellbeing – this is discussed in further detail later.

Level of threshold

Data for the HES 2018/19 shows that an estimated 162,000 households, or 9.7 per cent, had energy costs as a share of AHC income that was 10 per cent or more. However an estimated 370,000 households, or 22.1 per cent spent twice the median or more share of AHC income on domestic energy. This is a difference of around 200,000 households being identified as either experiencing energy hardship or not depending on which measure is used. Table 4 shows the difference in the number of households that are identified as experiencing energy hardship for the 10 per cent and twice median thresholds (when using AHC income) over the different years analysed.

These results show the significance of both the level and context for a threshold. As noted above, data from the HES shows that for Aotearoa the 'twice median' share of domestic energy spend from income is below 10 per cent, and has fallen over time. The threshold value for twice the median share of AHC income in 2018/19 was 6.3 per cent (see Table 3). As 10 per cent is a higher threshold, fewer households are identified as experiencing energy hardship using the '10 per cent' measure.

Table 4 Number and proportion of households meeting different threshold measures

	Domestic energy costs are 10% or more of AHC income		Proportion of AHC income spent on domestic energy is twice the median or more		Difference
Year	Number of households	Proportion of households (%)	Number of households	Proportion of households (%)	Number of households
2012/13	199,000 (174,000 - 225,000)	12.5 (11.0 - 14.2)	329,000 (299,000 - 360,000)	20.7 (18.8 - 22.7)	130,000
2015/16	175,000 (157,000 - 193,000)	10.6 (9.5 - 11.7)	339,000 (316,000 - 362,000)	20.6 (19.2 - 22.0)	164,000
2018/19	162,000 (144,000 - 181,000)	9.7 (8.6 - 10.8)	370,000 (347,000 - 394,000)	22.1 (20.7 - 23.5)	208,000

The '10 per cent' measure does not fit Aotearoa's context

"Energy costs 10% or more of income" was one measure of energy hardship considered in the Stats NZ 2017 report. We have included it in this analysis as it is a commonly used measure, but want to make it clear that we do not recommend it.

While 10 per cent is commonly referred to as a threshold when describing energy hardship, it has often been misused as a threshold for energy hardship. The '10 per cent' measure presented here and in the Stats NZ 2017 report is *based* on the influential work of Boardman, who in 1991 defined a household as being in fuel poverty if it is "unable to obtain an adequate level of energy services, particularly warmth, for 10 per cent of its income"[20]. At the time, 10 per cent was roughly twice the median actual spend on energy relative to total income for households in the UK. This definition is time and context dependent, and it is not appropriate to transfer this threshold to Aotearoa without considering whether this context is relevant here.

[20] Boardman, 1991, as cited in Scottish Fuel Poverty Definition Review Panel, 2017, p. 27.

Required energy use key for better expenditure measures

Using 10 per cent without relating it to the energy required to achieve thermal comfort is inappropriate in our context and is likely to underestimate the true extent of energy hardship in Aotearoa. As the Stats NZ 2017 report concludes, using the medians "more clearly reflected both the cost burden of fuel and related specifically to the situation in New Zealand"[21].

We do not have extensive information on required energy use in Aotearoa. Further research is necessary to model required energy use for different households. While we have information on actual energy spend as a proportion of household income, this is not an adequate measure of energy hardship without the required energy element. The calculation of the modelled consumption of energy demand remains the biggest challenge to using energy costs in relation to income accurately. This has led "the vast majority of the scientific community to an easier, apparently similar but misleading solution: the use of actual energy consumption in calculations"[22].

[21] Stats NZ, 2017, p. 29.

[22] Papada & Kaliampakos, 2018, p. 154.

Subjective measures results

Over 130,000 households could not afford to keep their home adequately warm

When we look at the results for subjective measures from the HES, numbers tend to be lower than when considering actual spend in relation to income, particularly in relation to median measures. Less than 10 per cent of households in 2018/19 experienced one of these subjective measures as Figure 4 shows.

Figure 4 Proportion of households that meet subjective measures

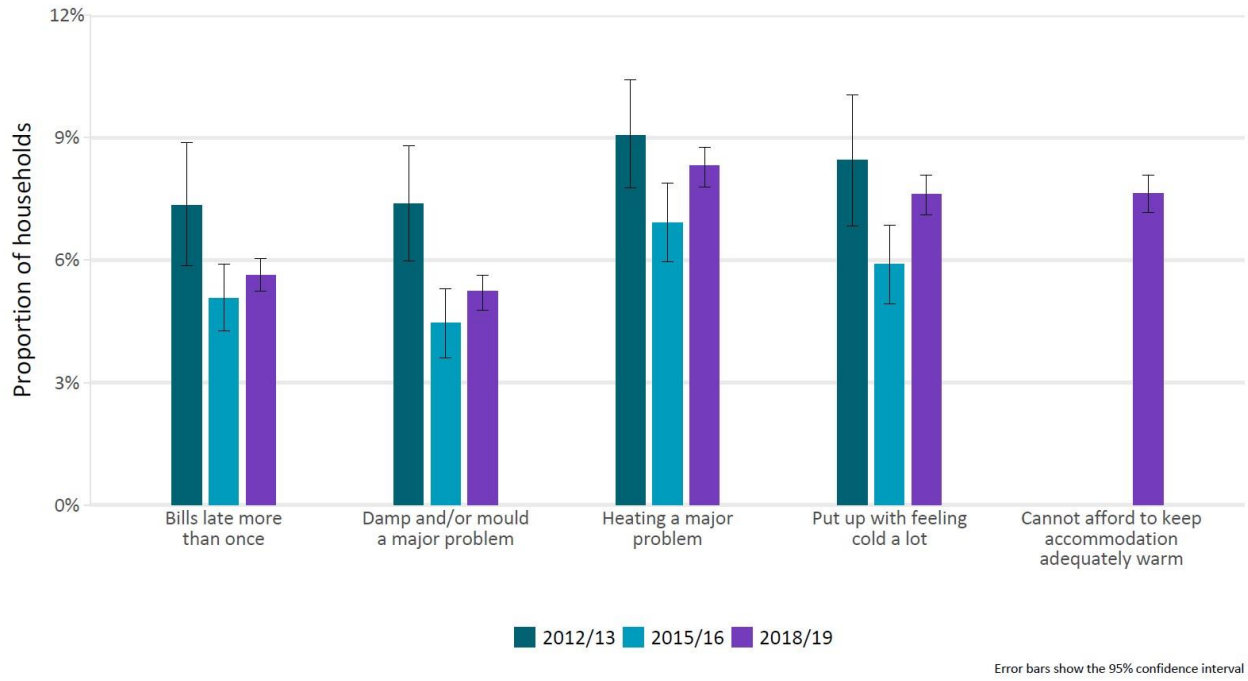


Figure 4 shows the proportion of households who experienced each of these subjective measures between 2012/13 and 2018/19. There is a significant difference for rates of damp and mould being a major problem between these two periods.

In 2018/19, 134,000 households (7.6 per cent) said that they could not afford to keep their accommodation adequately warm. Similar proportions of households reported having a major problem with heating their accommodation and/or keeping warm in winter (146,000 households, or 8.3 per cent), or putting up with feeling cold a lot to keep costs down (134,000 households, or 7.6 per cent).

There appears to be a dip in households meeting each measure between 2012/13 and 2015/16, which is statistically significant for the "damp and/or mould a major problem" measure. However, some caution should be applied when interpreting these results as they may be an artefact of the data rather than changes in real world household circumstances. The Ministry of Social Development did not publish low income or material hardship figures for 2015/16 and 2016/2017 HES years because "there was good reason to believe that the low-income and material hardship figures for households with children for these two years were under-estimates"[23].

[23] Perry (Ministry for Social Development), 2019, p.27.

The General Social Survey (GSS) is a different Stats NZ survey that also asks questions about thermal comfort in the home. In the 2018 GSS around 1 in 5 people (21.2 per cent) reported their house or flat was always or often colder than they would like in winter[24]. This is a higher proportion of people than those who reported "heating a major problem" and other measures from the HES related to warmth in the home as shown in Figure 4, however these two questions are asking different things – "heating a major problem" vs "always or often colder than they would like". We are interested in doing further research to compare results from different surveys.

Table 5 Updated energy hardship measures for all households[25]

Measure	Number of households	Proportion of households		
	2018/19	2012/13	2015/16	2018/19
Domestic energy costs are 10% or more of household income	100,000 (85,000 – 115,000)	7.7 (6.4 - 9.1)	7.0 (5.9 - 8.0)	6.0 (5.1 - 6.9)
Domestic energy costs are 10% or more of AHC income	162,000 (144,000 – 181,000)	12.5 (11.0 – 14.2)	10.6 (9.5 – 11.7)	9.7 (8.6 – 10.8)
Proportion of household income spent on domestic energy is twice the median or more	361,000 (339,000 – 384,000)	18.2 (16.3 – 20.2)	19.4 (18.0 – 20.9)	21.5 (20.2 – 22.9)
Proportion of AHC income spent on domestic energy is twice the median or more	370,000 (347,000 – 394,000)	20.7 (18.8 – 22.7)	20.6 (19.2 – 22.0)	22.1 (20.7 – 23.5)
Domestic energy costs as a share of total expenditure is in the highest quartile[26]	423,000 (393,000 – 452,000)	25.0 (23.2 – 26.8)	25.0 (23.0 – 27.0)	25.0 (23.3 – 26.7)
Bills late more than once	99,000 (92,000 – 106,000)	7.3 (5.9 - 8.9)	5.1 (4.3 - 5.9)	5.6 (5.2 - 6.0)
Damp and/or mould a major problem	92,000 (84,000 - 99,000)	7.4 (6.0 - 8.8)	4.5 (3.6 - 5.3)	5.2 (4.8 - 5.6)
Heating a major problem	146,000 (137,000 – 154,000)	9.1 (7.8 – 10.4)	6.9 (6.0 - 7.9)	8.3 (7.8 - 8.8)
Put up with feeling cold a lot	134,000 (125,000 – 142,000)	8.4 (6.8 – 10.0)	5.9 (4.9 - 6.9)	7.6 (7.1 - 8.1)
Cannot afford to keep accommodation adequately warm	134,000 (126,000 – 142,000)	Not collected	Not collected	7.6 (7.2 - 8.1)

[24] Stats NZ, 2020c

[26] The proportion of households in the highest quartile will always be 25%.

Almost 40 per cent of low income households could not afford to keep their accommodation adequately warm

Figure 5 Distribution of household that meet subjective measures by income quintile in 2018/19

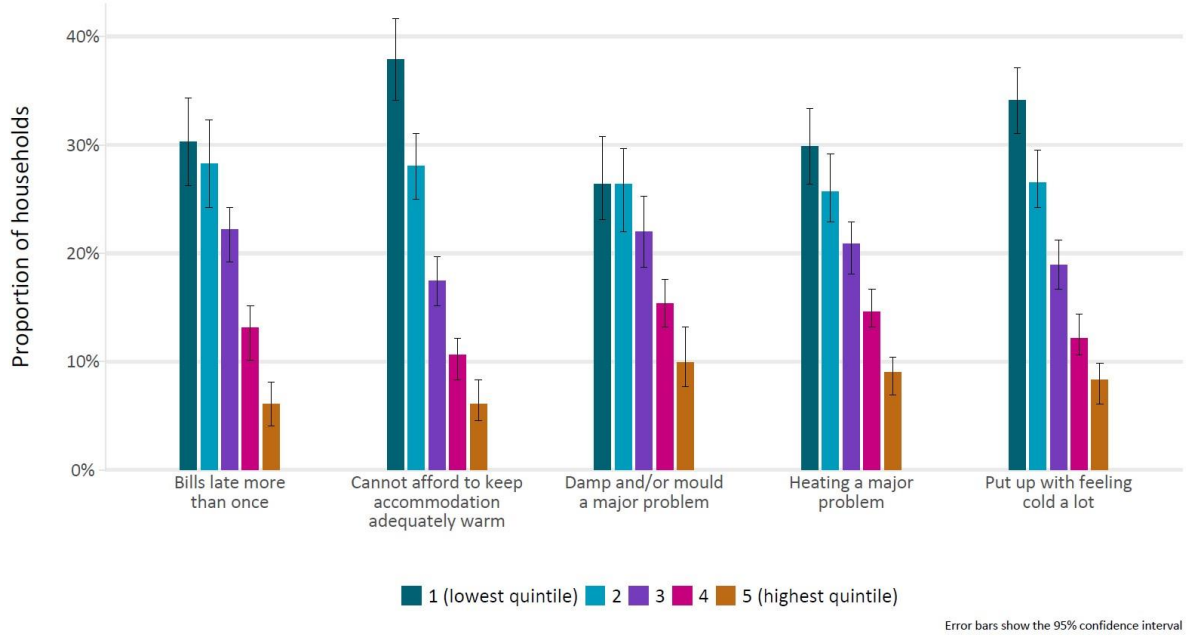


Figure 5 shows the rate of households experiencing different subjective measures of energy hardship across income quintiles. Households in the lowest income quintile are more likely to experience these measures for all but one of these subjective measures, highlighting the intersection between energy hardship and broader material hardship. These results are consistent with the Stats NZ 2017 report which found that low income households were significantly more likely to experience objective measures and most subjective measures of energy hardship[27].

The lowest income quintile has the largest proportion of households reporting negative outcomes for the subjective measures. This is statistically significant for the measures “Cannot afford to keep accommodation adequately warm” and the related measure “Put up with feeling cold a lot”. Almost 4 out of 10 households (37.9 per cent) in the lowest income quintile said they could not afford to keep their accommodation adequately warm, compared to 6.1 per cent in the highest quintile. Households in quintile 2 (the second lowest income quintile) also had high rates of subjective measures, with 28.0 per cent reporting they could not afford to keep their accommodation warm.

While households in the highest income quintile experienced subjective measures of energy hardship at significantly lower rates than those with lower household income, almost 1 in 10 (9.9 per cent) reported a major problem with damp and/or mould. These results may change when we analyse the data with equivalised income.

How do results vary by household characteristics?

In this section we look at the distribution of the selected measures by the ages of household members, selected ethnicities, and whether the household lives in an owner-occupied dwelling[28].

[27] Stats NZ, 2017

[28] We note that in this analysis of energy hardship measures we have not used equivalised income.

Households with older people more likely to have high energy costs compared to income

MBIE has analysed the rates of different energy hardship measures across several different household age profiles. These categories are:

- households with at least one child aged under 15
- households where everyone is aged under 65
- households where there is at least one person aged 65 or over.

These categories were selected to understand the differences between younger and older households. Both households with younger and older people have been noted as at risk of energy hardship, as they may need warmer temperatures and spend more time at home, leading to higher energy requirements generally[29]. Figure 6 and Figure 7 show the measures for these households, compared with the proportion of all households that meet these measures[30]. The numbers for both of these graphs are presented in Table 6.

Figure 6 Comparison of different household age profiles to all households for objective measures for 2018/19

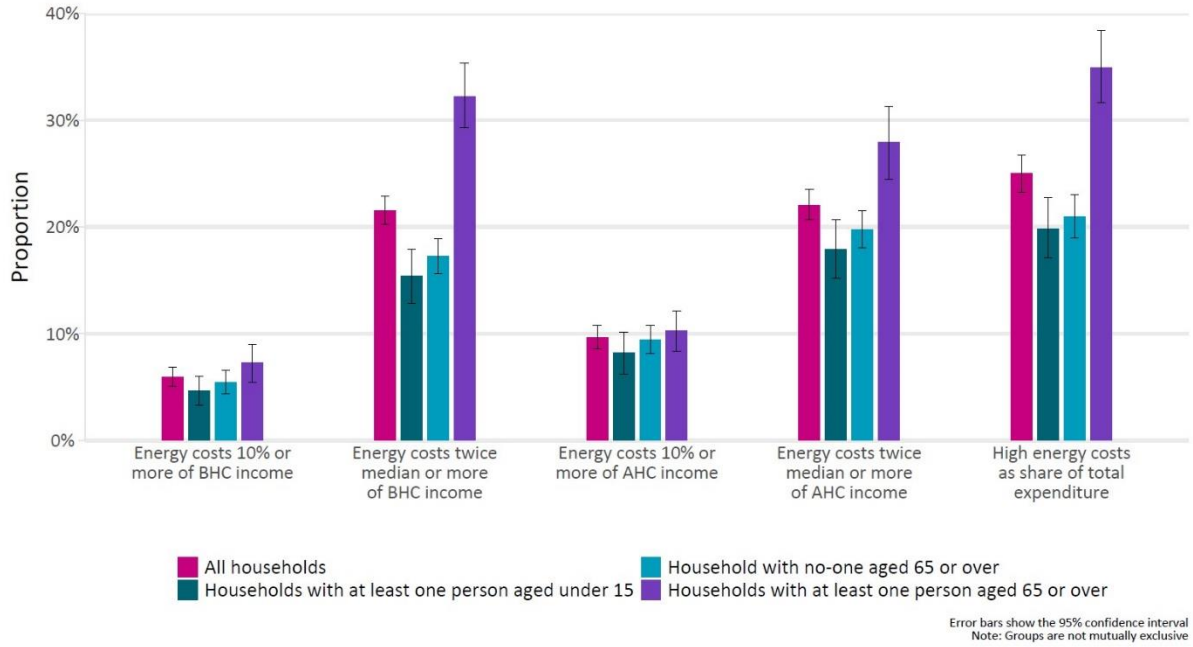
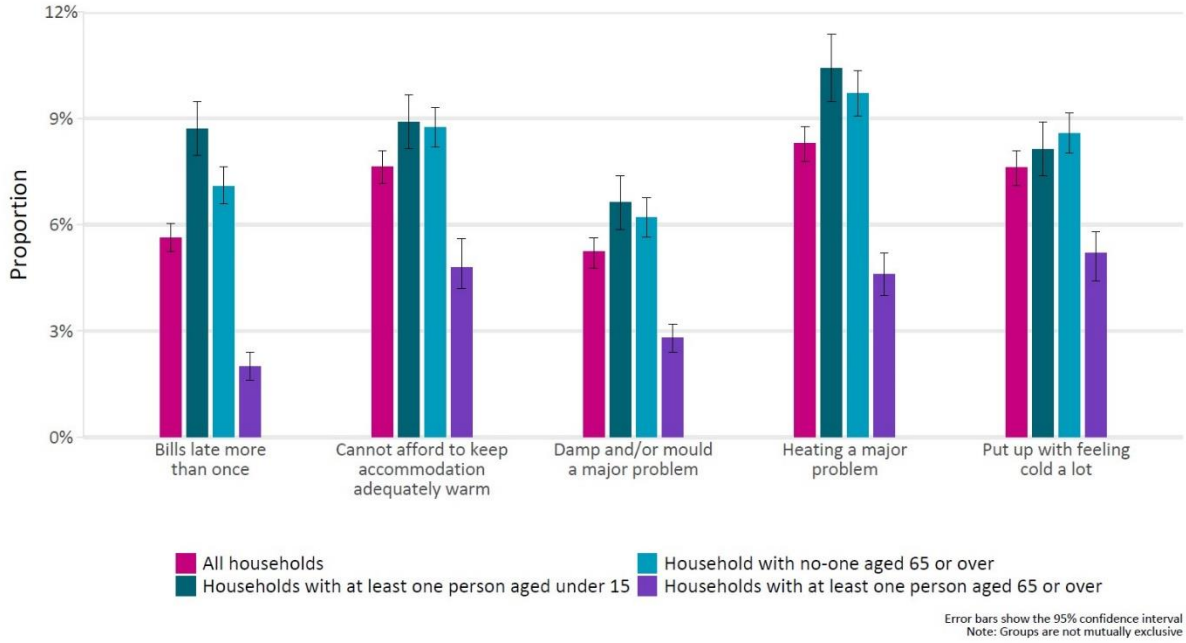


Figure 6 shows the results for objective measures of energy hardship across the different household age profiles. There are no significant differences between the groups for the stricter 10 per cent or more of income measures (for both BHC and AHC income). However for the twice median measures, and high energy costs as a share of total expenditure, households with at least one person aged 65 and over were significantly more likely to be included. Around 1 in 3 of households with at least one person aged over 65 met these three measures, compared with 1 in 5 households with at least one person aged under 15 years.

[29] PwC New Zealand, 2018.

[30] Note that household age profiles are not mutually exclusive – e.g. there will be households that have at least one person aged under 15 and no-one aged 65 or over

Figure 7 Comparison of different household age profiles to all households for subjective measures for 2018/19



Although households with at least one person aged 65 years and over had higher relative expenditure on energy, they were also significantly less likely to be experiencing subjective measures of energy hardship (Figure 7). This is consistent with findings in the Stats NZ 2017 report, and a 2015 Australian study[31]. Households with at least one child under 15 experienced higher rates of dampness and/or mould and cold compared to all households, and were also more likely to struggle to keep their house adequately warm and pay bills on time.

Households with individuals aged 65 years and over may be spending a higher proportion of their income on energy for a number of reasons. It might be because individuals that are 65 or over are likely to spend more time at home than other groups, and as a result have higher energy use and therefore bills. However, as Figure 7 shows these households are less likely to report issues with paying their bills. Households in this '65 or over' group may be in the situation where they are able to meet their energy needs and pay their bills on time, but this is at the expense of other essentials. They may also have lower income (if retired) but own their own dwelling and have saved wealth to draw on, so their energy spend as a proportion of their income is higher. Stats NZ household net worth statistics from 2017/18 show that for households where the highest earner is aged 65 or older, median wealth is higher than younger households across all income quintiles[32]. As Figure 6 shows, there was less of a gap between the groups when AHC income was used. Owner-occupied dwellings tend to be of higher quality, meaning residents are less likely to report subjective hardship[33] . This further highlights the multiple dimensions of a household's energy situation, and the interaction of energy hardship with broader material hardship.

MBIE is planning to undertake further analysis to better understand the overlaps between energy hardship and material hardship.

[31] Stats NZ, 2017; Azpitarte et al., 2015 in Stats NZ, 2017.
[32] Stats NZ, 2019d.
[33] Stats NZ, 2020c.

Table 6 Interaction between age profile and objective and subjective measures (proportions of households)

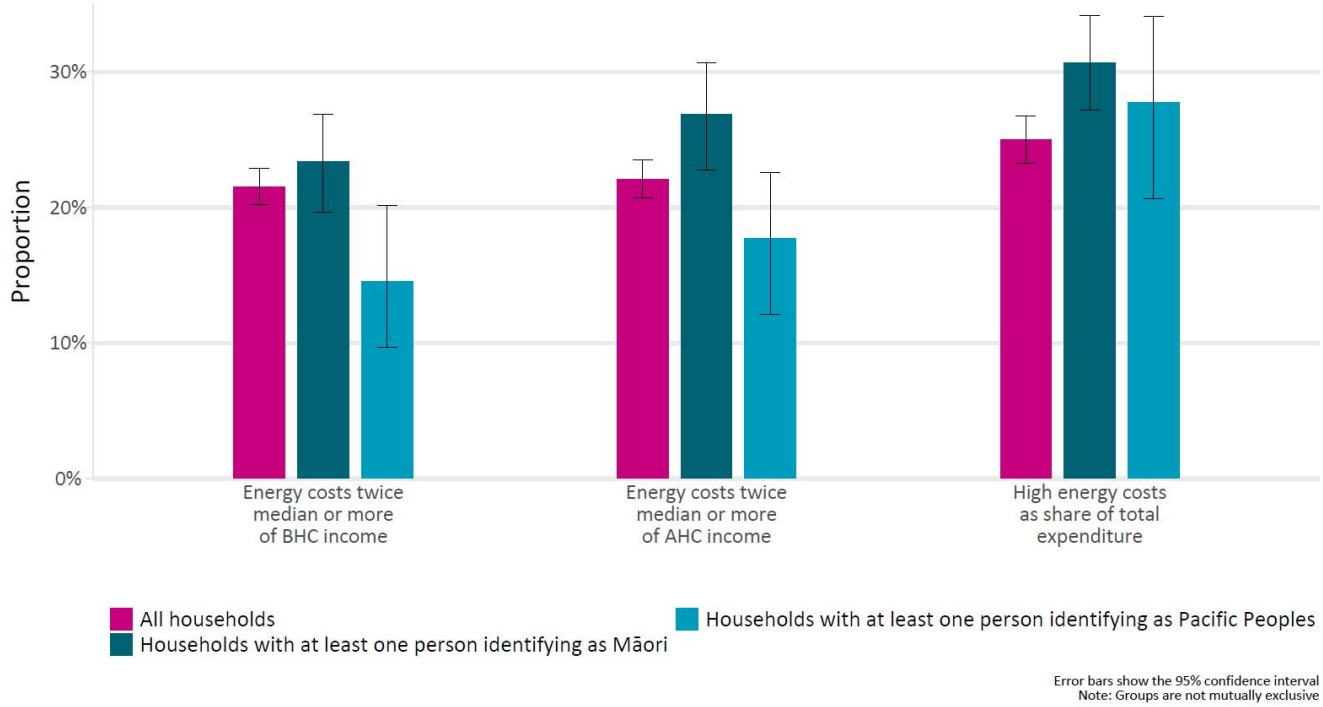
Measure	All households	Households with at least one person aged under 15†	Household with no-one aged 65 or over†	Households with at least one person aged 65 or over
Domestic energy costs are 10% or more of household income	6.0 (5.1 - 6.9)	4.7 (3.3 - 6.0)	5.4 (4.3 - 6.6)	7.3 (5.4 - 9.0)
Domestic energy costs are 10% or more of AHC income	9.7 (8.6 - 10.8)	8.2 (6.2 - 10.1)	9.4 (8.2 - 10.8)	10.3 (8.4 - 12.1)
Proportion of household income spent on domestic energy is twice the median or more	21.5 (20.2 - 22.9)	15.4 (12.9 - 17.9)	17.3 (15.6 - 18.9)	32.2 (29.3 - 35.4)
Proportion of AHC income spent on domestic energy is twice the median or more	22.1 (20.7 - 23.5)	17.9 (15.2 - 20.7)	19.8 (18.0 - 21.5)	28.0 (24.4 - 31.3)
Domestic energy costs as a share of total expenditure is in the highest quartile	25.0 (23.3 - 26.7)	19.8 (17.1 - 22.7)	21.0 (19.0 - 23.1)	34.9 (31.6 - 38.4)
Bills late more than once	5.6 (5.2 - 6.0)	8.7 (8.0 - 9.5)	7.1 (6.6 - 7.6)	2.0 (1.6 - 2.4)
Damp and/or mould a major problem	5.2 (4.8 - 5.6)	6.6 (5.9 - 7.4)	6.2 (5.6 - 6.8)	2.8 (2.4 - 3.2)
Heating a major problem	8.3 (7.8 - 8.8)	10.4 (9.5 - 11.4)	9.7 (9.1 - 10.3)	4.6 (4.0 - 5.2)
Put up with feeling cold a lot	7.6 (7.1 - 8.1)	8.1 (7.4 - 8.9)	8.6 (8.0 - 9.1)	5.2 (4.4 - 5.8)
Cannot afford to keep accommodation adequately warm	7.6 (7.2 - 8.1)	8.9 (8.1 - 9.7)	8.7 (8.2 - 9.3)	4.8 (4.2 - 5.6)

†Note that groups are not mutually exclusive

Households with Māori and Pacific peoples are more likely to experience subjective measures of energy hardship

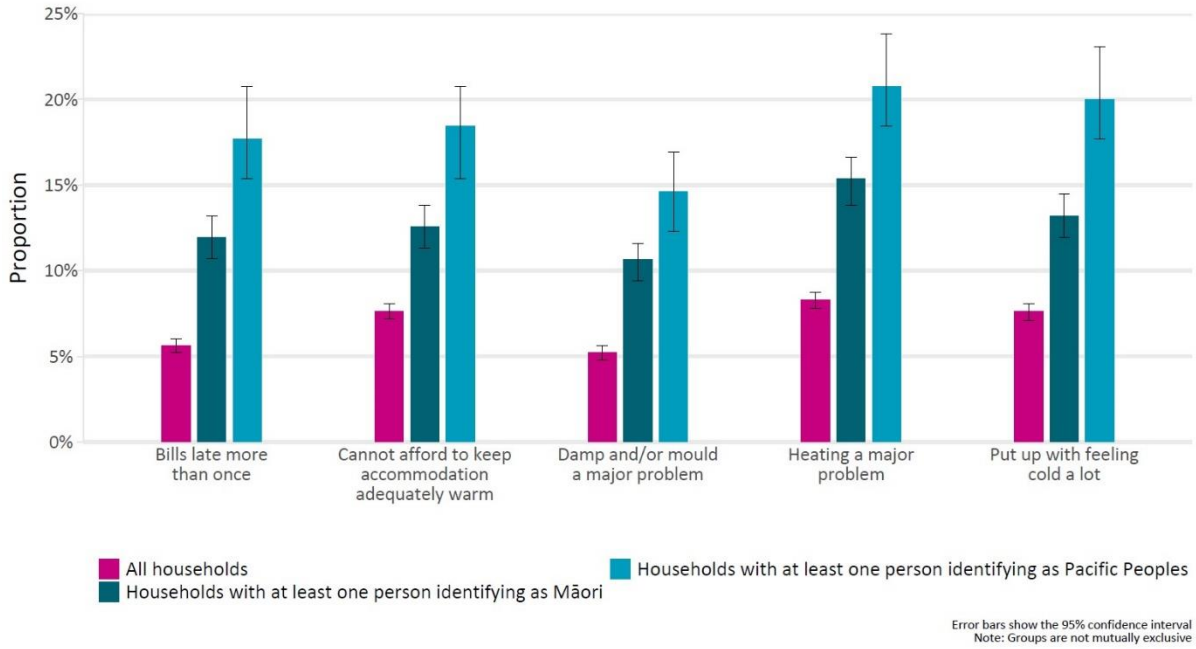
Figure 8 shows results for objective and subjective measures of energy hardship by selected household ethnicities. This compares all households with households where at least one person in the household is of a particular ethnicity.

Figure 8 2018/19 Objective measures by selected ethnicities



When looking at the measures by ethnicity, there are few significant differences between households for objective measures. However, households with at least one person identifying as Māori were slightly more likely to have high energy costs as a share of their total expenditure than all households. The smaller sample size means estimates for Māori and Pacific peoples have wider error bounds around estimates.

Figure 9 2018/19 Subjective measures by selected ethnicities



When we consider subjective measures, there were significantly worse outcomes for households with at least one person identifying as Māori, and for households with at least one person identifying as Pacific peoples, than for all households. One in five households with at least one person identifying as Pacific peoples put up with feeling cold a lot to keep costs down and found heating their home a major problem[34].

These results reinforce the importance of not relying on expenditure measures alone when considering energy hardship, and also the inadequacy of actual spend measures without a required energy element.

[34] See also, Teariki et al., 2020.

Table 7 Interaction between selected ethnicities and objective and subjective measures (proportions of households)

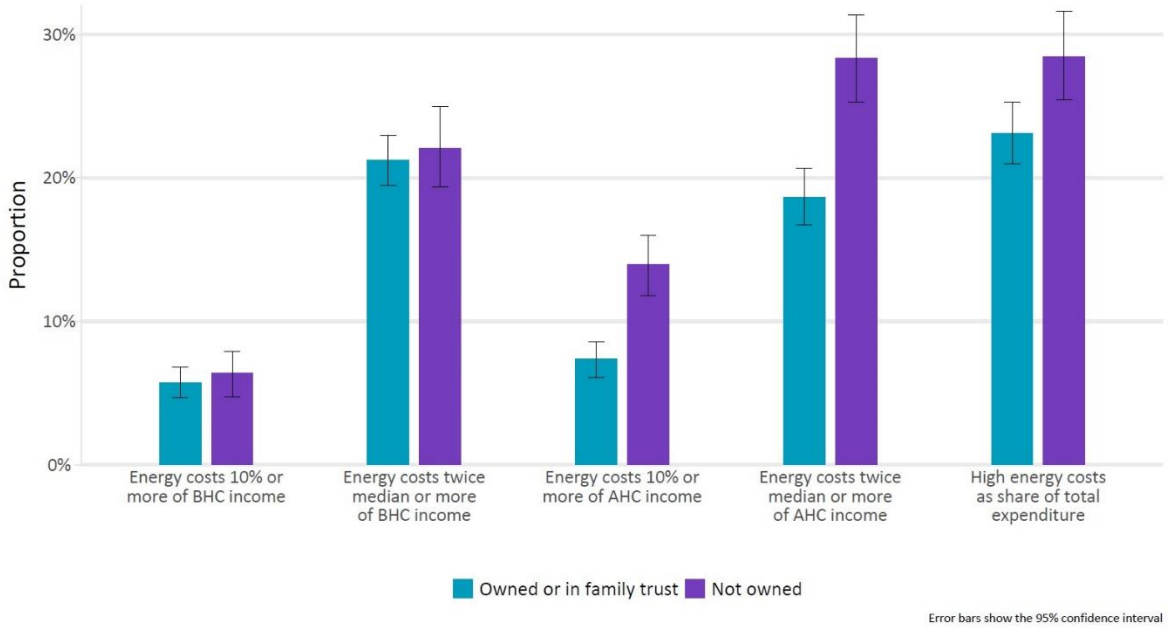
Measure	All households	Households with at least one person identifying as Maori†	Households with at least one person identifying as Pacific peoples†
Proportion of BHC household income spent on domestic energy is twice the median or more	**21.5 (20.2 - 22.9)**	**23.4 (19.6 - 26.9)**	**14.5 (9.7 - 20.2)**
Proportion of AHC income spent on domestic energy is twice the median or more	**22.1 (20.7 - 23.5)**	**26.9 (22.8 - 30.7)**	**17.7 (12.1 - 22.6)**
Domestic energy costs as a share of total expenditure is in the highest quartile	**25.0 (23.3 - 26.7)**	**30.7 (27.2 - 34.2)**	**27.8 (20.6 - 34.1)**
Bills late more than once	**5.6 (5.2 - 6.0)**	**11.9 (10.7 - 13.2)**	**17.7 (15.4 - 20.8)**
Damp and/or mould a major problem	**5.2 (4.8 - 5.6)**	**10.7 (9.4 - 11.6)**	**14.6 (12.3 - 16.9)**
Heating a major problem	**8.3 (7.8 - 8.8)**	**15.4 (13.8 - 16.6)**	**20.8 (18.5 - 23.8)**
Put up with feeling cold a lot	**7.6 (7.1 - 8.1)**	**13.2 (11.9 - 14.5)**	**20.0 (17.7 - 23.1)**
Cannot afford to keep accommodation adequately warm	**7.6 (7.2 - 8.1)**	**12.6 (11.3 - 13.8)**	**18.5 (15.4 - 20.8)**

†Note that groups are not mutually exclusive

Rented homes are between four and five times more likely to experience subjective measures of energy hardship

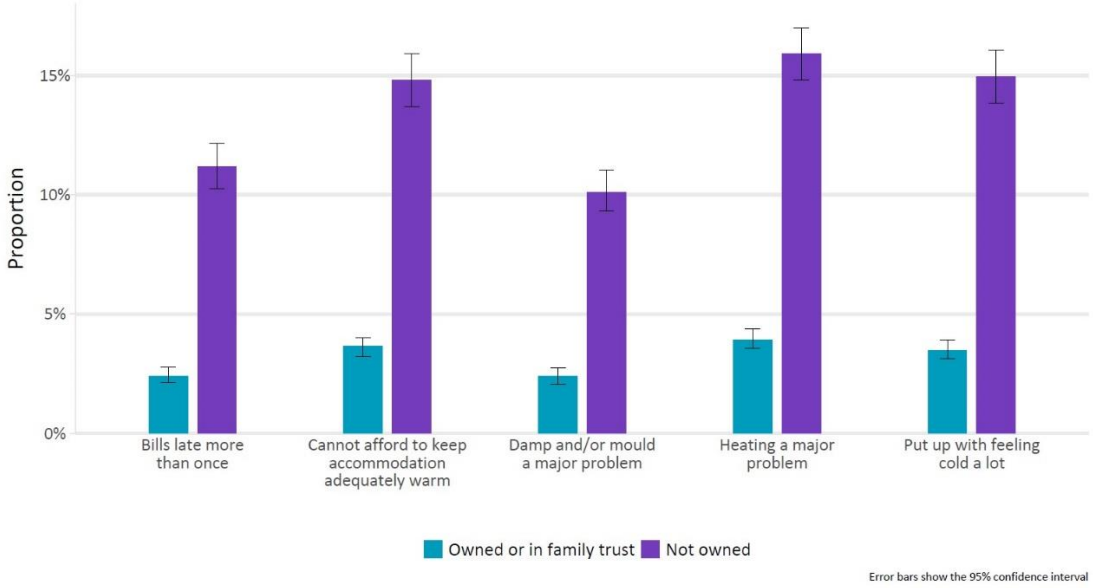
Figure 8 and Figure 9 show the results of energy hardship measures comparing whether the household lives in an owner-occupied dwelling or not. Note that while the category 'not owned' includes a small proportion of households who don't own or pay rent, for convenience we will refer to them as renting households in the text.

Figure 10 2018/19 Objective measures by tenure



There are marked differences in results depending on whether an AHC or BHC measure is used. There are no significant differences in results for the measures that consider domestic energy spend as a proportion of total income (BHC). However, the rate jumps significantly for renting households' expenditure after housing costs (AHC). Renting households were almost twice more likely (14.0 per cent compared with 7.4 per cent) than owner-occupied households to be paying 10 per cent or more of their AHC income on domestic energy.

Figure 11 2018/19 Subjective measures by tenure



The contrast between these two groups is more noticeable when we look at subjective measures, with renting households between four and five times more likely to experience one of these measures of energy hardship than owner-occupied households.

Table 8 Interaction between selected ethnicities and all measures (proportions of households), 2018/19

Measure	Dwelling owned or in family trust	Dwelling not owned
Domestic energy costs are 10% or more of household income	5.7 (4.7 - 6.8)	6.4 (4.7 - 7.9)
Domestic energy costs are 10% or more of AHC income	7.4 (6.1 - 8.6)	14.0 (11.8 - 16.0)
Proportion of household income spent on domestic energy is twice the median or more	21.2 (19.5 - 23.0)	22.1 (19.4 - 25.0)
Proportion of AHC income spent on domestic energy is twice the median or more	18.6 (16.7 - 20.7)	28.3 (25.3 - 31.4)
Domestic energy costs as a share of total expenditure is in the highest quartile	23.1 (21.0 - 25.3)	28.4 (25.4 - 31.6)
Bills late more than once	2.4 (2.1 - 2.8)	11.2 (10.3 - 12.1)
Damp and/or mould a major problem	2.4 (2.1 - 2.8)	10.1 (9.3 - 11.0)
Heating a major problem	3.9 (3.6 - 4.4)	15.9 (14.8 - 17.0)
Put up with feeling cold a lot	3.5 (3.1 - 3.9)	15.0 (13.9 - 16.1)
Cannot afford to keep accommodation adequately warm	3.7 (3.2 - 4.0)	14.8 (13.7 - 15.9)

Overlap between objective and subjective measures

Table 9 presents the overlap between objective and subjective measures. Each column shows the proportion of households who met each subjective measure, out of those households who met the objective measure for that row. The proportion of all households who met the objective measure and subjective measure are presented in the last column and row of the table.

The overlap between households who met objective and subjective measures is not very large in general – all proportions are below 20 per cent. This is consistent with findings from other studies, including the Stats NZ 2017 paper. The paper found that households identified as being in energy hardship using objective measures tended to be different from those identified by subjective measures[35]. However households are more likely to experience a subjective measure of energy hardship if they are experiencing an objective measure (compared to all households) for almost all subjective measures considered.

For example, of households who spent 10 per cent or more of their AHC income on energy, 17.3 per cent could not afford to keep their accommodation adequately warm (compared to 7.6 per cent of all households). However when we look at whether a household had a major problem with damp and/or mould, there is no significant difference in rates between all households and households that experience an objective measure.

[35] Stats NZ, 2017.

Table 9 Proportion of households meeting objective and subjective measures, 2018/19

		Subjective measures (numbers in brackets are show the 95% confidence intervals)				
	Proportion of all households who meet objective measure	Bills late more than once	Cannot afford to keep accommodation adequately warm	Damp and/or mould a major problem	Heating a major problem	Put up with feeling cold a lot
Households whose domestic energy costs are 10% or more of AHC income	9.7 (8.6 - 10.8)	14.0 (8.7 - 19.3)	17.3 (12.7 - 22.0)	8.1* (4.7 - 11.4)	17.4 (12.8 - 22.8)	12.8 (8.7 - 16.8)
Households whose domestic energy costs are 10% or more of household income	6.0 (5.1 - 6.9)	10.9* (5.4 - 16.3)	10.9* (5.4 - 15.2)	7.6* (3.3 - 12.0)	12.0* (6.5 - 17.4)	10.9* (5.4 - 16.3)
Households whose domestic energy costs as a share of total expenditure is in the highest quartile	25.0 (23.3 - 26.7)	9.0 (6.7 - 11.3)	10.8 (8.5 - 13.4)	6.7 (4.6 - 8.5)	12.9 (10.3 - 15.4)	11.3 (8.7 - 13.9)
Households whose proportion of AHC income spent on domestic energy is twice the median or more	22.1 (20.7 - 23.5)	11.5 (8.5 - 14.1)	12.7 (10.3 - 15.3)	6.5 (4.4 - 8.5)	13.0 (10.6 - 15.6)	10.6 (8.3 - 13.0)
Households whose proportion of household income spent on domestic energy is twice the median or more	21.5 (20.2 - 22.9)	8.9 (6.5 - 11.6)	11.6 (9.2 - 13.9)	5.3 (3.6 - 6.8)	11.6 (9.2 - 14.2)	10.1 (8.0 - 12.5)
All households		5.6 (5.2 - 6.0)	7.6 (7.2 - 8.1)	5.2 (4.8 - 5.6)	8.3 (7.8 - 8.8)	7.6 (7.1 - 8.1)

*Estimates are unreliable as they have a relative sampling error between 21 and 50 per cent

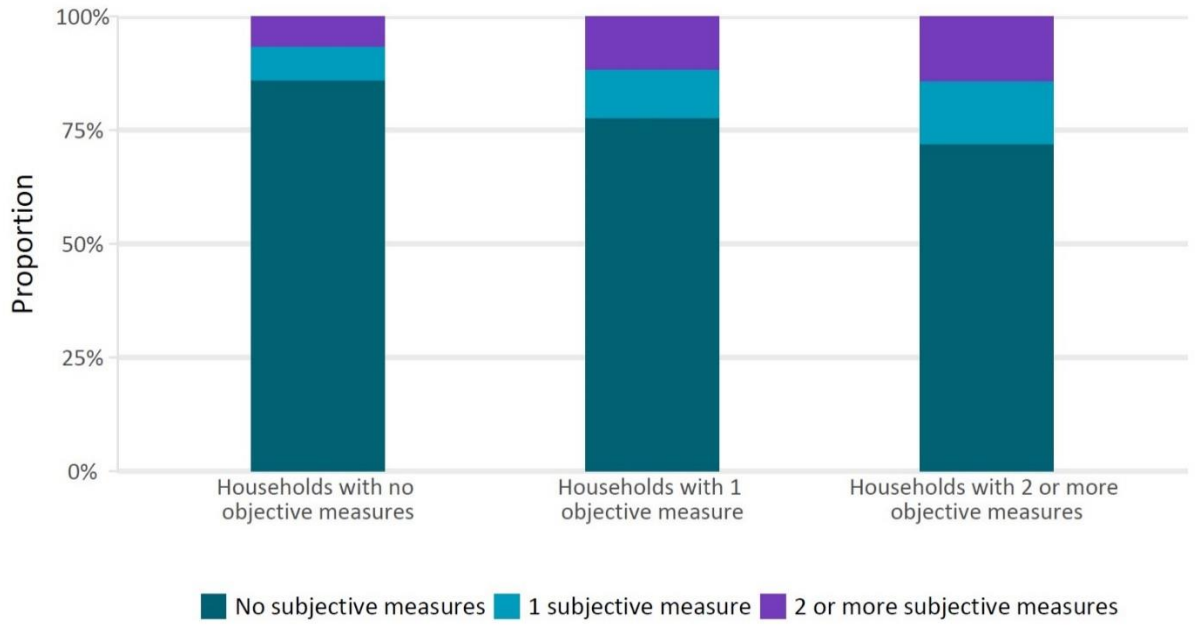
Depth of energy hardship

The relationship between the number of objective and subjective measures that households meet has been analysed, as one way of looking at the 'depth' of energy hardship across households[36].

Figure 12 and Table 10 presents the proportion of households who experience different numbers of subjective energy hardship measures, given the number of objective measures they meet. In 2018/19, 86 per cent of households who did not meet any objective measures of energy hardship also did not experience any subjective measures.

As the number of objective measures a household meets increases, so does the likelihood they experience one or more subjective measures. For example 14.2 per cent of households that met two or more objective measures also experienced two or more subjective measures, compared to 6.5 per cent of households that met no objective measures experiencing two or more subjective measures. As noted in the main body of the discussion document, we plan to do further research into ways of measuring the depth of energy hardship.

Figure 12 Proportion of households experiencing number of subjective measures by number of objective measures they meet 2018/19



[36] This analysis included all subjective measures of interest and all objective measures, excluding the measure of domestic energy costs being in the highest quartile as a proportion of all expenditure. This is because by definition a quarter, or 25 per cent, of households will always meet this measure.

Table 10 Proportion of households experiencing number of subjective measures by number of objective measures they meet 2018/19

	Number of subjective measures			
	No measures	1 measure	2 or more measures	**Total**
Households with no objective measures	86.0 (83.3 - 88.8)	7.4 (6.2 - 8.7)	6.5 (5.5 - 7.6)	100
Households with 1 objective measure	77.7 (64.1 - 91.3)	10.7* (5.8 - 15.5)	11.7* (6.8 - 16.5)	100
Households with 2 or more objective measures	71.9 (65.1 - 78.7)	13.9 (10.5 - 17.0)	14.2 (11.4 - 17.3)	100

*Estimates are unreliable as they have a relative sampling error between 21 and 50 per cent

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