MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Defining Energy Hardship

A discussion document on defining and measuring energy wellbeing and hardship in Aotearoa

November – December 2021

Te Kāwanatanga o Aotearoa
New Zealand Government

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment (MBIE)

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Stats NZ data

The Ministry of Business, Innovation & Employment (MBIE) has produced results for selected potential measures of energy hardship as part of initial analysis. These are referenced throughout this document, and published in the Technical Appendix.

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/.

Acknowledgements

We would like to thank all of those who have given their time and advice to help us in the development of this work so far. They have included various experts and stakeholders across government, academia, community groups, and industry. We would like to thank in particular Nina Campbell, Dr Rosemary Goodyear, Ian McChesney, Dr Kimberley O'Sullivan, and Atawhai Tibble for their time and expertise. The material in this discussion document does not necessarily reflect the individual views of these experts or their organisations.

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Minister's foreword

No one in Aotearoa should go without adequate heating or power in their home, and no one should have to compromise on other essentials to pay their power bills. Unfortunately, this is a reality for many, and more must be done to understand what's happening in our communities and how best to help those in need.

The Government has been working to develop a clear definition and set of measures for energy hardship. Without these, we cannot tell how large the problem of energy hardship is, or how it is changing over time. Once we have a generally agreed understanding of energy hardship and how to measure it, we can then monitor levels of hardship and assess whether the initiatives in place are working.

This Government is committed to supporting individuals, households and whānau improve their health and wellbeing. The COVID-19 pandemic has led to New Zealanders spending more time at home, and for some, made it harder to keep on top of household bills. These events have further highlighted how important it is that everyone can have a warm, dry and healthy home.

Energy hardship is not a simple problem, and we know that people's experiences of it vary widely. This is why input from a range of perspectives is key to developing an agreed definition. This discussion document outlines the Government's proposed definition and measures, and we now want to hear what you think. Your feedback will further enrich our understanding of what energy hardship looks like and how to measure it, and provide additional insight into the wide scope of experiences. The recently established Energy Hardship Expert Panel will also contribute to the final recommendations.

While energy hardship has not yet been defined, several initiatives are underway to assist households in managing their energy situation. These initiatives focus on providing more in-home energy education, piloting household renewable energy solutions and connecting government to others working in the community for a more cohesive, joined-up approach.

Thank you for taking the time to read about energy hardship. I look forward to hearing your thoughts on the proposals and questions in this paper. Your feedback will ensure our definition is inclusive, reflects real-life experiences and better positions the Government to help those in need. In doing this, we can reduce energy hardship in our communities and improve the health and wellbeing of people in Aotearoa.

Hon. Dr Megan Woods
Minister of Energy and Resources

We want to hear from you

Submissions Process

The Ministry of Business, Innovation and Employment (MBIE) seeks written submissions on the material and proposals in this document by 5pm on 16 December 2021. If submitting as a member of an organisation, we would appreciate one submission on behalf of the organisation or group with summarised input from your members.

You can make your submission:

- By completing the online survey which can be found at: https://www.research.net/r/DefiningEnergyHardship

- By filling out the submissions template available on the consultation website https://www.mbie.govt.nz/have-your-say/defining-energy-hardship
    - By emailing this to: definingenergyhardship@mbie.govt.nz with "Discussion document submission" in the subject line
    - By mailing this to:

        Markets Team, Evidence & Insights
        Ministry of Business, Innovation and Employment
        PO Box 1473
        Wellington 6140

Please direct any questions that you have in relation to the submissions process to: definingenergyhardship@mbie.govt.nz

Privacy statement

The information provided in your submissions will be used to inform MBIE's development of a definition and measures for energy hardship, related policy development, and will inform advice to Ministers. It will also become official information, which means it may be requested under the Official Information Act 1982 (OIA). The OIA specifies that information is to be made available upon request unless there are sufficient grounds for withholding it.

Use and release of information

To contribute to transparency in our decision making, MBIE proactively releases a wide range of information. MBIE will upload copies of submissions to its website at www.mbie.govt.nz. By making a submission, MBIE will consider you to have consented to uploading, unless you clearly specify otherwise in your submission.

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All information you provide will be visible to the MBIE officials who are analysing the submissions and/or working on related policy matters, in line with the Privacy Act 2020. The Privacy Act 2020 includes principles that guide how personal information can be collected, used, stored and disclosed by agencies in New Zealand**.**

If your submission contains personally identifiable information that should not be made public, please make clear what can and cannot be made public. For example, information about other people that you are sharing without their consent or information about children.

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Background to this work
Sections 1 and 2 explain why a definition and measure for energy hardship is important, as well as what prior research into energy hardship can tell us.

Proposed definition
Section 3 proposes a definition for energy wellbeing, and describes the reasoning and research behind its development.

Proposed framework
Section 4 proposes a conceptual framework for energy wellbeing and hardship, and describes its purpose and rationale.

Research
Section 5 describes the local and international research that has informed the proposed measures of energy hardship.

Proposed indicators and measures
Section 6 proposes and discusses a set of indicators and primary measures of energy hardship, as well as listing potential secondary measures. Measuring depth and the wider impacts of energy hardship is also discussed.

Data limitations
Section 7 describes the limitations and gaps in current data, and some ways these could be improved upon.

Future plans
Section 8 describes the plans MBIE is working on to fill some of the gaps in data.

Have your say
Section 9 explains how you can submit your feedback, and what the next stages of this work are.

There are also various **appendices** with further information, which include:

- Appendix C: Advantages and disadvantages of proposed measures
- Appendix D: Technical Appendix – Results for selected measures of energy hardship

Executive summary

Secure access to energy is an essential aspect of household wellbeing. Ensuring access to affordable, reliable, sustainable and modern energy for all is one of the United Nations' Sustainable Development Goals[1]. However, not all New Zealand households can afford their energy needs. In 2018/19, more than 130,000 households couldn't afford to keep their home adequately warm[2]. Households that cannot access or afford to use as much energy as they need can be said to be experiencing energy hardship. For these households, being unable to meet their energy needs can result in unhealthy living conditions in the home; in 2018/19, more than 90,000 households had a major problem with damp and/or mould[3]. There is extensive research documenting the negative health effects of living in a cold, damp or mouldy dwelling[4]. In particular, cold indoor temperatures have been associated with increased blood pressure, asthma symptoms and poor mental health, and contribute to excess winter deaths and illness[5].

Despite the potentially large extent of energy hardship in Aotearoa, there is no nationally accepted definition of it, or method for measuring it. Without these, we do not know if energy hardship is increasing or decreasing over time. This makes it difficult to design policies or measure progress towards improving energy wellbeing in our communities. The 2019 Electricity Price Review found that energy hardship is a 'pressing problem' in Aotearoa. It recommended that MBIE "develop a clear and generally accepted definition of energy hardship, and determine what statistics should be gathered to monitor changes in energy hardship levels" to help address this challenge[6].

We have developed two interconnected definitions in this document – **energy wellbeing** and **energy hardship.** Energy wellbeing is defined as

When individuals, households and whānau are able to obtain adequate energy services to support their wellbeing in their home or kāinga

Energy hardship occurs on the other end of the spectrum, when these **cannot** be obtained.

While we are defining energy wellbeing, we are proposing to measure levels of energy hardship in Aotearoa. An energy wellbeing definition allows us to understand and measure the multiple factors that

[1] In September 2015, the United Nations signed up to 17 Sustainable Development Goals. For more information see https://sdgs.un.org/goals/goal7

[2] Stats NZ Household Economic Survey data. For more information see Appendix D: Technical appendix – Results for selected measures of energy hardship.

[3] Stats NZ Household Economic Survey data.

[4] For some examples see Grimes & Preval, 2020; WHO, 2018; O'Sullivan et al, 2016.

[5] WHO, 2018.

[6] Electricity Price Review Final Report (https://www.mbie.govt.nz/dmsdocument/6932-electricity-price-review-final-report) p. 20

contribute to being unable to attain it. The goal is to help all New Zealanders achieve energy wellbeing, but the first step is to measure hardship, so we can track the size of the problem and target initiatives to reduce it.

This document is an invitation for feedback; all material can be commented on, and we will publish a summary of submissions after the consultation period has ended. This discussion document presents our proposed definition and potential measures in response to this task. When agreed upon, the definition and measures will enable us to measure levels of energy hardship across households in Aotearoa, identify areas to target with interventions, and assess the effectiveness of policies. Government, households, community groups, NGOs, and iwi can use this information to focus their activities that aim to improve energy wellbeing.

This document sets out:

- proposed definitions of wellbeing and energy hardship
- a conceptual framework for wellbeing and energy hardship
- a proposed suite of measures for measuring and monitoring energy hardship
- current measurement limitations, and possibilities for improvement

Through this consultation, we aim to integrate the diverse experiences of New Zealanders facing energy hardship. We used the Stats NZ 2017 report *Investigating different measures of energy hardship in New Zealand* as a starting point, and have built on this using international and local evidence. Recent developments in measuring material hardship and child poverty also contributed.

MBIE is committed to reducing energy hardship and enabling others to do so. When we agree on what energy hardship looks like, its drivers, and how to measure the problem, we can come together to improve the wellbeing of New Zealanders. MBIE is already progressing initiatives to address energy hardship, with a focus on pilots where we can learn quickly and scale-up what works[7].

We look forward to receiving your submissions.

List of acronyms

For a list of commonly used terms and their meanings please see the Glossary at Section 10

Acronym	Meaning
AHC	After Housing Costs
BHC	Before Housing Costs
DEP-17	Index used in measuring child poverty (deprivation out of 17 items)
EPOV	European Union Energy Poverty Observatory
EPR	Electricity Price Review
GSS	General Social Survey
HES	Household Economic Survey
WHO	World Health Organization

[7] Several initiatives are underway with the aim of addressing energy hardship to support communities while the definition and measures are being developed. Information about MBIE initiatives to address energy hardship can be found at https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-hardship/

1 Energy hardship needs to be defined and measured

1.1 Energy hardship affects the lives of New Zealanders

We want all New Zealanders to be able to achieve a high standard of living and participate successfully in society and the economy. However for many households in Aotearoa accessing and affording enough energy while also staying on top of other bills is a challenge. Many of our houses are not built to a standard that enables households to easily maintain a safe and comfortable home environment[8]. Cutting back on energy use can leave people in cold, damp and unhealthy homes, while other households reduce spending on other essentials to pay their energy bills. In 2018/19, almost 8 per cent of households (134,000) said they couldn't afford to keep their accommodation adequately warm[9]. Under-heating is likely to contribute to increased dampness within homes, and New Zealand houses report high rates of dampness and mould[10]. Energy hardship has a real impact on people's quality of life, and risks long-term negative health outcomes. It also results in increased costs for our health system: a recent study estimated that poor housing conditions in Aotearoa (including cold, dampness and mould) could be costing more than $140 million annually in hospitalisations[11].

1.2 Without defining energy hardship we can't tell how much of a problem it is or whether it's changing

Because of the various ways people experience energy hardship, it can be challenging to define and measure. There is currently no official definition for energy hardship in Aotearoa, which limits our understanding of how big the problem is, what factors contribute to it, or who is experiencing energy hardship in our communities. We know we need to improve data on households' experiences and housing quality. We do not know how long households stay in energy hardship for instance, or which risk factors are most important to monitor. However, we do know that it is a problem in our communities.

The better we understand the problem, the greater our capability to address it and track progress.

1.3 MBIE is developing a definition and measurement framework of energy hardship for Aotearoa

In 2019 the Electricity Price Review (EPR)[12], an independent review into the electricity market, described energy hardship as a 'pressing' issue in Aotearoa[13]. It noted that a key barrier to addressing this problem

[8] White & Jones, 2017. (Many of the reports and other papers discussed in this document can be viewed online. Links can be found in the References List)
[9] Stats NZ Household Economic Survey data. See *Appendix D: Technical appendix – Results for selected measures of energy hardship.*
[10] Stats NZ, 2020c.
[11] Riggs et al, 2021.
[12] For more information about the EPR, visit https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-consultations-and-reviews/electricity-price/
[13] Electricity Price Review, 2019.

is the lack of an agreed definition and regular measurement. In response to the EPR, MBIE was tasked with exploring a framework for measuring and monitoring energy hardship in Aotearoa.

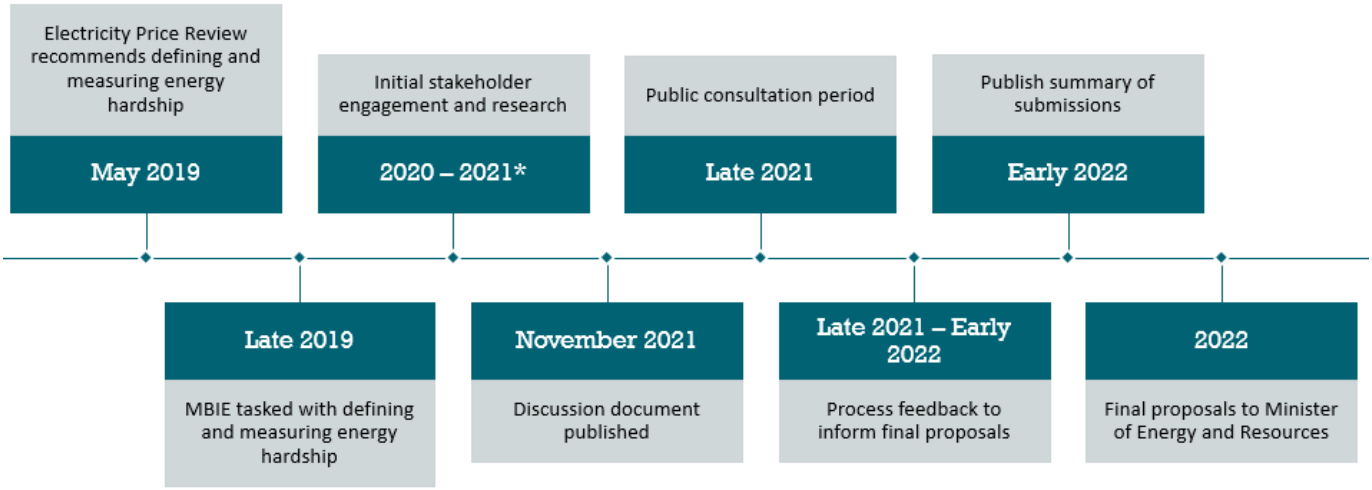
This paper is MBIE's first response to this request. It has been developed using international and local evidence, and with advice from recognised New Zealand experts in the field. We have also incorporated the input of a number of stakeholders, including representatives from other government agencies, NGOs, academics, industry, and Māori and iwi groups during the development of this paper.

1.4 This is a draft intended for your feedback

The purpose of this document is to report on our progress and seek feedback from the community on the draft material and proposed next steps. The structure of the paper covers:

- a proposed definition of energy wellbeing and hardship
- a conceptual framework that unpacks this definition
- proposals for what we can monitor already with existing data sources; and
- potential improvement and development of measures for the future.

Figure 1 Defining Energy Hardship project roadmap



1.5 We intend to bring clarity to the sector and develop a future-proof definition and suite of measures

The proposed definition and indicators are intended to:

- measure levels of energy hardship across Aotearoa
- help target policy interventions and programmes
- enable tracking of levels over time to measure the effectiveness of such policies and programmes.

These are the key requirements for our work. Additional recommendations from the EPR are that the definition should:

- align with the thresholds Stats NZ uses to measure child poverty, particularly the material hardship measure
- align with, and feed into, the Government's wellbeing budget framework
- include a set of indicators that measure energy hardship and that are recorded and monitored

We want to develop a definition that can be used and understood by all New Zealanders. A key outcome will be a clear and widely accepted definition of energy hardship and a suite of statistics that will measure its prevalence in Aotearoa.

Through a common definition and measurement framework of energy hardship, organisations across Aotearoa will be able to monitor the success of varied projects to address energy hardship and increase energy wellbeing.

1.6 What is included in the scope of this project

Table 1: The scope of MBIE's work stream to define energy hardship

In scope for the project	Out of scope of the project
- Seeking general agreement on a proposed definition. - Proposing a definition and suite of measures that can track energy hardship nationally, and can be used immediately, along with a suggested reporting framework. - Identifying data gaps in the recommended measures and suggesting prioritised actions for addressing these.	- Suggesting policy interventions or other actions to alleviate energy hardship. - Setting official targets for energy hardship levels. - Evaluating specific initiatives aimed at reducing energy hardship[14]. - Collecting data for evaluation of specific programmes and initiatives. - Collecting new data for developing measures of energy hardship. - Developing official definitions or measures outside of energy wellbeing/hardship.

Some stakeholders told us they would also like to be able to use the definition 'on the doorstep' to assess whether a household is in energy hardship or not. This could assist groups to identify eligibility for assistance. While this is not our primary aim, we think that our work will support targeting of assistance.

[14] Evaluation of government-led initiatives to address energy hardship will be undertaken by relevant agencies, however this evaluation work is not within the scope of this project.

1.7 The principles leading this definition development work

A good definition, framework, and measures of energy hardship for Aotearoa should:

- be credible and generally accepted
- be enduring
- be specific to the context of Aotearoa
- uphold Te Tiriti o Waitangi obligations
- meet the needs of agencies and organisations seeking to use it
- be measurable with available data
- be comparable over time
- be internationally comparable[15].

In order to uphold the Crown's obligations under Te Tiriti o Waitangi it is important that:

- The proposal demonstrates good government practice within the context of Te Tiriti
- Te Tiriti and Māori interests have been sought, considered, and included
- The proposal enhances Māori wellbeing overall and aims to achieve equitable outcomes[16].

1.8 This work has been informed by projects underway to address energy hardship

Although we need a robust and generally agreed upon definition and measurement framework for energy hardship in order to address it, we know that there are New Zealanders who need support now. Several initiatives are underway with the aim of addressing energy hardship while the definition and measures are being developed.

These initiatives include:

- establishing the Energy Hardship Expert Panel to advise government on policy priorities and actions to address energy hardship
- progressively building and expanding a network of community-level support services, for example, via the SEEC fund[17]
- establishing new consumer care guidelines

Work is being led by both MBIE and the Electricity Authority in response to the EPR. Information about the other EPR recommendations, and the government's response to them, can be found on MBIE's EPR webpage[18].

Further work is being undertaken across government to improve energy wellbeing, including:

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[15] Based on those used by Treasury in their work developing the Living Standards Framework measure of wellbeing, and material developed for indicator selection by Stats NZ

[16] https://www.tearawhiti.govt.nz/assets/Tools-and-Resources/CO-19-5-Treaty-of-Waitangi-Guidance-for-Agencies.pdf

[17] https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-hardship/support-for-energy-education-in-communities-programme/

[18] https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-consultations-and-reviews/electricity-price/

- The Māori and Public Housing Renewable Energy Fund
- The Winter Energy Payment
- The Warmer Kiwi Homes programme
- The Healthy Homes Standards

2 Background to energy hardship

To begin developing a definition of energy hardship, we considered how it has been defined nationally and internationally. There are a number of different terms used to refer to the concept of energy hardship, such as fuel poverty, energy poverty, energy vulnerability, and energy insufficiency. In this document we use the term energy hardship, unless referring directly to other definitions or measures in which case we will use the term used by the source.

2.1 Where did the concept of energy hardship come from?

The concept of fuel poverty first emerged in the 1970s, driven by discussions around groups that lacked the resources to keep their homes warm and well lit.

Much of the early work around fuel poverty occurred in the United Kingdom. In 1991, researcher and campaigner Brenda Boardman 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*"[19]. At the time, 10 per cent was roughly twice the median spend on energy relative to total income for households in the UK.

This work led to the development of legislation which targeted fuel poverty throughout the United Kingdom, although with varying definitions. England adopted an official measure based on Boardman's definition in the 2001 UK Fuel Poverty Strategy, but this was changed following the 2012 Hills Review, which noted that the 10 per cent measure "was flawed as a way of understanding both trends in the problem and who is at risk from it, and by implication of comparing the effectiveness of different policy approaches"[20]. Elsewhere in the UK, versions of the 10 per cent measure were retained. See section 5.3 for examples of how energy hardship has been measured by officials and researchers.

The Boardman definition remains influential in international literature, although it is often misunderstood as actual amount spent on energy rather than required spend. Further research and discussion on ways to define and measure energy hardship has been ongoing over the past decades. We refer to key examples throughout this document.

2.2 Energy hardship is not consistently defined internationally

Some countries have had official definitions and measures for energy hardship for decades, and some have only begun to consider it more recently. For example, the European Union Energy Poverty Observatory (EPOV)[21] noted there is no single definition of energy poverty for Europe[22]. Overall, most literature describes the concept of energy hardship broadly as being when a household is unable to

[19] Boardman, 1991, as cited in Scottish Fuel Poverty Definition Review Panel, 2017, p. 27.
[20] Hills, 2012, p. 8.
[21] EPOV was a research observatory that ran from 2016-2020. It aimed to facilitate knowledge sharing and research on energy poverty in the European Union. It has been replaced by the Energy Poverty Advisory Hub, which will run from 2021-2025. https://www.energypoverty.eu/
[22] Thomson & Bouzarovski, 2018.

afford adequate or sufficient energy services due to a range of factors, including housing quality, energy prices, energy efficiency, and income.

Defining the concept of energy hardship

Some definitions use a description of the concept and experience of energy hardship, while others are quantitative.

For example, Boardman's original '10 per cent' definition is quantitative: fuel poverty is determined based on a **set threshold** of required spending on energy in relation to income to meet living standards[23]. This definition prescribes the way fuel poverty is measured – those households that spend 10 per cent or more of their income on energy are determined to be in energy hardship, and those who don't are not.

In contrast, the European Commission's energy think tank INSIGHT_E provides a descriptive definition for energy poverty: "a situation where individuals or households are not able to adequately heat or provide other required energy services in their homes at affordable cost"[24]. This definition describes the concept of fuel poverty, but doesn't prescribe how to measure it.

We consider a descriptive definition to be more useful, as it is more easily understood and flexible to changes in measurement methodology.

Measuring the levels of energy hardship

There are many different ways that levels of energy hardship have been measured, each with associated advantages and disadvantages. These are discussed further in Section 5.

2.3 What does energy hardship look like?

Living in energy hardship does not look the same across all households experiencing it. There are different drivers that can cause a household to experience energy hardship, and people respond differently to the challenges they face.

A household might use less heating than they need to save money on their power bill in winter[25]. They may be without other amenities, like dryers, dehumidifiers, washing, refrigeration, or communications. Or they might cut back on other household necessities like groceries to afford their power bill. This is considered a common feature of energy hardship and is often referred to as "heat or eat". A New Zealand study of young people found that "more than a third of respondents (34.6 per cent) reported that their families juggled between paying for food or other bills and electricity at least sometimes"[26]. The same study found that households with children were more likely to cut back on food: 56.8 per cent reported cutting back on groceries to pay for electricity, compared with 41.2 per cent of childless

[23] Boardman's 10 per cent threshold is an absolute threshold based on a relative one. At the time 10 per cent was roughly twice the median actual spend on energy in the UK relative to gross income, as noted by the Scottish Fuel Poverty Definition Review Panel.
[24] Pye et al., 2015, p. v.
[25] Stats NZ, 2020c.
[26] O'Sullivan, et al., 2017.

households. Researchers in the United States found that during cold weather periods, poorer households eat less and spend less on food, while increasing spending on energy[27].

What is seen as 'normal' energy use also varies between households. While earlier studies have suggested that some New Zealanders have a culture of putting up with feeling cold[28], this may be more linked to cost of warming to a comfortable temperature than real preference. A recent study looking at the experiences of Pacific peoples found that being able to heat adequately was a recurrent problem.

> "While most households had heaters of some type, around a quarter of households did not use them, because they could not afford the electricity and were worried about unexpectedly high bills. When rooms were hard to heat through lack of insulation and heating, or through lack of money to pay for power, families crowded together in a single room to keep warmer. Restricting heating and room use was enacted out of structural and financial necessity, not due to behavioural or cultural preferences."[29]

It is clear that energy hardship involves deprivations and trade-offs between competing needs when resources are tight. These examples also highlight the important role that the standard of housing has on levels of energy hardship.

Recent research noted that there may have been a shift in attitudes towards increased expectations among both tenants and landlords around thermal comfort in housing[30]. The effects of healthy housing legislation may also lead to increased expectations of warmth as well as improvements in the thermal efficiency of the housing stock.

2.4 What are the outcomes of energy hardship?

Living in energy hardship affects the quality of life of the household and impacts their wellbeing physically, mentally, and socially.

The negative physical health outcomes of living in a cold, mouldy or damp home are well documented: people living in these conditions face higher risk of respiratory issues, colds and flu, and other preventable health conditions, such as rheumatic fever and skin infections[31, 32].

The World Health Organization's Housing and Health Guidelines recommends a minimum indoor temperature of 18 degrees. It notes that "evidence that cold indoor temperatures have adverse consequences for health is growing. Cold indoor temperatures are often a consequence of outdoor temperature, structural deficiencies, including a lack of insulation and airtightness, and lack of heating. Cold indoor temperatures have been associated with increased blood pressure, asthma symptoms and poor mental health. Cold homes contribute to excess winter mortality and morbidity."[33]

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[27] Bhattacharya et al., 2003.
[28] Howden-Chapman et al., 2009; McKague, 2019.
[29] Teariki et al, 2020, p. 8.
[30] Ambrose & McCarthy, 2019.
[31] https://www.health.govt.nz/our-work/preventative-health-wellness/healthy-homes-initiative
[32] Hales et al., 2012; Stats NZ, 2017.
[33] WHO, 2018, p. 32.

Recent analysis of data from the Growing Up in New Zealand study identified an ideal minimum temperature of 19°C and maximum humidity index rating[34] of 28 to optimise children's health[35]. It found that "many children who live in poor quality indoor environments, where it's too cold or too humid, do experience poorer overall health as a result"[36]. In other research, the wellbeing of children during heat waves is discussed, as a warming climate increases their frequency[37].

In Aotearoa, those on lower incomes who rent, or live in crowded housing, have a higher risk of seasonal illness and death[38]. The 2018/19 Household Economic Survey found that 10 per cent of rented houses reported a major problem with damp or mould, compared to 2 per cent of owner-occupied houses[39]. Populations with higher rates of renting are therefore more likely to be exposed to poor housing quality, and energy hardship. Research by the University of Otago shows that "New Zealand's poor housing quality, particularly private rental housing, has created a large health burden, with 28,000 children and 54,000 adults hospitalised each year for potentially avoidable hospitalisations linked to old, cold, damp and mouldy houses. Most of these affected children come from low-income households, with Māori and Pasifika children three and four times over-represented"[40, 41].

Housing challenges have been found to be "the most prevalent domain of disadvantage for Māori families in New Zealand"[42]. The three most challenging housing issues for Māori are that homes are cold, mouldy and in urgent need of repairs. Respondents to Te Kupenga[43] "with two or more major housing issues were significantly less likely than those with only one major issue to report a high level of whānau wellbeing"[44]

Energy hardship also has a negative impact on the social and mental wellbeing of household occupants. Examples of this include feeling ashamed to invite and manaaki people in cold houses, or spending significant time finding fuel for heating, which limits time available to spend with family and can create social exclusion. Stress and arguments over power bills can also strain relationships[45].

Factors contributing to energy hardship can interact and compound, resulting in more severe hardship.

Energy hardship is caused by, and contributes to further financial stress.[46] Some households have their power disconnected due to unpaid bills, or need to borrow money to pay their bills. They can end up in debt and with a poor credit rating, which can limit their available choices of energy retailer[47].

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[34] Humidex or, humidity index is a measure of combined heat and humidity
[35] Morton et al, 2021.
[36] https://growingup.co.nz/Children-scientists-in-world-first-study-looking-at-health-and-indoor-climate
[37] O'Sullivan & Chisholm, 2020.
[38] Hales et al. 2012.
[39] Stats NZ Household Economic Survey data. See Appendix D: Technical appendix – Results for selected measures of energy hardship.
[40] https://www.hrc.govt.nz/news-and-events/healthy-homes-all-kiwis-heart-major-new-research-programme
[41] Also see Ingham et al., 2019.
[42] Superu, 2018, p. 11.
[43] Stats NZ's Māori Social Survey
[44] Superu, 2018, p. 11.
[45] McKague, 2019; Azpitarte et al., 2015.
[46] Electricity Price Review, 2018.
[47] Lived experiences from Part three of the Electricity Price Review, 2018.

Households who aren't eligible for post-payment electricity retail plans may use prepayment metering, to have more control over their energy expenditure. However, prepayment metering plans can be more expensive than other forms of payment, meaning financially vulnerable households may be put at greater risk of severe energy hardship[48]. Also, using prepayment metering can enable rationing behaviour such as under-heating one's home to save money, and present a danger for medically vulnerable consumers[49, 50].

[48] O'Sullivan et al., 2015.
[49] O'Sullivan et al., 2011.
[50] The Electricity Authority has developed new Consumer Care Guidelines, which took effect from 1 July 2021, that replace the existing arrangements for vulnerable and medically dependent consumers. More information can be found at https://www.ea.govt.nz/development/work-programme/operational-efficiencies/medically-dependent-consumer-and-vulnerable-consumer-guidelines/

3 Our proposed definition for Aotearoa

The EPR recommended that MBIE develops a definition of **energy hardship**. The Government has a focus on promoting the wellbeing of all New Zealanders. Within this context, we have developed the following proposed definition of **energy wellbeing**:

> **Energy wellbeing** is when individuals, households and whānau are able to obtain adequate energy services to support their wellbeing in their home or kāinga

We propose that **energy hardship** is on the **opposite** end of a continuum to energy wellbeing, i.e.

energy hardship is when individuals, households and whānau are **not** able to obtain adequate energy services to support their wellbeing in their home or kāinga.

Figure 2 Continuum of energy wellbeing

The components of the energy wellbeing definition are further explained in Figure 3 below.

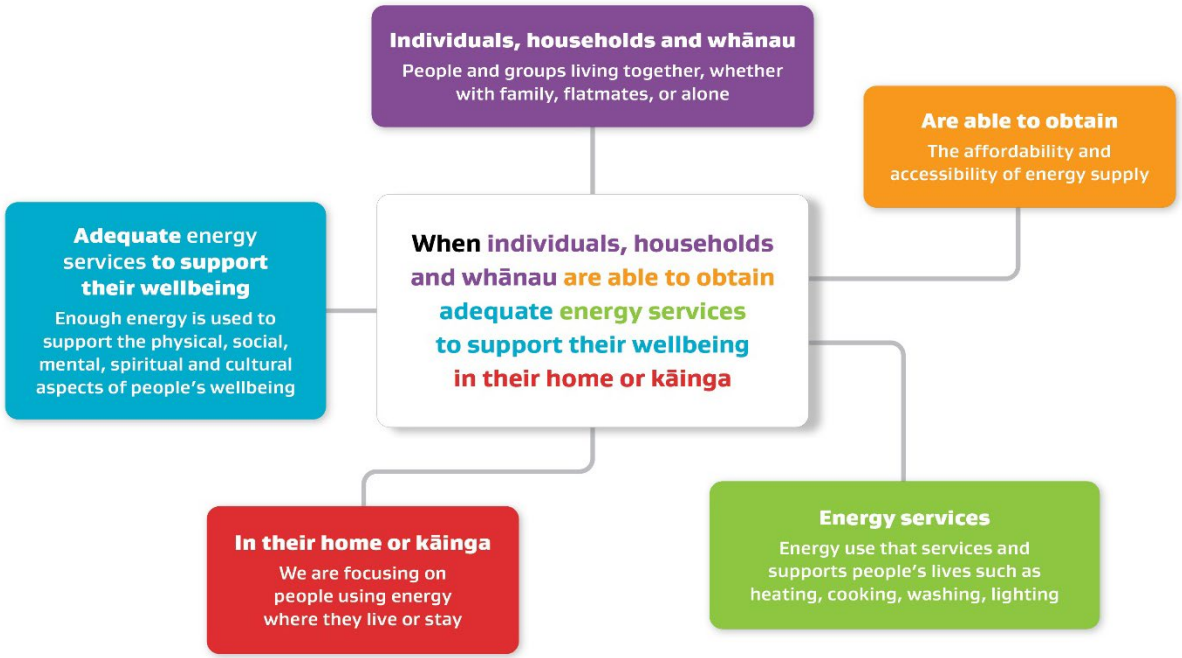

Figure 3: Proposed energy wellbeing definition explanation

3.1 Why we developed this proposed definition

3.1.1 An aspirational definition

We have followed a strengths-based approach for the definition[51], defining energy wellbeing, rather than energy hardship itself. This approach frames the definition as an aspiration, something that is being worked towards for all New Zealanders.

Wellbeing is seen as a measurement of individuals' and collectives' ability to live their lives as they want[52]. Our definition also seeks to incorporate views of Māori wellbeing, which can be individual, collective and societal, and that includes multiple dimensions[53].

3.1.2 A plain language definition is accessible and flexible

We propose a plain language, descriptive definition of energy wellbeing and hardship. This will be supported by a conceptual framework and suite of measures.

Our aim is to have a definition that is clear for everyone, regardless of their knowledge of statistics or measurement. A definition that is easy to understand will likely have greater uptake across community organisations and other groups, as well as government, industry, and academia. This is compared to a technical definition that is based on measures and thresholds.

A descriptive definition is also flexible to changes in measurement methods in the future, as data availability and measurement methods improve. It is also adaptable to changing societal expectations, behaviours, and new technologies.

We have purposefully kept this definition broad. This is to capture the diversity of lived experiences, the multi-dimensional nature of energy wellbeing, and different ways people can be in energy hardship.

The definition reflects that experiences can be either individual or for a household, as well as including a view of wellbeing at the whānau level. Similarly, as the concepts of 'home' and 'house' are not universal, the definition is applicable to varied living situations.

3.2 We have set some boundaries to the definition scope

International and local definitions have set different boundaries for what is considered as part of energy hardship or not. Below are some of the key boundaries we have set to the scope of our definition.

3.2.1 We are focused on domestic energy use

We have not included commercial use of energy as part of the definition of energy hardship. This follows the EPR's explicit concern for the wellbeing of households, as well as the vast majority of international definitions and measures we have come across[54].

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[51] Te Puni Kōkiri, 2015.
[52] Sen, 1990.
[53] Stats NZ, 2002.
[54] Examples include the various official definitions of the countries in the United Kingdom, the Energy Poverty Observatory and Australian research.

All types of fuel are considered in our definition, not just electricity. It also considers all energy services, not just heating, which some definitions focus primarily on. While heating is a key household energy use, and often a significant driver of energy bills, other energy services contribute to and are necessary for wellbeing, e.g. lighting, ventilation, washing, and running of medical equipment.

3.2.2 We are not considering transport energy

When we refer to household energy services, we do not include energy use for transport. This follows from the idea that energy hardship is centred on use of energy within a dwelling, for domestic purposes. It aligns with the approach of much of the research and other official definitions[55]. While Stats NZ's framework for housing quality[56] includes access to transport amenities within functionality, we don't see transport energy itself as part of energy hardship. As the ownership and use of electric vehicles increases in Aotearoa, we will need to consider how vehicle charging (and discharging) is included or not in measurement of household energy use.

3.2.3 Relationship between energy hardship, living situations and dwelling types

The word 'dwelling' is used in this document to refer to the building or structure where someone lives. Understanding the breadth of situations or places where people reside, and how that relates to energy wellbeing or hardship is important for developing targeted initiatives. Type of dwelling is not necessarily an indicator for energy hardship, however when data is gathered on levels of energy hardship, we may gain insight into how people's experiences vary depending on their type of dwelling. For example, people living in an apartment building may be warmer compared to a free-standing house as surrounding apartments can provide a form of insulation.

Below we discuss how different living situations have been conceptually considered in relation to the proposed definition. Section 7.5.2 discusses how various dwelling types may or may not be captured by official data sources.

Papakāinga and marae

Papakāinga can refer to a group of houses on whenua Māori that function as a community in accordance with tikanga[57]. Papakāinga dwellings may share communal facilities and therefore energy services. People may also reside temporarily or permanently on marae. Both marae and papakāinga dwellings are included in the scope of the definition. However, there are measurement challenges for energy use of those living on marae. These are discussed further in section 7.5.3.

Homelessness and energy hardship

There is a spectrum of housing and shelter in Aotearoa, and we recognise some people do not have access to safe and secure housing.

Energy wellbeing focuses on how a household lives within a dwelling, its appliances, and energy sources available. Therefore, we propose all living situations are within the scope of our definition, except those

[55] Some recent literature raises the intersection of transport and energy hardship as an area for future research, for example Bouzarovski et al., 2020.
[56] Stats NZ, 2019a.
[57] Te Puni Kōkiri, 2021.

living 'without shelter'[58]. That is, all except those sleeping rough and inhabiting improvised dwellings without access to energy services (including living in a car). While people living without shelter are clearly not able to obtain adequate energy services, these situations are not related to energy use within a dwelling.

University of Otago researchers have developed a methodology to estimate the number of people who are living without shelter in Aotearoa using census and administrative data[59]. People living without shelter are not excluded when considering wider policy interventions either, instead it is important that their housing situation is prioritised before consideration of energy wellbeing.

[58] Recent reports estimate that the number of people living without shelter is approximately 3,500 (Stats NZ, 2020b).
[59] Amore et al., 2020, as cited in Stats NZ, 2020c.

4 A conceptual framework for energy wellbeing

To support the proposed definition, we have developed a proposed conceptual framework of energy wellbeing and hardship (Figure 4). This framework presents the interlinked factors that contribute to energy wellbeing, or hardship. Each factor is fully explained Section 4.3

Figure 4 Conceptual framework for energy wellbeing and hardship

4.1 Purpose of the framework

The framework expands on our proposed definition to show the interacting factors that affect energy wellbeing or hardship in more detail. It helps identify the underlying drivers of the problem, which can then be used to develop or focus initiatives aimed at reducing energy hardship.

4.2 Rationale and research behind the framework

4.2.1 A wide range of factors affect people's energy wellbeing

The framework aims to show each of the components that can affect whether individuals, households or whānau are able to achieve energy wellbeing or not. People and their dwellings are at the centre of the framework (Figure 4), surrounded by the factors that can affect their energy wellbeing. Factors can interact with each other in a number of ways, so individual households may have different experiences of energy hardship.

There are many factors that may not be within the control of the household. For instance, people may not be able to improve the quality of their dwelling if they are renting, or because of the cost for home owners. Additionally, while most households have the option to choose between different energy retail plans, they do not have control over energy prices in general.

We have chosen not to weight some factors higher than others in the framework because the most influential factors affecting a household's energy wellbeing vary between individual circumstances.

4.2.2 While not explicitly mentioned, regulation and policy are reflected in the framework

Regulation and policy can impact or influence many of the factors above. Broader government commitments and obligations, such as Te Tiriti and climate goals under the Climate Change Response Act will influence many factors. More specific influences could include:

- Energy efficiency standards and regulation
- Consumer protection
- Rental Standards
- Building Code
- Energy market regulation
- Environmental regulation such as clean air rules

4.2.3 Other frameworks informed our development

The proposed framework is intended to show the main drivers of energy hardship and how they are connected. Various related frameworks for energy hardship and general wellbeing have helped inform our proposed framework. We have also drawn on Stats NZ's conceptual framework for housing quality. See *Appendix A: Other frameworks considered while developing this* document for reference to other relevant frameworks.

4.2.4 Lived experiences

It is important that the framework reflects lived experiences in Aotearoa. Early on, we engaged with stakeholders working with vulnerable communities to get their understanding of the drivers behind energy hardship and wellbeing. Their views helped shape our definition and framework. We are now seeking wider feedback on whether we have appropriately captured the lived experiences of New Zealanders. *Appendix E: Case studies of experiences of energy hardship*

presents some examples of New Zealanders' experiences of energy hardship.

4.3 Components of the framework

4.3.1 Environment

4.3.1.1 Climate

Temperatures and weather conditions vary widely across Aotearoa, influencing the energy requirements of a dwelling. Recent analysis found that a third of homes in Aotearoa were too cold in winter, and over a third too warm in summer[60]. Furthermore, with changing weather patterns likely to occur due to climate change, New Zealanders may be facing increasingly variable conditions in the future.

4.3.1.2 Location

Houses built on wet terrain, and rooms with minimal natural light can be more prone to being damp or cold. Location may also affect the amount of energy a household may be able to generate itself, for example using a solar panel, or local geothermal energy. The location of a household also influences the energy sources available to them, as well as their retail plan options. Local regulations around energy use also vary across regions.

4.3.1.3 Taiao

Within this framework, taiao represents the natural environment and its link to wellbeing. Within te ao Māori and other worldviews, human and environmental health are deeply linked. In other words, an unhealthy environment impacts on human health and vice versa. The type of energy available to people can also impact their wellbeing. In our initial engagement on these proposals we found that for some people, the use of non-renewable energy sources is harmful to their wellbeing, as the associated environmental impacts cause stress and uncertainty for the future.

4.3.2 Energy Prices

4.3.2.1 Energy prices

Domestic prices for all types of energy are made up of wholesale prices, distribution, and retail costs. These can vary over time of day and season, as well as over different areas of the country. Energy prices directly affect the size of a household's energy bill.

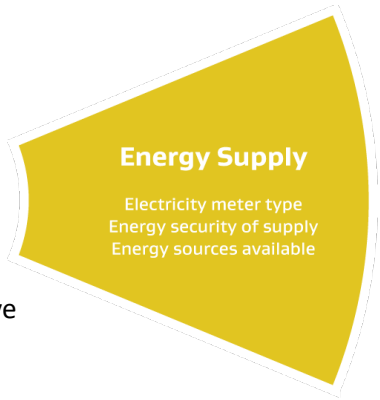
4.3.2.2 Energy retail plans

Energy plans can be structured in many different ways, which may or may not suit a household's needs. This includes bundling, discounts, and time of use pricing or fixed price components. Different types of plans may be available in different areas of Aotearoa. Available options can also depend on a household's energy consumption and household debt, which is likely to limit the number of retail plans available to them.

[60] Stats NZ, 2020a.

4.3.3 Energy Supply

4.3.3.1 Electricity meter type



The type of meter a dwelling has affects the level of information the household gets about their energy use and the retail plans available to them. Smart meters enable more regular consumption monitoring, while older meters might only have a reading every second month[61]. Prepayment meters are also occasionally used by households and can have various fees[62].

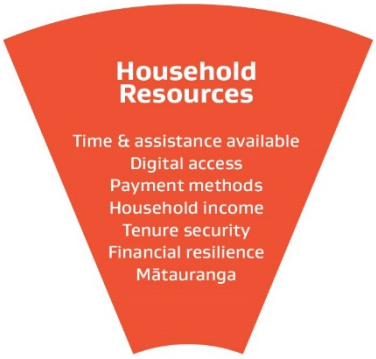
4.3.3.2 Energy security of supply

If energy is not consistently accessible, households cannot expect to always be able to meet their needs, and will have to manage that uncertainty.

4.3.3.3 Energy sources available

This affects the choices a household has to meet their energy requirements. Rural homes may have more challenges connecting electricity to their dwellings, while it may be more difficult for urban homes to source firewood cheaply. Reticulated natural gas is unavailable in the South Island, so residents must buy LPG (liquid petroleum gas) for gas appliances, or have access to a local network. In some areas of Aotearoa, households can gather free firewood locally, while households on the West Coast and in Invercargill have been able to purchase coal at low prices from mines[63]. Some households might be able to utilise solar panels on their roofs if they can afford to install them. Additionally, different regions of Aotearoa are subject to different regulation affecting the methods of energy use in their homes[64]. In some specific cases, households and communities have access to geothermal resources to use directly for heating[65].

4.3.4 Household Resources



4.3.4.1 Time and assistance available

Assistance could include financial contributions from family members, or the accessibility of support organisations. The availability of time to manage the household's energy situation is also critical. Managing energy bills, and researching different options can be a time-consuming

[61] Over 80 per cent of residential electricity connections in Aotearoa are a smart meter. There is no official requirement for smart meters, but many retail companies are rolling these out across their customers. For more information visit https://www.ea.govt.nz/consumers/what-are-electricity-meters/

[62] Households who have run out of credit on their account and are going without electricity are sometimes said to be 'self-disconnected'. A household with a smart meter can be on a prepaid contract without being on a specific prepayment meter, in this case the prepayment is managed remotely.

[63] Centre for Social Research and Evaluation - Te Pokapu Rangahau Arotake Hapori, 2010.

[64] For example, Clean Air Zone rules in Canterbury guide the installation and heating rules for heating that involves burning solid fuel. https://www.ecan.govt.nz/your-region/your-environment/air-quality/home-heating/home-heating-options-in-my-clean-air-zone/

[65] https://www.gns.cri.nz/Home/Learning/Science-Topics/Earth-Energy/Case-Studies

process and a barrier to energy wellbeing. Also, if a household uses firewood as an energy source, they may need extra time to collect or purchase this[66].

4.3.4.2 Financial resilience

If individuals, households or whānau do not have savings to help pay for an unexpectedly high energy bill, they could be pushed into energy hardship. Financial resilience also takes into account unexpected or regular costs that can make energy less affordable. Unexpected costs could be associated with a health incident, or being out of work. Debt and savings are also a factor, as debt repayments increase a household's costs. Personal debt levels can also affect eligibility for some energy retail plans, creating barriers to accessing services.

4.3.4.3 Household income

Income is a key determinant of a household's ability to afford adequate housing and sufficient energy. In particular, income after housing costs is critical to the amount of money a household can spend on energy and other services. This is linked with financial wellbeing, appliance efficiency and housing quality. Household income includes all sources of income, including benefits and family/community assistance.

4.3.4.4 Tenure Security

This covers whether the dwelling is owned, has a mortgage or is rented. Home-owners have greater incentives as well as autonomy to improve the quality of their home, while renters may have less control over housing quality and appliance efficiency. Another influence is the security of their situation. If tenants have good relationships with their landlords it will likely be easier for them to raise concerns or ask for energy efficiency improvements to be made. We have received feedback from organisations working with vulnerable households that fear for tenure security is a significant barrier to improving housing quality.

4.3.4.5 Mātauranga

Mātauranga can be described as knowledge and understanding of the world, and use of resources from a Māori worldview. Mātauranga Māori is a taonga passed down from ancestors through iwi and hapū[67]. Mātauranga can enhance energy wellbeing by informing ways of accessing and using energy, especially where wood and geothermal sources are available. Mātauranga can also increase household resources in other ways; we received feedback in initial discussions with iwi groups that for some, they held Mātauranga that enabled them to hunt and gather food on their whenua which left them with more money for other things.

4.3.4.6 Payment methods

Retail plans and prices are affected by whether payment is via direct debit, internet bank transfer, or by credit card. Some retail companies offer electronic payment discounts. Some prepay options have a

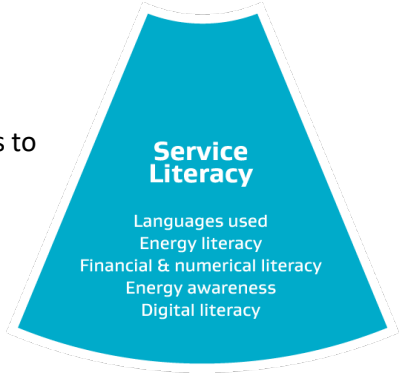
[66] McKague, 2019.
[67] Hikuroa, 2017.

higher top-up cost depending on whether a consumer tops up via internet banking, debit or credit card online, or buying top-up credit at a dairy. This factor links with digital access.

4.3.4.7 Digital Access

Whether households have access to the internet, a computer, or a phone to manage their energy situation, pay bills and get advice. The access to and means to pay for these tools can help households manage their bills more effectively, and be connected to other resources. Not having access to these technologies can be a barrier.

4.3.5 Service Literacy



4.3.5.1 Energy Literacy

An understanding of how the energy retail sector works allows consumers to compare plans and switch to the most cost-effective option. Good energy literacy will increase awareness of the resources available to help with energy costs, and gives people the confidence to talk to retailers about bills.

4.3.5.2 Financial and numerical Literacy

To manage their energy situation, households need to be able to understand the financial and numerical aspects of their bills. This is also important for knowing which plans will be the most cost effective and how discounts can be applied.

4.3.5.3 Languages used

All aspects of service literacy are impacted if consumers are unable to communicate with energy providers. Challenges could include accessing assistance, changing plans and understanding bills and communications from energy providers.

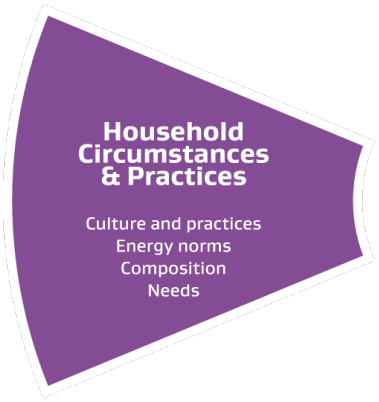
4.3.5.4 Digital Literacy

As well as being able to access technology like phones and the internet, it is necessary for consumers to have some digital literacy to use these technologies for managing their energy situation. Information is available online to help inform consumer retail choices and provide energy management tips. Using these tools can help consumers get a better retail deal, or access assistance if they need it.

4.3.5.5 Energy awareness

The understanding of how much energy your household uses, for what purpose, and the most efficient way to use it. Changing some energy use habits can save households money on their energy bill. However many households in energy hardship will not be able to get out of hardship solely by becoming more aware of how they can manage energy use. For example, they may have insufficient income for everyday needs, and they also may not be able to afford more energy efficient appliances.

4.3.6 Household Circumstances and Practices



4.3.6.1 Culture and practices

An individual, family or whānau will have patterns of energy use that are influenced by their culture. For example, manaakitanga, which can be interpreted as the uplifting of one's mana, values hospitality and relationships and is often expressed through the responsibility to provide hospitality and protection[68]. In order to extend manaakitanga, extra energy use may be required for guests, including greater use of heating and other services for welcoming and hosting.

4.3.6.2 Energy norms

How a household, whānau or individual perceives 'normal use' of energy for them will influence actual consumption. This includes whether people will put up with a cold home, or wear more layers of clothing rather than heating/insulating the home (if they are able to). People may also be reluctant to use air conditioning in summer and put up with over heated housing. This can be linked to energy awareness.

4.3.6.3 Composition

Composition relates to the make-up of the household, and this feeds into household needs (below). Composition covers the number of people in a household or whānau, the age of occupants, and their health and wellbeing. Composition also influences a household's resources, for example households with only one income earner are likely to have less income than those with multiple earners.

4.3.6.4 Needs

How a household's composition feeds into increased or decreased energy needs. For example, larger households are likely to consume more energy, and people of different ages have different energy needs. If occupants require energy that is specific to their health or disability (e.g. ventilators) these needs cannot be compromised. Needs affect the disposable income a household has; for example if someone has a chronic illness, they are likely to face higher medical costs and have less income to spend on energy. Also, if members of a household are at home during the day (working from home or caring for children, for example), they will have greater energy needs than other households.

4.3.7 Dwelling appliances

4.3.7.1 Efficiency

More energy efficient appliances use less energy to perform the required task. Appliances include anything that consumes energy, such as heat pumps, wood burners, and lights. The use of more efficient appliances, such as heat pumps and LED lightbulbs, can reduce a household's energy bill as they use fewer units of energy to meet the user's energy

[68] https://www.imsb.maori.nz/maori-wellbeing-in-tamaki-makaurau/manaakitanga/

requirements. However, they can have a higher upfront cost and be difficult for lower income households to afford.

4.3.7.2 Fuel used

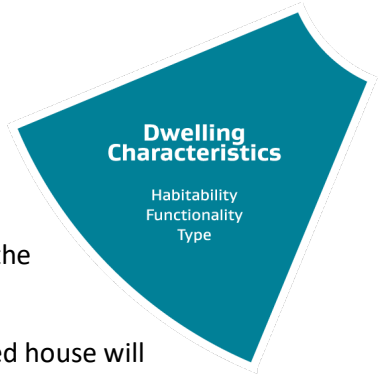
In Aotearoa, the fuel that is most easily available and affordable for different energy services varies. This also depends on the type of appliances in the house and what fuel they require. For a household with easy access to cheap firewood, a wood burner could be the most affordable means of heating, however for household without easy access to cheap firewood, heating that uses another fuel source is likely more appropriate.

4.3.7.3 Suitability and reliability

Unsuitable appliances include heaters that cannot heat a whole room, or are not available in living areas or bedrooms. Portable gas heaters can be unsafe when used incorrectly[69], and broken or unreliable appliances are not suitable to meet energy needs.

4.3.8 Dwelling characteristics

4.3.8.1 Habitability



The degree to which housing and its location provide a physically safe, secure, and healthy environment. This includes the design, construction, materials, service provision and how well it has been maintained. It covers the primary function of housing as providing shelter, focusing on the condition of the house's physical structure and the facilities within it[70].

Dwelling habitability is a key factor in energy wellbeing. A draughty, uninsulated house will be expensive and difficult to heat to a comfortable temperature, for example.

4.3.8.2 Functionality

The degree to which the design, construction, and location of housing support the specific physical, mental, emotional, cultural, and social needs of individuals, families, and whānau in their kāinga and communities[71].

4.3.8.3 Type

This represents the type of dwelling a household or individual is living in. Whether a building is standalone or part of a complex affects the thermal envelope of the dwelling. It can also affect the energy retail plans available to inhabitants; in some apartments or rentals, households are required to join with a specified retailer. This definition's scope includes all types of dwellings, including those that may be insecure like garages and motor homes.

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[69] These appliances create condensation and can be hazardous when used in rooms without ventilation. They are not recommend for use by those with asthma. https://www.worksafe.govt.nz/about-us/campaigns/gas-and-electricity-safety-winter/using-an-lpg-cabinet-heater-safely/

[70] Stats NZ, 2019a, p. 5.

[71] Stats NZ, 2019a, p. 5.

5 How should we measure levels of energy hardship

5.1 Why measure hardship and not wellbeing?

The starting point for measuring energy hardship is defining energy wellbeing. By understanding the dimensions of energy wellbeing we can understand and measure the multiple factors that contribute to being unable to attain it. When helping people in our communities it is important to focus on aspirations and goals. However, for lifting energy wellbeing at a policy level, it is important to have measures of hardship, so that programmes can be better targeted and evaluated.

In developing our proposed definition and measurement framework, we have kept in mind both the **goal** of increasing energy wellbeing, as well as the **need to measure** energy hardship.

5.2 Requirements for statistical standards

In considering how to measure energy hardship, we have referred to the following criteria, based on material developed for indicator selection by Stats NZ[72]:

Guiding principles

- Indicators should be outcome focused
- They should be relevant to Aotearoa and incorporate te ao Māori views
- Movement should be unambiguously associated with progress
- Quality of indicators is preferred over quantity
- Selection of the indicators should not be data driven
- The indicator set should provide a complete picture

Technical criteria - the indicators should be:

- Relevant to energy hardship and lived experience
- Objective and subjective
- Sensitive to change in energy hardship
- Statistically sound
- Able to be broken down into demographic groups
- Easy to interpret
- Grounded in research
- Consistent over time and location

[72] Stats NZ, 2009; Stats NZ, 2019b.

5.3 How have others measured energy hardship?

Energy hardship and how best to measure it has been discussed within Aotearoa and internationally for a few decades. Table below shows some examples of different measures of energy hardship that have been used. Some are official measures, while others have been used in research. Those measures where the source is marked with a * are, or were, official national measures. More examples of different measures can be found in *Appendix B: Examples of measures of energy hardship*.

Table 2: Examples of energy hardship measures

Source	Year	Measure
Boardman (UK)	1991	Households in fuel poverty are "unable to obtain an adequate level of energy services, particularly warmth, for 10 per cent of its income"[73].
Lloyd (NZ)	2006	Measured fuel poor households as those who would need to spend more than 10 per cent of total income on energy to have a satisfactory indoor environment (at least 21 Celsius in the living areas and 18 Celsius in other parts)[74] - Research modelled the expenditure required to adequately heat and use other energy in a 90m^2 house in Aotearoa.
O'Sullivan et al. (NZ)	2015	Research investigated how accurately prepayment meter usage can be taken as a proxy for fuel poverty. Different measures of fuel poverty used: - electricity expenditure as a proportion of household income, a range of thresholds considered - estimated required energy spend as a proportion of household income, 10 per cent threshold used composite measures (a combination of objective and subjective measures relating to financial constraint, adequacy and affordability of heating, and housing quality).[75]
EPOV (EU)	2016 - 2020	The EU Energy Poverty Observatory (EPOV) used four primary indicators of energy poverty and a range of 19 secondary indicators[76]. The four primary measures are: - 2M: The proportion of households whose share of energy expenditure in income is more than twice the national median share - M/2: The share of households whose absolute energy expenditure[77] is below half the national median - Inability to keep home adequately warm - Arrears on utility bills (in the last 12 months)
PwC New Zealand	2018	Households in a Census Area Unit are considered energy vulnerable if: - 10 per cent or more of AHC income[78] is spent on energy

[73] Boardman,1991, as cited in Scottish Fuel Poverty Definition Review Panel, 2017, p. 27.
[74] Lloyd, 2006.
[75] O'Sullivan et al., 2015.
[76] https://www.energypoverty.eu/indicators-data
[77] In the 2M and M/2 measures, both income and energy expenditure are equivalised using the OECD modified equivalence scale.
[78] After Housing Costs income is the income a household has left over after it has paid rent, or its dwelling insurance, rates and mortgage.

Source	Year	Measure
		Households in a Census Area Unit are considered high priority energy vulnerable if four out of five additional risk factors are met: - households spend more than twice the median proportion of AHC income on energy - households spend more than 15 per cent of AHC income on energy - a greater proportion of older houses - more younger children (9 years and under) - more older residents (65 years and over).[79]
England*	2021	Low income, low energy efficiency (LILEE) A household is fuel poor if: - They are living in a property with low energy efficiency, and When they spend the required amount to heat their home, they are left with a residual income below the official poverty line[80]

5.4 What we can learn from how others have measured energy hardship

5.4.1 A suite of measures is required

A single measure cannot adequately capture the state of energy wellbeing or hardship in Aotearoa. A suite of measures is necessary to capture the multiple dimensions and experiences of energy hardship. This approach is consistent with recommendations by Stats NZ in 2017[81], as well as with the way that child poverty is measured in Aotearoa, and with the approach recommended by EPOV to measure energy poverty. Recent energy hardship research in Aotearoa has suggested ways a suite of measures could be constructed, which has helped inform our proposals[82].

When using a suite of measures we must be aware of how much overlap there is between measures. Research has consistently found that different measures identified different groups as being in energy hardship with little overlap[83]. This is something to investigate, and is discussed further in Section 6.6.

5.4.2 Both subjective and objective measures are necessary

Measures of energy hardship can generally be categorised as objective or subjective.

Objective measures use information about a household's circumstances and living conditions based on objective data. For example, measures that look at a household's expenditure on energy, or temperature reading inside a house. England's current official measure of fuel poverty is an example of an official objective measure.

[79] PwC, 2018.
[80] Department for Business, Energy and Industrial Strategy, 2021.
[81] Stats NZ, 2017.
[82] PwC, 2018; O'Sullivan et al., 2015.
[83] Stats NZ, 2017; Azpitarte et al., 2015. Sokołowski et al., 2020.

Objective measures allow for information to be captured and compared consistently, without difference in results due to people's different perceptions, expectations, or interview settings. However objective measures cannot tell us the whole story of the lived experience of households.

Subjective measures use self-reported information from members of the household on their experiences or situation. For example, questions like "Have you been unable to keep your home adequately warm in the past year through lack of money?" provide subjective data.

Subjective measures directly ask respondents about their lived experiences. They are used to broaden our understanding of people's quality of life[84]. They are not necessarily meant to replace objective measures, instead they add information and insights that are not captured by objective measures[85]. However, they can be subject to recall bias and error. These measures can also vary depending on people's expectations, perceived experiences and norms.

Objective and subjective measures are both useful for measuring energy hardship, but neither can form a complete picture. Research recommends that both are used to measure energy hardship[86]. This was also a technical criterion in *Ngā Tūtohu Aotearoa - Indicators Aotearoa NZ development*[87].

5.4.3 Measure the amount of energy people need, not the amount of energy they use

To measure energy affordability, a number of energy hardship measures compare the **actual** energy spend of a household to its income. However, to understand whether a household can afford to meet its energy needs we must compare their **required** energy spend to their income.

Actual energy spend measures can be subject to both false positive and false negative results. Households who use very high amounts of energy (but can afford to) can be incorrectly identified as being in energy hardship, and households that ration their energy use to levels that risk their wellbeing are not identified as being in hardship because their bills are relatively low. Domestic energy expenditure as a proportion of income is not considered a reliable measure of energy hardship without some measurement of the thermal efficiency of the dwelling.

Required energy spend measures instead attempt to determine whether a household's needs are being met. They estimate the amount of energy a household would need to buy for a healthy environment and then consider whether a household could afford this. These are more rigorous but they require significant data and effort to produce[88]. The calculation of the modelled consumption or 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"[89]. There are some caveats to this approach, such as

[84] For example OECD, 2020.
[85] Noll, HH. Subjective Social Indicators: Benefits and Limitations for Policy Making—An Introduction to this Special Issue. Soc Indic Res 114, 1–11 (2013). https://doi.org/10.1007/s11205-013-0379-7
[86] For example Sareen et al., 2020.
[87] Stats NZ, 2019b.
[88] For example, the fuel poverty gap measured in England uses required fuel costs, which need to be modelled. This involves energy use, energy prices, the size of the property, energy efficiency, number of occupants, and fuel types used. It is known as the BREDEM model. See Department for Business, Energy & Industrial Strategy, 2021 for further information.
[89] Papada & Kaliampakos, 2018, p. 154.

the lack of a universally accepted "basket of basic energy services"[90] for households, and that they cannot adequately represent all individual circumstances. When measuring energy hardship, it is 'required energy' that enables us to accurately measure energy affordability.

5.4.4 Thresholds matter when defining energy hardship

Thresholds are commonly used in objective measures of energy hardship, to allow us to estimate the number of individuals, families or whānau who are above or below a threshold value for a given metric.

The chosen threshold needs to be tested to ensure that the underlying distribution of energy spend is understood and the choice of cut-off value is not sensitive to small changes. There is a need to undertake analysis to understand how many households may be clustered on either side of the threshold, and what the characteristics of these households are. In the discussion below we refer to thresholds for the ratio of household spending to income, but the conclusions can apply to any measure that uses a threshold to determine if a household is experiencing energy hardship.

Different thresholds determine different levels of energy hardship

A common threshold used to define energy hardship in international literature is the '10 per cent' measure, based on Boardman's 1991 definition of fuel poverty (see Section 5.3). This threshold was also used as an example for measuring rates of energy hardship in the final report of the EPR, published in 2019[91].

However, we need to understand how the chosen threshold affects the number of households considered to be in energy hardship for Aotearoa. When Boardman published her initial threshold, 10 per cent was roughly twice the national median ratio of energy spend to household income in the UK. Although we are not recommending the use of the '10 per cent' measure in Aotearoa, we have included some data here for context.

MBIE has updated the analysis in Stats NZ's 2017 report, using results from Household Economic Survey (HES) 2018/19 to see how these measures have changed over time. *Appendix D: Technical Appendix – Results for selected measures of energy hardship* contains various statistics and graphs presenting this data[92]. This analysis shows a large difference in the number of households determined to be in energy hardship depending on which threshold is used:

- Using a 10 per cent measure sees an estimated 100,000 households (6.0 per cent) in 2018/19 experiencing energy hardship (spending 10 per cent or more of their gross income on energy)
- Using 5.3 per cent (the actual value for twice the median spend in relation to income in Aotearoa in 2018/19) as the threshold sees 361,000 households (21.5 per cent) experiencing energy hardship (spending twice the median or more or their gross income on energy).

[90] Culver, 2017, p. 2.
[91] The measure used was the number of households in New Zealand who spent 10 per cent or more of their income before housing costs on energy. The data was taken from Stats NZ's 2017 report *Investigating different measures of energy hardship in New Zealand*.
[92] Note that this data was collected pre-COVID-19

These two measures produce very different results for the number of households experiencing energy hardship. One estimates 100,000, the other estimates there are 361,000 households, a difference of 261,000 households.

Looking at these results and considering the basis of Boardman's original '10 per cent' measure, it is clear that:

- A numerical threshold needs to consider the properties of the underlying distribution. This is important as there may be a large number of households clustered just above or below a chosen threshold. As a result, even small increases or decreases in the chosen value for the threshold can have significant impact on the number of households deemed to be in energy hardship.
- Boardman's threshold was based on twice the median expenditure for the UK at a specific time (the 1980s), as well as referring to a household's required, rather than actual energy spend. This means it is unlikely to have reflected the underlying distribution and characteristics of household energy use in Aotearoa at that point in time, or today. Thresholds need to be relevant to the underlying population that is being measured.

Changes over time in national measures will shift relative thresholds

Relative thresholds (e.g. those that use a national median as a cut-off value, which changes over time) can make it difficult to measure changes in levels of energy hardship, as the value for the threshold will be influenced by changes in everyone's circumstances. Households can go in and out of being classified as in energy hardship, depending on their position relative to the population, rather than their individual circumstances[93]. When interpreting comparisons over time, the influence of different underlying distributions on these measures need to be considered.

5.4.5 Energy hardship is not a binary situation

Individuals' experiences exist on a continuum where there are different levels of energy wellbeing and hardship. This is one of the problems with setting thresholds for measuring energy hardship. We should not only measure the number of households who are experiencing energy hardship, but also the depth of energy hardship that is experienced across the country. Some research has investigated using multiple measures to help understand the depth or severity of energy hardship[94]. England's official statistics include a measure of how far from a given threshold of fuel poverty households are. Potential for measuring the depth of energy hardship is discussed further in Section 6.6.

There are also issues with using only binary measures of energy hardship – characterising households as in energy hardship or not, according to a particular measure or set of measures. One study noted that a binary measure "clashes with the reality of energy poverty experienced in various forms and intensities"[95]. Additionally, some households may experience intermittent hardship. There is a range of factors that could quickly move a household into or out of energy hardship.

[93] For further discussion on relative hardship, see Department for Business, Energy & Industrial Strategy, 2019.
[94] PwC, 2018; Sokołowski et al., 2020; Stats NZ, 2017.
[95] Tirado-Herrero, 2017, p. 1026.

5.4.6 Stories, as well as surveys, are important for understanding

Quantitative data is key for creating measures. However, people's stories of their lived experiences can give insights that are not fully captured by a survey. Stories can help give context and explain trends in data that otherwise might not be obvious. Initial engagement with community organisations has helped to inform our proposed framework for energy wellbeing and hardship. Case studies illustrating how households cope with heating their homes and paying their power bills have also helped to inform our work. *Appendix E: Case studies of experiences of energy hardship* presents case studies collected by the EPR with examples of different New Zealanders' experiences of energy hardship.

Continued engagement with those experiencing energy hardship or those working with households experiencing hardship, as well as evaluation of projects to address energy hardship will also give us further insight into lived experience.

6 How can we measure energy hardship in Aotearoa now?

Considering lessons from how others have measured energy hardship, as well as initial engagement with stakeholders, we have developed proposals for measuring energy hardship in Aotearoa. We first propose key indicators of a household's energy wellbeing, and then how we might measure levels of energy hardship in relation to these indicators.

We are proposing a suite of primary and secondary measures of energy hardship. We have considered how energy hardship can be measured now using available data. It is important that we begin to measure and monitor energy hardship levels in Aotearoa as soon as possible, rather than waiting on perfect measures and data. Limitations and plans for improving measurement are discussed in Section 7 and Section 8.

6.1 Proposed key indicators of energy wellbeing

We have identified the following indicators of energy wellbeing, following from our proposed definition. Our aim is to capture the outcomes of the varied factors of energy wellbeing in a few carefully chosen key indicators. We have used these indicators of wellbeing to consider how to measure energy hardship.

Proposed definition of energy wellbeing: When individuals, households and whānau are able to obtain adequate energy services to support their wellbeing in their home or kāinga.

Table 3: Proposed indicators of energy wellbeing for Aotearoa

Theme	Energy wellbeing indicator
Able to obtain – access	Access to a reliable energy supply when needed
	Able to access and use technologies to manage energy, such as making online transactions.
Able to obtain – able to afford and manage bills	Able to afford energy bills without borrowing or economising on other expenses
	Able to heat, wash, cook and use other energy services as required to stay comfortable without having to forego other necessities
Able to obtain – enabling resources	A dwelling that can maintain a healthy temperature
	Access to necessary appliances that are safe, effective and efficient
Wellbeing is supported in the home or kāinga	A dry and well-ventilated home
	A healthy indoor temperature

6.2 What data sources have we considered initially?

We have considered a number of official data sources for measuring energy hardship now. These include the following Stats NZ surveys: Household Economic Survey (HES), General Social Survey (GSS), and the Census of Population and Dwellings, as well as data published by the Electricity Authority, Commerce Commission, Ministry of Social Development, and the Ministry of Health.

For the measures proposed in this document, we considered official data sources that are nationally representative. While regional breakdown of measures is important, the key outcome for this work is to be able to monitor progress at a national level. In order to do this, it is important that we use statistics with national coverage that are collected consistently using transparent methods. Since government data sources enable reliable, national gathering of statistics, they will primarily be used in measurement of energy hardship.

There is also relevant and helpful information in some data sources that are not continuous but one-off collections. These include the Pilot Housing Survey that was linked to the 2018 General Social Survey Housing and Physical Environment Supplement, and the Household Energy End-use Project. Since these are not regularly undertaken, they are not suitable for a national measure to track levels of energy hardship, however they can inform future analysis. Future analysis planned by MBIE is further detailed in Section 8.

Table 4 provides an overview of the data sources for the proposed measures.

Table 4: Data sources for proposed measures of energy hardship

Data source	Frequency	Sample size (households)
Household Economic Survey (HES) – Core	Annual	20,000 approximately (prior to 2018/19, sample size was approximately 3,500)[96]
HES – Expenditure	Every three years	3,500 approximately
Census of Population and Dwellings	Every five years	All of New Zealand
General Social Survey (GSS)	Every two years	8,500 approximately
GSS – Housing and Physical Environment Supplement	First collected in 2018, intention to include every six years[97]	8,500 approximately
Electricity Authority retail information request	Annual	All residential electricity customers

[96] https://www.stats.govt.nz/methods/expanding-the-household-economic-survey-to-obtain-good-measures-of-child-poverty

[97] Stats NZ has indicated that it intends to collect the Housing and physical environment module every third iteration of the General Social Survey i.e. every 6 years. This would see the next iteration held in 2024.

6.3 We propose a suite of measures for energy hardship

We are proposing a suite of primary and secondary measures. This follows the way we measure child poverty in Aotearoa and the approach of the EU Energy Poverty Observatory.

We have chosen the primary/secondary structure as it is clear and easy to follow. It is valuable to distinguish some indicators as primary to identify those that most directly measure energy hardship. A small and targeted selection of primary indicators allows concise communication of the major overall trends, while a secondary suite can expand upon these and provide insights into the broader dimensions of the framework.

Some research we encountered looked at applying weights to different measures and then adding them into a single measure of energy hardship[98]. While it may be helpful to have a single number to represent the level of energy hardship nationally, this approach makes it hard to distinguish changes in different aspects of energy hardship, and harder to understand in general. It also requires us to set weightings, which place more value on some experiences than others. Stats NZ's 2017 report did not recommend this weighted sum approach either[99].

6.4 Proposed measures of energy hardship

Based on the key indicators of energy wellbeing above, we have considered ways we can measure levels of energy hardship against each indicator. We have identified a selection of primary and potential secondary measures, as well potential for future development. Advantages and disadvantages of each individual measure are discussed in *Appendix C: Advantages and disadvantages of proposed measures*.

6.4.1 Proposed primary measures of energy hardship

The following table presents our proposed **primary** measures of energy hardship against the associated indicator of energy wellbeing (presented in Section 6.1).

Table 5: Proposed primary measures of energy hardship

Indicator of energy wellbeing	Measure ID	Energy hardship measure name	Data source and frequency
Able to afford energy bills without borrowing or economising on other expenses	P1 (interim)	Proportion of AHC household income spent on domestic energy costs twice the median or more (moving line)	HES - Expenditure, every 3 years
	P2 (interim)	Proportion of AHC household income spent on domestic energy costs twice the median or more (fixed line)	HES - Expenditure, every 3 years
Able to wash, clean, cook and heat/cool as required to stay	P3	Put up with feeling cold to keep costs down a lot	HES - Core, annual; also in

[98] Stats NZ, 2017; Healy, 2004.
[99] Stats NZ, 2017.

comfortable (without economising on other necessities)			the GSS every 2 years.
A dry and well ventilated home	P4	Dampness and/or mould problems - major	HES - Core, annual

We have selected four primary measures of energy hardship, reflecting the approach used to measure child poverty in Aotearoa. We have selected these measures as primary because they closely link to the indicators of energy wellbeing.

P1 and P2 are both energy expenditure measures, with P1 (a moving line measure) tracking how the proportion of households in energy hardship is changing over time, and P2 (a fixed line measure) looking at how levels are changing compared to a baseline year. P4 also aligns with the Government Child Poverty Related Indicator for housing quality.

We propose P1 and P2 be **interim** measures as they are based on **actual** rather than **required** spend on energy. While it is our intention that required energy be measured, this is not currently feasible and will be the subject of further research. This is discussed in Section 6.5.2. By using additional subjective measures we will ensure an inclusive and thorough approach to measuring energy hardship.

6.4.2 Potential secondary measures of energy hardship

We propose that a collection of secondary measures are also monitored. The table below presents a range of possible **secondary** measures of energy hardship against associated indicators of energy wellbeing (presented in Section 6.1). We propose these as secondary because they are less direct measures of energy hardship, they overlap, they are collected less often, or because they come from different sources which makes them harder to compare. However, they all provide insight into different experiences of energy hardship. Advantages and disadvantages of each measure are discussed in *Appendix C: Advantages and disadvantages of proposed measures.*

Some of the proposed measures are collected in multiple surveys, for example the same question for P8 is in both the HES and the GSS. In this situation we propose the HES as the preferred source as it is more frequent than the GSS. Where the same question is asked in both the Census and the GSS Housing and Physical Environment Supplement, we propose using the Census, as it is a full population survey, as well as more frequent.

We have not proposed a specific limit on the number of secondary measures. We are interested in feedback as to how many secondary indicators would be suitable. The national Child Youth and Wellbeing Strategy monitors 36 indicators to measure progress against six wellbeing outcomes for children and young people. EPOV considered a range of 19 secondary indicators of energy poverty in the European Union (in addition to four primary measures).

Table 6: Potential secondary measures of energy hardship

Indicator of energy wellbeing	Measure ID	Energy hardship measure name	Data source & frequency
Access to a reliable energy supply when needed	P5	No access to electricity supply	Census of Population and Dwellings (2018 onwards), every 5 years
Able to access and use technologies to manage energy, such as making online transactions.	P6	No home access to computer or internet	HES - Core, annual
	P7	No access to financial institution account	HES – Expenditure, every 3 years
Able to afford energy bills without borrowing or economising on other expenses	P8	Could not pay electricity, gas, rates, or water bills on time (more than once)	HES - Core, annual; also in the GSS every 2 years
	P9	Unable to afford unexpected expense without borrowing	HES - Core, annual
	P10	Proportion of BHC household income spent on domestic energy costs twice the median or more (moving line)	HES - Expenditure, every 3 years
	P11	Proportion of BHC household income spent on domestic energy costs twice the median or more (fixed line)	HES - Expenditure, every 3 years
Able to wash, clean, cook and heat/cool as required to stay comfortable (without economising on other necessities)	P12	Absolute domestic energy expenditure half the national median or less (moving line)	HES – Expenditure, every 3 years
	P13	Cannot afford to keep the dwelling adequately warm	HES - Core, annual
	P14	Using prepayment metering	Electricity Authority retailer survey
	P15	No heating type used	Census, every 5 years
	P16	Not heating own bedroom in winter	GSS – Housing and physical environment (2018 onwards), every 6 years
	P17	Not heating children's bedroom in winter	GSS – Housing and physical environment (2018 onwards), every 6 years

	P18	Not heating main living room in winter	GSS – Housing and physical environment (2018 onwards), every 6 years
A dwelling that can maintain a healthy temperature	P19	Trouble heating accommodation and/or keeping it warm in winter	HES, annual; also in the GSS every 2 years, from 2014[100].
Access to necessary appliances that are safe, effective and efficient	P20	Use of unsafe substitute heating methods (portable gas heater).	Census, every 5 years, from 2018
	P21	Lacking one or more basic amenity.	Census, every 5 years, from 2018
	P22	Housing repairs needed - major	GSS, from 2018
A dry and well ventilated home	P23	Mould larger than an A4 - Always	GSS, from 2018; also in the Census, every 5 years, from 2018
	P24	Damp always	Census, every 5 years, from 2018
A healthy indoor temperature	P25	Can see breath indoors in winter	GSS, once every 2 years
	P26	Indoors always colder than would like in winter	GSS, once every 2 years, from 2014

6.5 Discussion of the proposed measures

For each measure, we have considered which indicator of energy wellbeing they relate to, and whether they should be primary or secondary measurements. We considered the strengths and weaknesses of each measure, particularly whether it directly measured energy hardship or would be considered a proxy, and how often the data is collected.

6.5.1 How directly do the measures relate to energy hardship?

Some of the measures directly correspond to the associated energy wellbeing indicator, and others are proxies. Proxies help us understand experiences of energy hardship when the exact data we need does not exist, so we must use measures that are close but not the direct measure we would like. For example, households that could not pay electricity, gas, rates, or water bills on time more than once in the last 12 months may have experienced no issues paying their energy bills on time, but struggle to meet their rates bills. Despite this, we have chosen this as a potential measure of energy hardship as it can signal financial vulnerability, and difficulties paying bills generally.

[100] These questions were also asked in the HLFS wellbeing supplement June 2020 to March 2021. This supplement was introduced in response to the COVID-19 shut down of HES and GSS as these required face-to-face interviews. The HLFS is a longitudinal survey and only the first interview is face-to-face. After that, interviews are conducted by phone.

'Technologies that enable access' is an indirect indicator. Measures such as P6 and P7 are important despite the fact they are not considered direct measures of energy hardship independently. They can influence a household's ability to improve their energy situation. If someone does not have access to the internet, this could prevent them comparing power plans, or accessing discounts for online payment.

Some measures directly reflect changes in regulation and/or policy from agencies and industry

We aim to propose measures that reflect the experiences of people in Aotearoa and are not overly sensitive to policy or regulation decisions. For example, in initial stages of this work we considered looking at rates of electricity disconnection due to non-payment, and the Ministry of Social Development (MSD) hardship assistance grants for electricity or gas. Disconnections for non-payment and self-disconnections by those with prepayment meters were noted as important statistics to measure in relation to energy hardship by the EPR. These measures can indicate levels of hardship in Aotearoa, but are also highly sensitive to changes in policy, regulation or administration (from government, regulators, and industry)[101]. Rates of electricity disconnection due to non-payment could be affected by regulation, or the amount of MSD grants could be changed. This would not necessarily correspond with a change in whether people are able to access and afford adequate energy services. Similarly, a retailer's disconnection practices could change. For instance, during the COVID-19 Alert Level 4 in early 2020, the number of disconnections for non-payment decreased, as retailers chose not to disconnect customers[102]. This does not reflect a long-term change in households' ability to meet their needs, but a decision that retailers undertook to support their customers.

This doesn't mean that these statistics shouldn't be monitored, but we do not recommend they be included in an official suite of measures of energy hardship.

We have included the rate of uptake of prepayment meters as a potential secondary measure, but we note that this measure could also be sensitive to regulation and/or classification. Additionally, some households may be on prepayment meters without being at risk of energy hardship. It also doesn't capture how many of these users are 'self-disconnecting' when they run out of credit, but there is currently no data source for this to measure prevalence.

6.5.2 Including expenditure measures

Two of our primary measures are expenditure measures (P1 and P2), based on actual expenditure on energy by households. Expenditure measures are useful as they are objective and measure a household's actual energy situation. They attempt to capture the affordability aspect of energy and how the energy efficiency of a house significantly affects the energy needs of a household.

However, it is required energy expenditure that should be measured for energy hardship, rather than actual expenditure. This is the approach taken by the official English measure of fuel poverty. The measures of household energy spend (P1 and P2) are based on what a household *actually* spent on energy, rather than the amount of energy *required* to keep their home healthy. While it is our intention

[101] The Electricity Authority new consumer care guidelines came into effect 1 July 2021 and include specific expectations on retailers around disconnection procedures

[102] https://www.ea.govt.nz/about-us/media-and-publications/market-commentary/market-insights/covid-19-and-alert-level-effects-on-disconnections-and-debt-september-update/

that required energy be measured, this is not currently feasible and will be further researched. We propose that P1 and P2 act as **interim measures**, until we can confidently measure a required energy spend against income. For more information about plans for future research in this area see Section 8.

Income After Housing Costs vs Before Housing Costs

We have proposed using **after** housing cost income when considering the amount households are spending on energy for proposed measures P1 and P2, because housing costs are not generally something that households can reduce spending on. However, we are planning to further investigate the effect of using before housing costs income (BHC) and after housing costs income (AHC), as well as different relative thresholds. For an international example, EPOV's '2M' measure of energy poverty considered disposable income **before** housing costs. We have also included BHC measures in the list of potential secondary measures.

6.5.3 Using the median as a threshold

The median is the 'middle value' of a set of ordered values. We have proposed twice the median be used as a threshold when considering the ratio of a household's domestic energy spend compared to its AHC income (proposed measures P1 and P2). These measures capture households who are spending a very high amount of their disposable income on energy relative to other households in Aotearoa.

Using multipliers of the median for a threshold is an approach used in both measures of energy hardship recommended by EPOV and measures of child poverty in Aotearoa. We have proposed both a moving-line median measure and a fixed-line median measure. Official measures of Child Poverty also consider fixed-line and moving-line measures[103].

Moving median: to measure the number of households experiencing energy hardship in **any given year**, the median from that year will be used. This is most useful when comparing different households relative to each other in a given year. Because spending on energy varies each year, the median is 'moving'. For example, to measure energy hardship in 2018 using the moving-line median measure, the median spending from 2018 will be used.

Fixed median: to measure how energy hardship levels **change over time**, the median will be from a baseline year (a fixed median). This is most useful when identifying changes over time. For example, to measure changes in energy hardship between 2018 and 2020, the median spending from the baseline year would be used for each year and adjusted for inflation. We plan to do further analysis to identify an appropriate baseline year.

6.5.4 How often can we collect data on the measures?

The two proposed primary subjective measures (P3 and P4) are derived from the HES which collects data annually, and surveys approximately 20,000 households. However, the measures of energy expenditure (P1 and P2) are based on the HES expenditure survey of around 3,500 households every three years. Including an objective measure provides balance and decreases the risks of perception bias that come with subjective questions. However, as well as being collected less frequently, the HES expenditure also has a smaller sample size, meaning it is harder to track changes over time because of

[103] These measures are legislated in the Child Poverty Reduction Act 2018.

larger sample errors. In this case, we propose that the advantages of including an expenditure measure outweigh the disadvantages. A potential future solution to the smaller sample size and less frequent collection of the HES expenditure data is the use of Installation Control Point (ICP) data. This is discussed further in section 7.1.1.

The proposed secondary measures are updated at a range of frequencies, from annual collections to up to every five or six years. Limitations due to the frequency of data sources we have considered are noted in section 7.6.

6.6 We are investigating how to measure the depth of energy hardship

6.6.1 Why measuring depth is important

Different households may be in energy hardship but experience it in different ways. Some households may prioritise adequate energy services at the cost of cutting back on other areas of essential expenditure (such as food). Alternatively, other households may minimise energy use in order to have money for other necessities and go without energy services such as heating. Some households may be experiencing such poor housing conditions that they cannot heat their dwelling adequately, and therefore also minimise heating.

Energy hardship is also not a binary situation, but a continuum. Measures that class households as either in or out of energy hardship do not reflect this continuum of experience. Researchers have attempted to address this issue by identifying ways to measure the depth of energy hardship (as noted in Section 5.4.5). However, there is no internationally agreed methodology for addressing this problem.

6.6.2 Potential ways to measure depth of energy hardship

We are interested in exploring different methodologies to measure the depth of energy hardship. There are three potential methods we are considering, based on previous research: a simple number of indicators approach, an approach similar to the way that material hardship is measured in Aotearoa, and an energy hardship 'gap' approach (as used in the current official English measures). Each approach has advantages and disadvantages, and requires further research to identify which is best for Aotearoa. We have included a brief description of the different approaches below.

6.6.2.1 Combining measures

This methodology uses a combined indicator approach by simply grouping households according to the number of energy hardship measures they have[104]. Here, energy hardship is presented in the context of a continuum – from households experiencing no hardship measures to households experiencing multiple measures. This approach has the advantage of being relatively simple to understand with a transparent methodology. A recent Polish study defined a household as being in multidimensional energy poverty if it experienced at least two out of five measures of energy deprivation[105].

Counting 'distinct' measures

[104] See examples in Stats NZ, 2017; PwC, 2018.
[105] Sokołowski et al., 2020.

If we use this approach of looking at the number of measures that a household meets to measure a 'depth' of energy hardship, the measures should be unique aspects of energy hardship. This is important because of the effect it has on the depth of energy hardship a household is determined to be in. For example, if two of the measures we consider both relate to the level of housing dampness, then households who have dampness already meet two measures.

Different measures may identify different groups as being in energy hardship with little overlap[106]. This is consistent with findings in the Stats NZ 2017 report[107], and a 2015 Australian study[108]. This may be because they are measuring different factors of energy hardship, or because households have varied experiences of energy hardship. It is important to investigate how much measures overlap in a suite. Data from the HES 2018/19 shows us that households experiencing more than one objective measure are more likely to experience one or more subjective measures[109].

Using only one data source

We would aim use a single common data source for this analysis – likely the HES. Taking measures from a single survey limits the measures we can consider but is important for producing a reliable statistic of this kind, for consistency of sample and method.

A DEP-17 approach

One way of combining measures is to use an approach similar to the DEP-17 index (deprivations out of 17 factors). The DEP-17 is used in Aotearoa to measure the percentage of children living in households that in material hardship. This is one of the official primary measures of child poverty[110].

The DEP-17 is an index of material hardship that looks at the number of items a household isn't able to afford across 17 different questions (e.g. not having suitable clothes, or putting up with feeling cold). A household is defined as being in material hardship if they lack six or more items from the 17, and in severe material hardship if they lack nine or more.

The DEP-17 index makes it easier to communicate and interpret material hardship trends. It identifies households lacking items that we recognise as "resources that every New Zealander should have"[111]. It doesn't place more importance on any specific essential item out of the 17 it considers, instead it weights them equally. What's important is that households have an enforced lack of essentials, not which items they are forced to cut back on.

6.6.2.2 An energy hardship 'gap' measure

Another way of measuring the depth of energy hardship is to ask "how far are we from eliminating it?"

In England, the current official measures of fuel poverty give both the proportion of households who are in fuel poverty, as well as the size of the 'fuel poverty gap'. In the context of England's 'Low Income, Low

[106] As shown in results presented in Appendix D: Technical appendix – Results for selected measures of energy hardship.
[107] Stats NZ, 2017.
[108] Azpitarte et al., 2015 in Stats NZ, 2017.
[109] See *Appendix D: Technical Appendix – Results for selected measures of energy hardship.*
[110] Stats NZ, 2019d.
[111] Stats NZ, 2019d, p. 4

Energy Efficiency' measure of fuel poverty, the fuel poverty gap measures the reduction in energy costs needed for a household to not be in fuel poverty. The fuel poverty gap can be changed by changes in the energy efficiency of a home, household income, and energy prices.

Headline official English measures report on both the size of the average household fuel poverty gap, as well as the aggregate national gap across all households. The official English Fuel Poverty measures report recommended that the fuel poverty gap statistic is used, together with the proportion of households in fuel poverty as an indication of fuel poverty at the national level[112].

This method requires information on a household's required energy, energy performance, and income. It is not simple to calculate, nor does it take into account subjective information about a household's experiences. However, it is useful in providing an estimate of the depth and distribution of energy hardship nationally, and how far there is to go to eliminate it.

6.6.3 How might a depth measure be used in our official measures?

We suggest that a depth measure could be added to our suite of primary measures. This would require further development. A combined indicator approach for depth measurement is likely to be possible earlier than the energy gap approach as that requires further work around required energy in Aotearoa.

An important principle to follow in all of these different approaches is ensuring the methodology is transparent and enhances our understanding of energy hardship. We do not want to add "layers of data and algorithms" which may undermine our ability to understand what the data actually represents[113].

6.7 Measuring the wider impacts of energy hardship

Living in energy hardship can negatively affect people's health and wellbeing in multiple ways. We are interested in measuring health outcomes alongside energy hardship. However, at a national level, changes in indicators of health cannot be directly attributed to changes in levels of energy hardship. We propose to select a number of measures of health and wellbeing as energy hardship-related indicators. This is a similar approach to the New Zealand government's child poverty measurements, which report on four Child Poverty Related Indicators (CPRIs) related to the broader causes and consequences of child poverty.

Energy hardship-related indicators will be useful in further research into the relationship between energy hardship measures and health outcomes. They may also be used to evaluate specific projects – as opposed to national programmes – established to address energy hardship.

There are a number of different ways to measure health and wellbeing in Aotearoa. The Treasury's Living Standards Framework Dashboard includes measures of physical and mental health, as well as social connections and subjective wellbeing. We are considering measures and data sources to select for energy hardship-related indicators from a range of different sources. These include administrative data like rates of avoidable hospitalisations, as well as survey data such as Stats NZ's General Social Survey which the Treasury Living Standards Framework uses to measure wellbeing across different domains.

[112]Department for Business, Energy and Industrial Strategy, 2019.
[113] Sareen et al., 2020, p. 36.

7 There are limitations and gaps in data currently available

There will be limitations with any method used to measure something complex like energy hardship. Whatever our final recommended measures are, we will note their limitations, provide advice around interpreting results, and how measures might be improved in the future.

There are currently significant gaps in the data available that limit the measures we can investigate, as well as other related factors. Below we have identified key gaps in the data available and current possibilities for addressing these. We will need to use proxies initially, but it is possible that we will be able to better measure these factors as more data becomes available in the future.

We can't be certain that a suite of measures will capture everyone's experience, but as new measurement techniques and data sources for the chosen indicators are made available we can update these to gain a broader picture. Our proposed plain language definition allows for this flexibility.

7.1 Better information on energy use, costs, and needs will be critical

Our proposed measures use information on energy expenditure from the HES, which has a limited sample size and is collected every three years. It also doesn't tell us about the energy needs of the households surveyed, only what they have spent.

7.1.1 Electricity use from ICP data will be an important data source

We are working with a number of agencies and organisations to facilitate key electricity usage data to be included in Stats NZ's Integrated Data Infrastructure (IDI)[114]. While energy hardship is not just about electricity use, electricity accounts for almost 75 per cent of residential energy consumption in Aotearoa[115].

Most households in Aotearoa that use electricity have an Installation Control Point (ICP). Retailers track the amount of electricity supplied at each ICP monthly. This data is compiled by electricity retailers and provided to distributors to allow for network charge invoicing, among other things. If added to the IDI, this would give us more detailed and frequent information about electricity consumption for different types of households. This will mean that the electricity used by each household can be measured alongside HES questions like how damp a house is, or if people are putting up with feeling cold to keep costs down. When we develop models of required energy, these can be used in conjunction with ICP electricity data to better measure energy hardship (see below section 8.1.2).

[114] The Integrated Data Infrastructure (IDI) is a large research database holding anonymised microdata about people and households in Aotearoa. The data is about life events like education, income, benefits, migration, justice, and health. It comes from government agencies, Stats NZ surveys, and non-government organisations (NGOs). The data is linked together, or integrated, to form the IDI.
https://www.stats.govt.nz/integrated-data/integrated-data-infrastructure/

[115] MBIE Balance tables 2019 https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/energy-balances/

7.1.2 Energy use, behaviours, housing performance, and appliances from HEEP2 will also provide valuable insights

MBIE is supporting BRANZ in updating its Household Energy End-Use Project (HEEP2)[116]. This project will help us to better understand how, where, when and why energy is currently used in homes. HEEP2 will collect information from households throughout the country. This will include measuring how much electricity, gas, and solid fuel households use. It will also collect information about what the energy is used for (e.g. heating rooms and water, cooking, refrigeration and entertainment) and how effectively it does the job. In addition to monitoring the amount of energy used and the home environment, HEEP2 will survey participants about how they use energy in the home. Questions will include how often they heat the main living room in winter and at what times of day, and information about cooking, laundry and bathing.

HEEP2 will help us better understand the interaction between these different factors. However, it is not currently a suitable data source for an ongoing official measure of energy hardship, as frequency and future data collections are yet to be confirmed. HEEP2 is currently being rolled out, and data from the study will be available in the IDI from 2024.

7.1.3 Self-generated energy

As technologies like solar panels become more accessible and popular, data on the use and impact of self-generated energy will be increasingly important. Self-generated power will reduce a household's required electricity spend (although these systems have associated costs)[117]. We know that approximately 1.7 per cent of residential dwellings currently have installed capacity to generate electricity[118].

7.1.4 Transport energy

Transport energy is out of the proposed definition's scope. However, as ownership of electric vehicles increases, it will be more important to understand the amount of household electricity used for charging.

7.2 Data on housing quality and performance is needed

Better information about the quality of housing in Aotearoa is key for understanding and measuring energy hardship, as it is a fundamental factor determining the energy required to make and keep a home warm and dry. Information on housing condition is a necessary input into models of required energy.

Aotearoa does not currently have an official national measure regarding levels of housing quality and building performance, however the Ministry of Housing and Urban Development is working on a measurement framework for housing quality.

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[116] https://www.branz.co.nz/environment-zero-carbon-research/heep2/

[117] The amount of electricity spend that is offset depends on how much is self-generated and how this is used.

[118] ICP uptake rate as at 31/05/2021, Electricity Authority data https://www.emi.ea.govt.nz/Retail/Reports/GUEHMT?DateFrom=20130901&DateTo=20210531&MarketSegment=Res&FuelType=All_Total&_rsdr=ALL&Show=ICP_Rate&_si=v|3

For current official government data on housing performance, we have some proxies available. These include subjective responses in the HES and GSS as responses to "How would you describe the condition of your house or flat (repairs and maintenance)?" and "Does your accommodation have a problem with heating and/or keeping warm in winter?" A drawback of subjective measures of housing performance is that there is often a difference between self-reported housing condition and the results of a trained inspection. People often underestimate the extent of housing quality issues. In both the 2010 and 2015 BRANZ House Condition Surveys, occupants consistently rated the condition of their housing higher than that of trained assessors[119]. MBIE is aware of unpublished work comparing subjective measures of housing performance and physical inspections that found the two different sources of information did not align with each other well.

Some objective information is available but collected infrequently. HEEP2 will give more information about dwelling energy efficiency and maintenance. The Pilot Housing Survey[120]also has information on housing quality and performance which can be analysed further. Neither of these data sources are currently planned to be longitudinal datasets.

7.3 We need improved data about appliances and energy efficiency

7.3.1 Access to amenities available to meet needs

Some households in Aotearoa don't have access to the amenities they need. For example, recent analysis of 2018 Census data found that 5.2 per cent of private residential dwellings did not have access to at least one of: electricity supply, cooking facilities, tap water that is safe to drink, kitchen sink, bath or shower, or a toilet[121, 122]. To be counted in the Census, these amenities need to be in working order.

The Census is only done every five years, and more investigation is required to interpret this data properly. For example, we don't know whether people do not have these appliances at all, whether they were temporarily unavailable, or whether they have them but do not use them because of the cost. Buying or repairing appliances like fridges can be a large cost for households. The HEEP2 can provide more information on appliances in the home, but the sample size could limit conclusions we can make about the whole of Aotearoa.

7.3.2 Energy efficiency of household appliances

While the Census provides us with some information on the availability of key amenities and heating appliances, it doesn't include information about appliance energy efficiency. HEEP2 will provide information about heating type availability and attitudes to energy efficiency for the households it surveys.

The Energy Efficiency and Conservation Authority (EECA) holds a product database on the efficiency of new appliances. However, as we tend to keep larger appliances for a long time, it's likely that many

[119] White et al., 2017.

[120] Households from the 2018 GSS sample were asked to participate in the Pilot Housing Survey, which collected data on house condition and energy efficiency. 832 surveys were completed, providing national estimates on the quality of housing in Aotearoa (BRANZ, 2020).

[121] Viggers et al., 2021.

[122] The Census asks includes one further amenity; a refrigerator. See Viggers et al., 2021 for further information.

households in Aotearoa still own older and less efficient models. This means there is limited information on the existing stock of household appliances in Aotearoa, resulting in limited understanding of the full range of appliances used by households.

7.4 How people manage their energy use and bills could be better understood

7.4.1 Service literacy

We do not have extensive data on how well New Zealanders understand and communicate information about energy needs, use, and bills. Service literacy is important to be able to understand and communicate about bills with retailers, and to get the best deal for your circumstances. The EPR found that "some households struggle to understand the various plans and how to choose the one that's best for them" and that "Low-income consumers are more likely to face language, education and internet access barriers that can make it hard for them to understand the various plans and choices"[123].

The Programme for the International Assessment of Adult Competencies survey of adult skills provides the best information on skills of adults within Aotearoa and allows comparison with other OECD countries[124]. There is also some information in the GSS and Census on language spoken, which could be useful to understand situations where English as a second language might be a barrier.

7.4.2 How people use and manage energy

Smart meters, as well as prepayment meters provide different ways to manage and understand electricity consumption. However not everyone has access to a smart meter, and while prepayment meters make it easier to control spending on electricity, they are sometimes seen as a retail plan of 'last resort' for customers who are not eligible for post-pay retail plans. Research suggests that lower income households are more likely to use prepayment meters, and that consumers using these meters for electricity have a higher likelihood of being in energy hardship[125]. Furthermore, we have no way of knowing when someone with a prepayment meter 'self-disconnects' their electricity by not topping up their credit. Beyond this, how households manage their energy consumption is not well documented. There is some information on energy behaviours in the GSS, for example: "In the evening during the winter, how often do you heat your main living area/bedroom/child's bedroom?" Detailed energy behaviour and awareness information will be provided by the HEEP2, but this not currently planned as a long-term survey.

7.4.3 Financial resilience and debt

As well as being a financial burden, debt can affect the choices available to households for energy retail plans. Financial resilience is also a factor contributing to a household's risk of experiencing energy hardship.

[123] Electricity Price Review, 2018, p. 28.
[124] OECD, 2016.
[125] O'Sullivan et al., 2015.

This information is currently best covered by the core HES question "If you [or your partner] had an unexpected and unavoidable expense of $500 in the next week, could you pay it within a month without borrowing?" We have more detailed information around household debt and assets as part of the HES net worth questionnaire. This is collected every three years, however it is not asked in the same year as HES Expenditure, so we cannot compare debt and assets to spending on energy.

7.5 There are limitations to demographic measurement

With the data available for our proposed measures, we can understand the experience of energy hardship measures by different population groups. However, there are limitations; it's difficult to reach all different types of households and small samples mean it's harder to draw conclusions.

7.5.1 It's difficult to look at different groups and locations in detail

We are interested in looking at the ways energy hardship affects different groups, for example people of different ethnicities, disabled people, age, tenure, or location. This analysis will help better understand if and why some groups might be at greater risk of energy hardship.

However, the data source for two of our proposed primary measures is the HES Expenditure survey. The sample size for this survey means that we cannot break down the measures adequately to compare different groups or locations before sample errors become too large.

There is likely to be a range of levels and factors driving energy hardship in different locations, which will not be shown by a national average[126]. We are interested in investigating levels and drivers of energy hardship in different locations. Currently, regional data is limited except for indicators based on Census data[127]. Adding electricity use data collected through ICPs to the IDI would help with comparing electricity consumption over different groups and regions in greater detail.

7.5.2 Some places where people live are not captured in the current data

Household surveys

The survey population of the HES and GSS excludes:

- New Zealand usual residents temporarily overseas or staying elsewhere in New Zealand who don't return within the survey period
- New Zealand usual residents who live in remote areas that are costly or difficult to access
- people residing in non-permanent dwellings
- people residing at a wharf or landing place[128]

[126] Sareen et al., 2020.
[127] We note that the larger sample size from the core HES will give enable greater regional breakdown for subjective measures
[128] Stats NZ, 2019c.

The information collected in household surveys doesn't include some vulnerable groups who may be affected by energy hardship, such as people living in non-private dwellings (e.g. boarding houses), which may have habitability problems.

Census information

The 2018 Census collected information relevant to energy hardship, including questions about housing habitability (dampness, mould, access to basic amenities), and heating types. However, we only have this information for around 92 per cent of private dwellings. Missing information is higher for Māori and Pacific populations. For example, we have information on indoor mould for 95.5 per cent of people with European ethnicity, 89.6 per cent of Asian, 88.6 per cent of Māori and MELAA[129], and 88.6 per cent of Pacific peoples.

What types of dwellings are excluded?

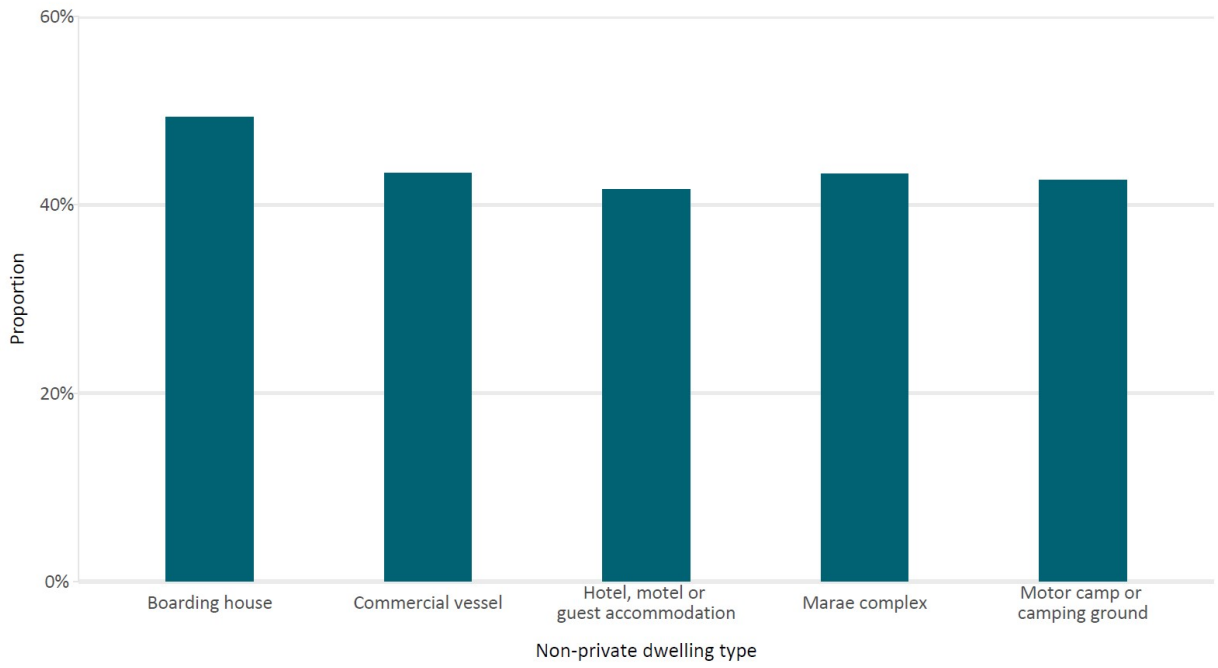
People living in certain types of non-private dwellings could be affected by energy hardship. However, we do not have the relevant information for these people as they do not fill in a dwelling form in the Census and they are not part of the household surveys.

These people are counted as part of the population experiencing severe housing deprivation. At the time of the 2018 Census, 5,827 people living in camping grounds, motor camps, boarding houses, hotels, motels and vessels were considered to be experiencing severe housing deprivation[130].

In non-private dwellings, power may be included in board payments, but this may be not be enough to support energy wellbeing. People living in these dwelling types were commonly experiencing low incomes as Figure 5 shows.

[129] Of Middle Eastern, Latin American or African ethnicity.
[130] Amore et al., 2021.

Figure 5 Percentage of people living in selected NPD types who have a personal income of $20,000 or less – 2018 Census



7.5.3 Marae

Marae are included as a dwelling type in our proposed definition of energy hardship. However, there are restrictions on how well we can measure the energy wellbeing of people who live on marae. There is limited information in official collections that concerns marae as a dwelling type, and many different activities happen on marae. Marae can be places of education, social service provision, assembly and more, alongside housing people, which involves different or increased energy requirements.

The Status of Marae in 2009 – Te Ora o te Marae i 2009[131] reported that 94 per cent of marae were connected to mains electricity supply, and 15 per cent used one or more alternative energy sources (diesel or petrol-fuelled generators, solar panels etc.). The report also showed that 65 per cent of marae could house 50 people or more overnight. These findings show the importance of energy services to marae, especially when they serve as places where people are living or staying.

We are seeking feedback with suggestions on how to understand energy wellbeing and hardship for people living or staying on marae. Including these groups will help measurements of energy hardship experiences be more accurate, supporting the design of initiatives.

[131] Te Puni Kōkiri, 2012.

7.6 Frequency of data collection limitations

We obtain expenditure data from the HES every three years and the GSS is every two years, while the core HES[132] is annual. With these surveys we cannot measure any experience of intermittent hardship, where people move in and out of hardship relatively frequently.

Survey data will capture households at a point in time so that we get an idea of the overall levels of hardship, but it won't capture whether households move in and out of hardship in between time each survey happens. Additionally, the HES and the GSS do not follow the same households over time, so we cannot track how the same household's situation changes. Instead, Stats NZ uses a robust statistical method where every household in the country has a known chance of being selected to be surveyed.

We would ideally like to understand the length of time spent in hardship, or whether households are frequently in hardship. The Living in Aotearoa survey (which goes into the field in April 2022) is a longitudinal survey designed to measure poverty persistence, so we may be able to also track the persistence of energy hardship using this new survey data.

7.7 Additional data sources

There are measures of energy hardship for which we only have ad hoc data, or measures we think are useful but only have proxies. Measures that are not chosen can still be useful for evaluating projects, or for those looking to determine eligibility for an intervention.

[132] 'Core' HES includes questions about wellbeing, but not expenditure.

8 We are proposing further research to better understand energy hardship in Aotearoa

8.1.1 Further analysis of data currently available

We have included in this consultation document some initial analysis of currently available data for potential measures of energy hardship (*Appendix D: Technical Appendix – Results for selected measures of energy hardship*). We plan to carry out further analysis and sensitivity testing of some of these potential measures, including individual-level analysis to understand the number of people who may be experiencing one or more measures. We are also interested in better understanding potential energy rationing, as well as exploring the overlap between energy hardship and levels of material deprivation.

Other potential areas to explore are measures or combinations of data sources that could identify areas of energy vulnerability within Aotearoa at a more detailed level.

8.1.2 Modelling the energy consumption required to support wellbeing

The proposed definition focuses on adequate energy services to support wellbeing. With a combination of various types of data (some of which are yet to be developed) we could model and monitor the amount of energy required for households to support wellbeing. This would give better information on energy rationing and management and add depth to our proposed existing objective measures of energy hardship. MBIE is working with research partners to explore possible methods for addressing this data.

8.1.3 Measures of energy hardship and health outcomes – energy hardship related indicators

Existing research, both national and international, has shown the negative health outcomes associated with cold, damp homes (as noted in Section 2.4). The research relating to overheating and energy hardship is not as comprehensive, but overheating is likely to become more of an issue as the climate warms. We are interested in further research in this space for Aotearoa, in particular any work around housing habitability and disease outcomes.

9 What comes next

We are seeking submissions on this document. Visit the consultation website for more information on how you can submit your feedback, and learn more about the proposals: https://www.mbie.govt.nz/have-your-say/defining-energy-hardship

Consultation will be open for six weeks. With consent from those giving feedback, submissions will be published on our website. Once submissions and other feedback from the consultation process have been reviewed, we will publish a summary of submissions.

Time will also be spent analysing measures and data sources that are recommended, as well as undertaking the further analysis described in Section 8.

This feedback and analysis will be incorporated into MBIE's final recommendations on defining and measuring energy hardship.

9.1 How you can stay informed

9.1.1 Via the MBIE website

There are a number of initiatives underway across government that are helping address energy hardship. The MBIE website includes some initiatives MBIE is progressing based on recommendations in the 2019 Electricity Price Review. For more information visit https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-hardship/

9.1.2 Via the Energy Hardship Update

MBIE's Energy hardship update is our new regular e-news about efforts to reduce energy hardship in New Zealand. You can sign up to receive this, and view previous issues at https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-hardship/energy-hardship-update/

10 Glossary

Term	Definition
After Housing Costs Income (AHC Income)	Household income left after housing costs have been spent. Housing costs include rent, mortgage, rates, and dwelling insurance (not contents insurance). *Stats NZ, 2017*
Before Housing Costs Income (BHC Income)	Household income before housing costs have been spent. *Stats NZ, 2017*
Dwelling, house, building	Dwelling means any building or structure, or part thereof, that is used (or intended to be used) for the purpose of human habitation. It can be of a permanent or temporary nature and includes structures such as houses, motels, hotels, prisons, motor homes, huts, and tents. *Framework for housing quality, Stats NZ 2019*
Energy services	Energy use that services and supports people's lives such as heating, cooking, washing, lighting
Kāinga	Home, address, residence, village, settlement, habitation, habitat, dwelling. *Framework for housing quality, Stats NZ 2019*
Objective measure	Objective measures use information about a household's circumstances and living conditions based on objective data. For example, measures that look at a household's expenditure on energy, or temperature reading inside a house.
Subjective measure	Subjective measures use self-reported information from members of the household on their experiences or situation. For example, questions like "Have you been unable to keep your home adequately warm in the past year through lack of money?" provide subjective data.
Whānau	An extended family, family group; a familiar term of address to a number of people – the primary economic unit of traditional Māori society. In the modern context, the term is sometimes used to include friends who may not have any kinship ties to other members. *Framework for housing quality, Stats NZ 2019*

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Appendix A: Other frameworks considered while developing this document

The Living Standards Framework

The Domains and Capitals within The Treasury's Living Standards Framework[133] feed into our framework and definition. It is possible to understand energy hardship in some way through all 12 of the Domains of Current Wellbeing[134]. Some are obvious such as Housing, and Income and consumption, while some are less direct. Social connections, for example, can be less accessible if a household is in energy hardship, as it can bring about feelings of shame, or an inability to welcome people to your home. If an individual or whānau needs to spend a lot of time sourcing energy or maintaining sources (for example collecting firewood), their availability to participate in other parts of society is limited. Acknowledging the indirect nature of how energy hardship can play into living standards and wellbeing helps to strengthen the holistic definition and framework.

He Ara Waiora framework

The He Ara Waiora framework[135] shows mana as essential to wellbeing. Mana whanake and mana āheinga particularly are aspects that may be diminished when a whānau or individual is in energy hardship. Mana tauutuutu is enhanced when whānau or individuals can participate in manaakitanga and be connected to their community without shame. In the context of energy hardship, if guests cannot be invited over to a household because adequate energy services cannot be obtained, this diminishes the mana of the household and impacts cultural, social and emotional wellbeing.

The Whānau Rangatiratanga frameworks

The Whānau Rangatiratanga frameworks provide a platform and a guide – from within a Māori world view – for collecting, analysing and using data about whānau wellbeing[136]. This provides context for understanding the 'wellbeing' section of the energy wellbeing definition for whānau specifically, as well as units like household and individual. Here, the capabilities that inform wellbeing are collective, rather than individual. While collective measures may not be suitable for all New Zealanders, they enhance the mana of whānau as a unit of measurement. The model also supports the notion that Māori wellbeing should be seen as a state in which Māori people are able to live whatever life they choose to live.

Te Whare Tapa Whā

Te Whare Tapa Whā is a model used to understand Māori health and wellbeing. It uses the symbol of a wharenui to represent hauora, and the interlinked factors of taha wairua, hinengaro, whānau and tinana (spiritual, mental, family and physical health). If one tapa, or wall, is not cared for, the wharenui becomes unstable. The framework's grounding in te ao Māori and holistic view of wellbeing contributes to our proposed energy hardship framework. It presents a way of understanding the whānau or household at the centre. Energy wellbeing is equally comprised of one's spiritual, family, physical and mental wellbeing, all of which are interdependent.

[133] The Treasury is planning to refresh the LSF in 2021, developing the framework to better reflect Māori and Pasifika world views; what matters for child wellbeing; and the different ways in which culture contributes to wellbeing

[134] The Treasury, 2019.

[135] McMeeking, Kururangi & Kahi, 2019.

[136] Superu, 2016.

The te ao Māori-centred frameworks present a holistic worldview which emphasises relationality. The energy hardship definition and framework acknowledges that factors interact, and healthy spirit, environment and people can all be improved through mana enhancing processes (e.g. reducing energy hardship).

Framework for Housing Quality

The conceptual framework for Housing Quality[137] designed by Stats NZ provides context for measuring the quality of housing stock. The framework sections are interconnected, and show us what a high quality house might look like conceptually. Housing quality is a factor in energy hardship, so being able to measure it contributes to our overall view of the Dwelling Characteristics component of the energy wellbeing framework. It also helps us to understand houses and dwellings more generally which is helpful as they are the site where energy hardship is mainly experienced. The simplicity of this framework makes it accessible..

[137] Stats NZ, 2019a.

Appendix B: Examples of measures of energy hardship

Energy hardship and how best to measure it has been researched and discussed in literature for decades. Table 7 below shows some examples of measures of energy hardship. Some are official measures, others have been used in research. Those measures where the source is marked with a * are, or were, official national measures.

Table 7: Examples of energy hardship measures

Source	Year	Measure
Boardman (UK)	1991	Households in fuel poverty are "unable to obtain an adequate level of energy services, particularly warmth, for 10 per cent of its income"[138].
Wales*	2004	The Welsh Government defines a household as being in fuel poverty if they would have to spend more than 10 per cent of their income on maintaining a satisfactory heating regime[139].
Lloyd (NZ)	2006	Measured fuel poor households as those who would need to spend more than 10 per cent of total income on energy to have a satisfactory indoor environment (at least 21 Celsius in the living areas and 18 Celsius in other parts)[140] Research modelled the expenditure required to adequately heat and use other energy in a 90m^2 house in Aotearoa.
Northern Ireland*	2006	A household is fuel poor if, in order to maintain a satisfactory level of heating (21 degrees Celsius in the main living room and 18 degrees Celsius in other occupied rooms), it is required to spend in excess of 10% of its household income on all fuel use[141].
England*	2015	Low income, high costs (LIHC) A household is fuel poor if: - They have required fuel costs that are above average (the national median level). - were they to spend that amount, they would be left with a residual income below the official poverty line[142]
O'Sullivan et al. (NZ)	2015	Research investigated how accurately prepayment meter usage can be taken as a proxy for fuel poverty. Different measures of fuel poverty used: - electricity expenditure as a proportion of household income, a range of thresholds considered - estimated required energy spend as a proportion of household income, 10 per cent threshold used

[138] Boardman,1991, as cited in Scottish Fuel Poverty Definition Review Panel, 2017, p. 27.
[139] Hinson & Bolton, 2021, p. 16
[140] Lloyd, 2006.
[141] Hinson & Bolton, 2021, p. 18
[142] Hills, 2012, p. 9.

Source	Year	Measure
		composite measures (a combination of objective and subjective measures relating to financial constraint, adequacy and affordability of heating, and housing quality).[143]
EPOV (EU)	2016 - 2020	The EU Energy Poverty Observatory (EPOV) used four primary indicators of energy poverty and a range of 19 secondary indicators[144]. The four primary measures are: - 2M: The proportion of households whose share of energy expenditure in income is more than twice the national median share - M/2: The share of households whose absolute energy expenditure[145] is below half the national median - Inability to keep home adequately warm: Responses to the question “Can your household afford to keep its home adequately warm?” Arrears on utility bills: Responses to the question "In the last twelve months, has the household been in arrears, i.e. has been unable to pay on time due to financial difficulties for utility bills (heating, electricity, gas, water, etc.) for the main dwelling?"
PwC New Zealand	2018	Households in a Census Area Unit are considered energy vulnerable if: - 10 per cent or more of AHC income is spent on energy Households in a Census Area Unit are considered high priority energy vulnerable if four out of five additional risk factors are met: - households spend more than twice the median proportion of AHC income on energy - households spend more than 15 per cent of AHC income on energy - a greater proportion of older houses - more younger children (9 years and under) more older residents (65 years and over).[146]
Scotland*	2019	A household is fuel poor if: - after housing costs have been deducted, more than 10% (20% for extreme fuel poverty) of their net income is required to pay for their reasonable fuel needs; and after further adjustments are made to deduct childcare costs and any benefits received for a disability or care need, their remaining income is insufficient to maintain an acceptable standard of living,

[143] O’Sullivan et al., 2015.
[144] https://www.energypoverty.eu/indicators-data
[145] In the 2M and M/2 measures, both income and energy expenditure are equivalised using the OECD modified equivalence scale.
[146] PwC, 2018.

Source	Year	Measure
		defined as being at least 90% of the UK Minimum Income Standard (MIS). [147, 148]
Sokołowski et al (Poland)	2019	Recommended a general definition and a specific definition of energy poverty for Poland. The general definition is measured using LIHC (see England) and 2M (see EPOV). The specific definition uses; - Inability to pay utility bills on time; - Living in a dwelling with a leaking roof; damp walls, floors, or foundations; or rot in the window frames or floors; and Inadequate thermal comfort in winter[149].
England*	2021	Low income, low energy efficiency (LILEE) A household as fuel poor if: - They are living in a property with low energy efficiency, and - When they spend the required amount to heat their home, they are left with a residual income below the official poverty line[150]

[147] To take account of the generally higher costs of living in Scotland's remote, rural and island communities, the legislation provides for uplifts to be applied to the MIS for households in these areas.

[148] https://www.gov.scot/policies/home-energy-and-fuel-poverty/fuel-poverty/

[149] Sokołowski et al., 2019.

[150] Department for Business, Energy and Industrial Strategy, 2021.

Appendix C: Advantages and disadvantages of proposed measures

Some of the proposed measures are based on responses to questions which are asked in multiple surveys. Where this is the case we have distinguished the two with a letter suffix on the Measure ID and noted the advantages and disadvantages of using each data source separately.

Primary measures

Table 8: Advantages and disadvantages of proposed primary measures

Measure ID	Measure description	Advantages	Disadvantages
P1 (Interim) (HES Expenditure)	Proportion of AHC household income spent on domestic energy costs twice the median or more (moving line)	• Similar to international measures • Measures high spend on energy which may compromise other areas of wellbeing (what is often called the 'heat or eat' situation). • Allows some comparison between population groups and different income levels. • Identifies households that are likely to be under financial pressure because of energy spend.	• Measures actual spend rather than spend required for wellbeing. • HES Expenditure sample of 3,000-4,000 limits ability to break down by area and different populations. • Could potentially pick up people who are rich in capital but have lower incomes.
P2 (Interim) (HES Expenditure)	Proportion of AHC household income spent on domestic energy costs twice the median or more (fixed line)	• Measures high spend on energy which may compromise other areas of wellbeing (a heat or eat situation). • Allows some comparison over time, population groups and different income levels. • Identifies households that are likely to be under financial pressure because of energy spend.	• Measures actual spend rather than spend required for wellbeing. • HES Expenditure sample of 3,000-4,000 limits ability to break down by area and different populations. • Requires agreement over which year is the baseline. • Could potentially pick up people who are rich in capital but have lower incomes.
P3.A (HES Core)	Put up with feeling cold to keep costs down	• A direct measure • Subjective measure which can link to subjective wellbeing • Large sample size • Annual collection	• Although a larger sample than HES Expenditure, HES Income is still limited in ability to be broken down below regional council level. • Subjective measure – people may have differing expectations of what is cold

Measure ID	Measure description	Advantages	Disadvantages
P3.B (GSS)[151]	Put up with feeling cold to keep costs down	• A direct measure • Subjective measure which can link to subjective wellbeing	• Limited in how it can be broken down due to sample errors • Subjective; people may have differing expectation of what is cold
P4 (HES Core)	Dampness and/or mould problems - major	• A measure of dwelling habitability. • Subjective measure which can link to subjective wellbeing. • Large sample size • Dampness and mould linked to poorer health outcomes.	• Although a larger sample than HES Expenditure, HES Income is still limited in ability to be broken down below regional council level.

Secondary measures

Table 9: Advantages and disadvantages of proposed secondary measures

Measure ID	Measure description	Advantages	Disadvantages
P5 (Census)	No access to electricity supply	• Measures whether an individual/household has electricity • Census data is available for small areas and small populations, enabling targeting of resources.	• We don't know why the household is unable to access electricity in the dwelling – whether it is choice or enforced because of inability to pay or location. • Problems with 2018 Census means it is likely to be an undercount.
P6 (HES Core)	No home access to computer or internet	• Shows ability of household to easily access information about the best energy provider and manage their situation. • Available from larger HES sample of around 20,000 households • Annual measurement	• Not direct measure of energy hardship but rather an enabling indicator. • Although a larger sample than HES Expenditure, HES Income is still limited in ability to be broken down below regional council level.

[151] We are not proposing the GSS be the data source for this primary measure of energy hardship. It is included here to note that the same question is asked in this survey.

Measure ID	Measure description	Advantages	Disadvantages
P7 (HES Expenditure)	No access to financial institution account	• People lacking access to a bank account will be severely limited in their ability to access energy – in particular electricity	• Not direct measure of energy hardship but rather an enabling indicator. • Small sample • Only available 3 yearly
P8.A (HES Core)	Could not pay electricity, gas, rates, or water bills on time	• Indicates energy insecurity. Households that have been unable to pay utility bills on time are more likely to find it difficult to get an electricity connection, and may be at risk of disconnection. • Large sample size • Collected annually	• Not solely about energy • Although a larger sample than HES Expenditure, HES Income is still limited in ability to be broken down below regional council level.
P8.B (GSS)	Could not pay electricity, gas, rates, or water bills on time	• Indicates energy insecurity. Households that have been unable to pay utility bills on time are more likely to find it difficult to get an electricity connection, and may be at risk of disconnection.	• Not solely about energy • Smaller sample than HES
P9 (HES Core)	Unable to afford unexpected expense without borrowing	• Indicates that a household would struggle to manage high energy bills • Indicates financial insecurity • Available from around 20,000 households • Collected annually	• Not solely about energy • Although a larger sample than HES Expenditure, HES Income is still limited in ability to be broken down below regional council level.
P10 (HES Expenditure)	Proportion of BHC household income spent on domestic energy costs twice the median or more (moving line)	• Similar to international measures • Measures high spend on energy which may compromise other areas of wellbeing (what is often called the 'heat or eat' situation). • Allows some comparison between population groups and different income levels. • Identifies households that are likely to be under financial pressure because of energy spend.	• Measures actual spend rather than spend required for wellbeing. • HES Expenditure sample of 3,000-4,000 limits ability to break down by area and different populations. • Could potentially pick up people who are rich in capital but have lower incomes.
P11 (HES Expenditure)	Proportion of BHC household income spent on domestic	• Measures high spend on energy which may compromise other areas of wellbeing (what	• Measures actual spend rather than spend required for wellbeing.

Measure ID	Measure description	Advantages	Disadvantages
	energy costs twice the median or more (fixed line)	is often called the 'heat or eat' situation). • Allows some comparison over time, population groups and different income levels. • Identifies households that are likely to be under financial pressure because of energy spend.	• HES Expenditure sample of 3,000-4,000 limits ability to break down by area and different populations. • Requires agreement over which year is the baseline. • Could potentially pick up people who are rich in capital but have lower incomes.
P12 (HES Expenditure)	Absolute domestic energy expenditure half the national median or less (moving line)	• Measures low spend on energy which may indicate energy rationing • Allows some comparison over time, population groups and different income levels.	• Measures actual spend rather than spend required for wellbeing. • Won't distinguish between highly energy efficient households, so should be limited to lower income households • Small sample, which limits ability to break down by area and different populations.
P13 (HES Core)	Cannot afford to keep dwelling adequately warm	• A direct measure • Large sample size and annual collection	• This is a new question in the HES from 2018/19, so no time series is available
P14 (Electricity Authority)	Using prepayment metering	• Relevant as households on prepayment metering may have struggled to pay their electricity bills in the past or are been unable to access a standard electricity account	• Prepayment metering is a proxy measure • Data not currently available for research in the IDI
P15 (Census)	No heating type used	• About use rather than access • Indicator of energy hardship – due to NZ's temperate climate and thermal inefficiency, most NZ housing requires heating. • Long time-series available – with some caveats around change in question. • Census data is available for small areas and small populations, enabling targeting of resources.	• Only collected every 5 years • Census does not ask whether dwelling feels cold and we do not know the thermal capacity of the dwelling
P16 (GSS supplement)	Not heating own bedroom in winter because it costs too	• Indicates energy rationing behaviours.	• It has only been collected once, so not yet possible to compare results over time.

Measure ID	Measure description	Advantages	Disadvantages
	much, or heating is broken/unavailable	• GSS data can be linked to a wide range of wellbeing measures.	• Only collected every six years • Sample size of 8,500 people limits potential disaggregation.
P17 (GSS supplement)	Not heating children's bedroom in winter because it costs too much, or heating is broken/unavailable	• Indicates energy rationing behaviours. • GSS data can be linked to a wide range of wellbeing measures.	• It has only been collected once, so not yet possible to compare results over time. • Only collected every six years • Sample size of 8,500 people limits potential disaggregation.
P18 (GSS supplement)	Not heating main living room in winter because it costs too much, or heating is broken/unavailable	• Indicates energy rationing behaviours. • GSS data can be linked to a wide range of wellbeing measures.	• It has only been collected once, so not yet possible to compare results over time. • Only collected every six years • Sample size of 8,500 people limits potential disaggregation.
P19.A (HES Core)	Trouble heating accommodation and/or keeping it warm in winter	• Aims to provide a measure of thermal adequacy. • Relatively direct measure • Subjective measure which can link to subjective wellbeing. • Available from larger HES sample of around 20,000 households	• It doesn't cover summer, however if a dwelling is hard to heat in winter it is likely to be hot in summer as indicative of thermal efficiency of dwelling • Subjective measure – people may have differing expectation of 'a major problem' or what 'keeping warm' means • Although a larger sample than HES Expenditure, HES Income is still limited in ability to be broken down below regional council level.
P19.B (GSS)	Trouble heating accommodation and/or keeping it warm in winter	• Aims to provide a measure of thermal adequacy. • Relatively direct measure • Subjective measure which can link to subjective wellbeing.	• It doesn't cover summer, however if a dwelling is hard to heat in winter it is likely to hot in summer as indicative of thermal efficiency of dwelling • Subjective measure – people may have differing

Measure ID	Measure description	Advantages	Disadvantages
			expectation of 'a major problem' or what 'keeping warm' means
P20 (Census)	Use of unsafe substitute heating methods (portable gas heater).	• Relevant as portable gas heaters increase moisture and potentially harmful gases in a dwelling. They have been noted as an expensive means of heating often used by low income households.	• We don't know the reason why people are using them • Only collected every five years
P21 (Census)	Lacking one or more basic amenity	• A measure of whether household has appliances required to support their energy wellbeing (e.g. cooking facilities, fridge)	• Only collected every five years • Some amenities (e.g. toilet) not specifically relevant to energy however are considered necessary amenities for wellbeing generally
P22 (GSS)	Housing repairs needed – major	• Indicator of housing habitability. Housing that requires major repairs is unlikely to have an adequate thermal envelope. • GSS data can be linked to a wide range of wellbeing measures.	• Doesn't tell you about thermal efficiency directly, we don't know what kind of repairs are needed. • A subjective measure in terms of what moderate/major may mean to people. • Sample size of 8,500 people limits potential disaggregation.
P23.A (Census)	Mould larger than an A4 – Always	• Visual spread of mould is considered one of the most reliable self-reported measures. • Presence of mould is a good indicator of housing habitability and is associated with asthma and other respiratory conditions.	• Comparison with objective measurement (building inspections) show that levels of mould are still underreported. • Smaller sample size
P23.B (GSS)	Mould larger than an A4 - Always	• Visual spread of mould is considered one of the most reliable self-reported measures. • Presence of mould is a good indicator of housing habitability and is associated with asthma	• Comparison with objective measurement (building inspections) show that levels of mould are still underreported. • Smaller sample size

Measure ID	Measure description	Advantages	Disadvantages
		and other respiratory conditions.	
P24 (Census)	Damp always	• A measure of dwelling habitability. • Census data is available for small areas and small populations, enabling targeting of resources. • Subjective measure which can link to subjective wellbeing. • Dampness and mould linked to poorer health outcomes.	• Subjective measure – people may have differing understanding of dampness • Only collected every five years • Census is held in early autumn, people may respond differently than they would in winter
P25 (GSS)	Can see breath indoors in winter	• Good measure of dwelling temperature and indicator of adequacy of thermal envelope. • GSS data can be linked to a wide range of wellbeing measures.	• Sample size of 8,500 people limits potential disaggregation.
P26 (GSS)	Indoors always colder than would like in winter	• Good measure of temperature of dwelling and indicator of adequacy of thermal envelope. • GSS data can be linked to a wide range of wellbeing measures.	• Sample size of 8,500 people limits potential disaggregation.

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

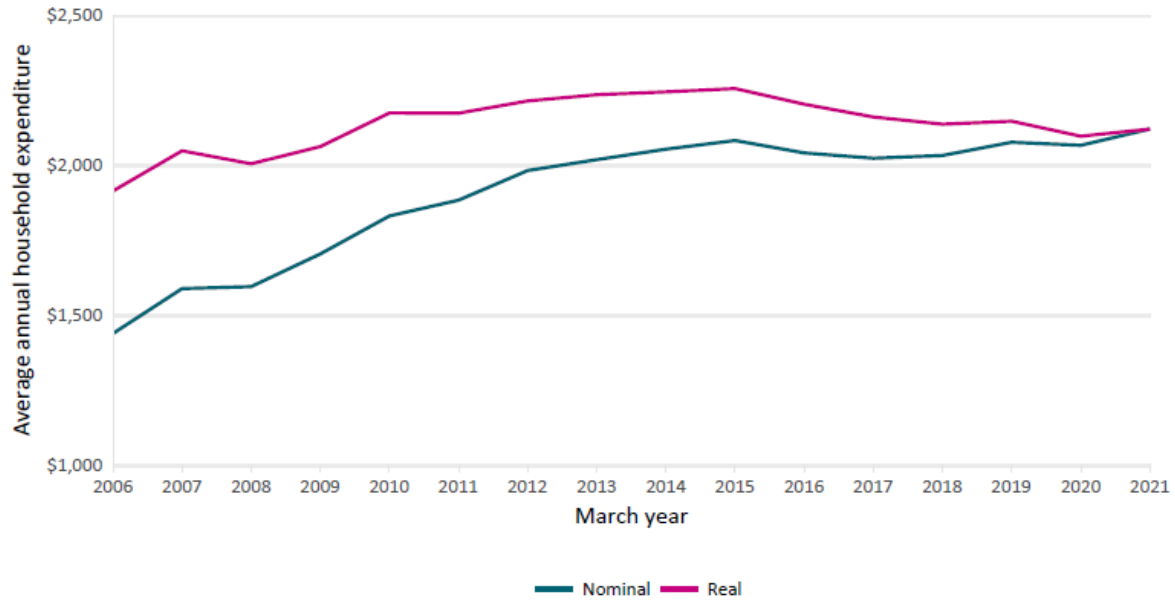
What are we measuring?	How do we measure it?	What might it tell us?
Poor quality housing and energy rationing	Households that put up with feeling cold a lot to keep costs down in the last 12 months	Difficulty affording bills, poor quality housing, rationing energy use to pay for other essentials
Poor 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



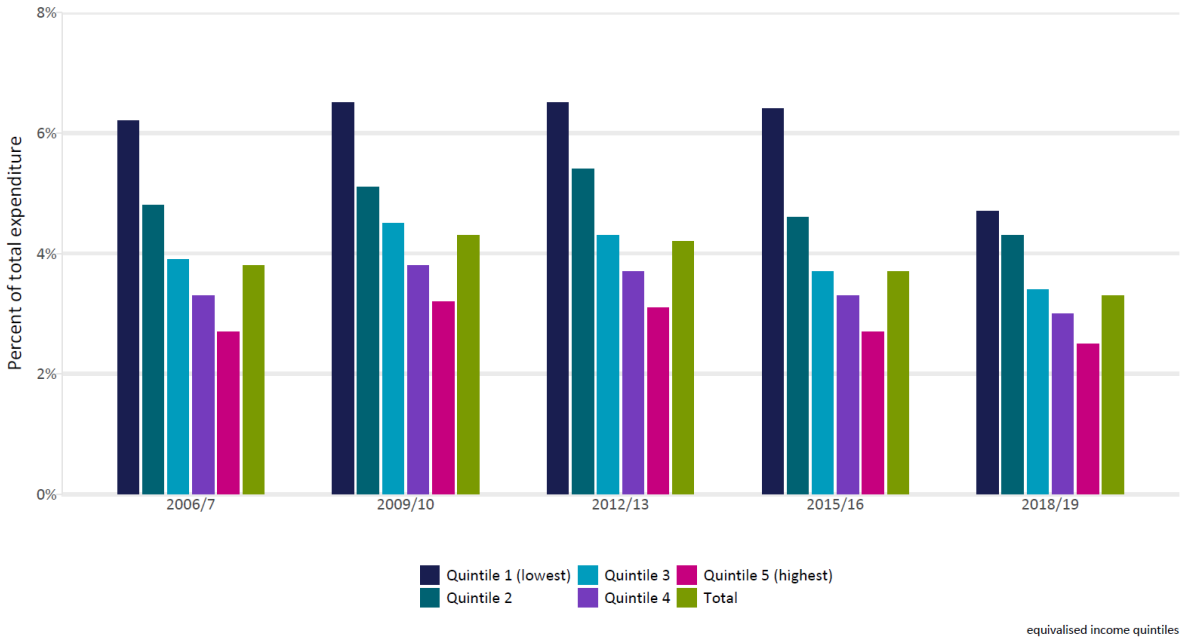
While most of the information in this Appendix comes from the Household Economic Survey, MBIE also collects some information on domestic energy expenditure on electricity through sales-based electricity cost data. This does not include other forms of energy such as gas or firewood, but it provides a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

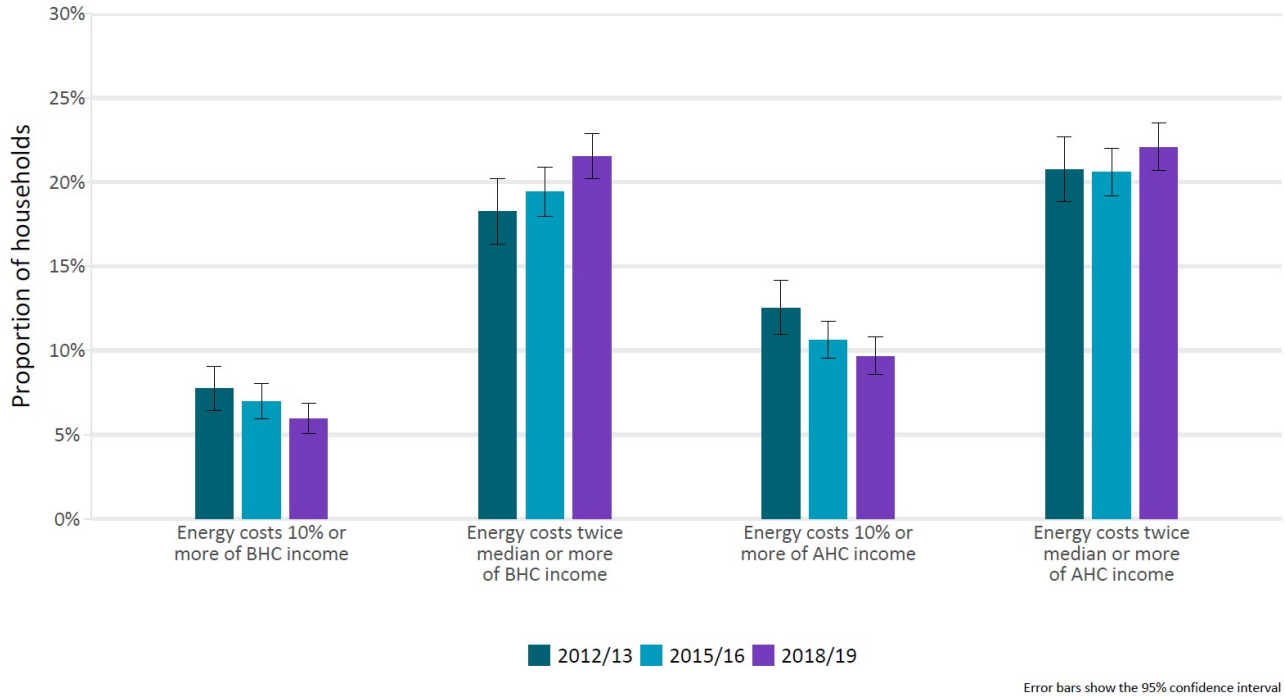


Figure 3 shows the proportion of households meeting the different objective measures of energy hardship over the three HES expenditure surveys analysed. There is considerable variation in levels depending on which measure is used.

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

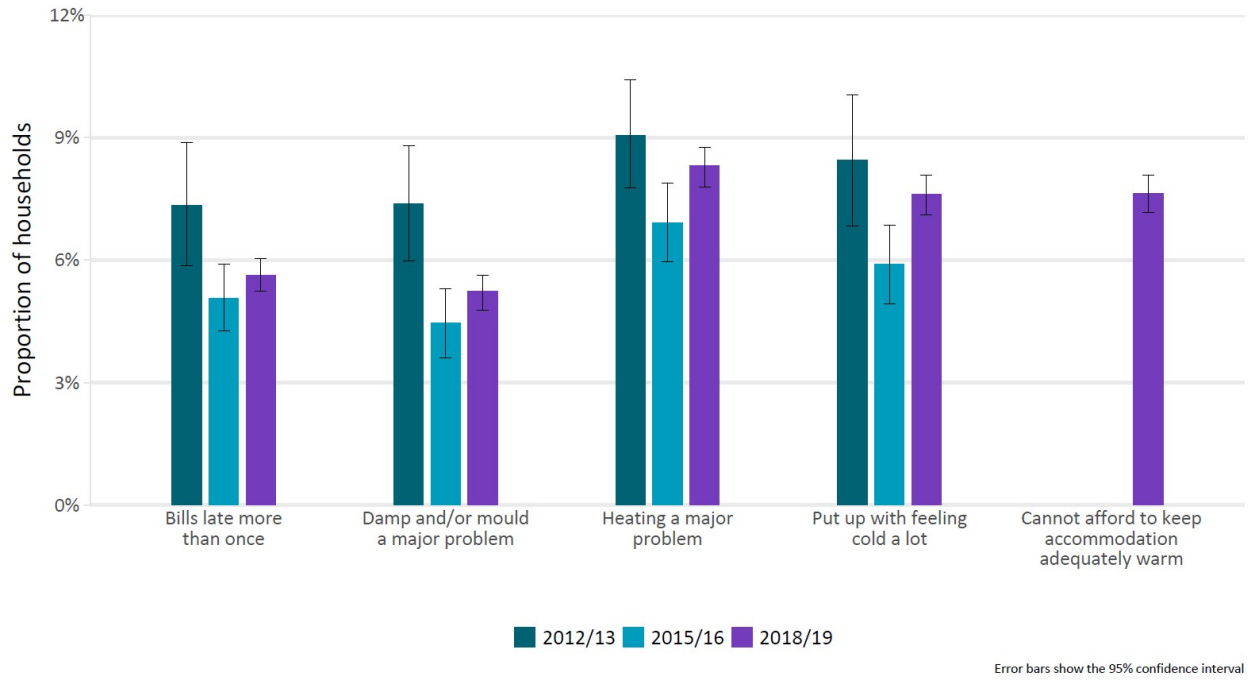


Figure 4 shows the proportion of households who experienced each of these subjective measures between 2012/13 and 2018/19. There is a significant difference for rates of damp and mould being a major problem between these two periods.

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

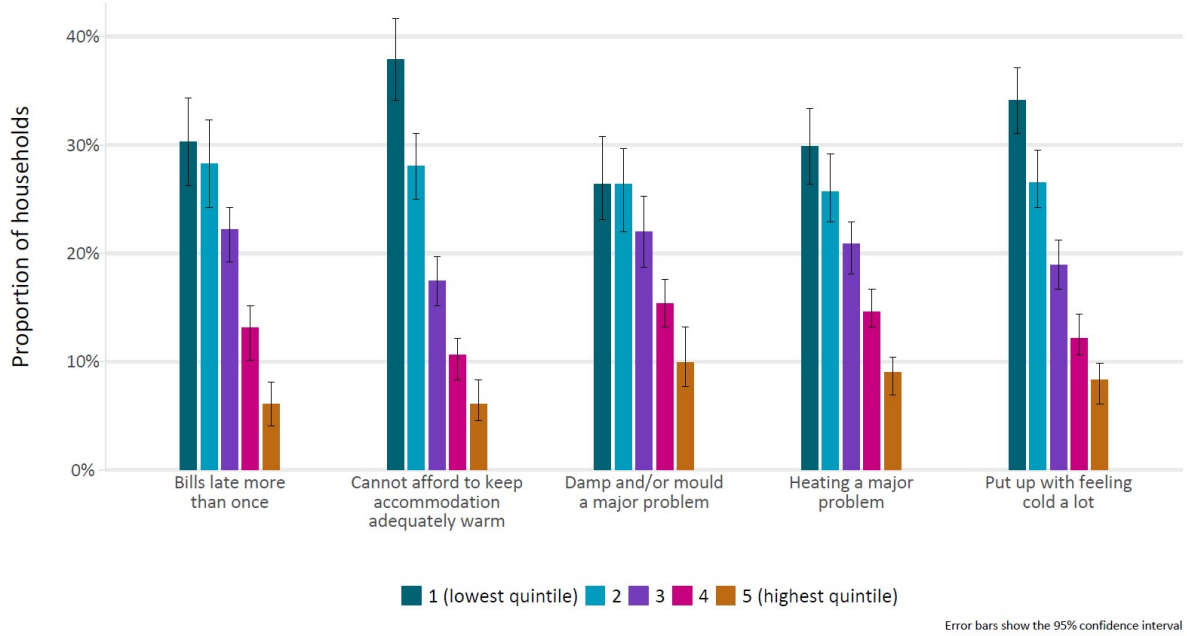


Figure 5 shows the rate of households experiencing different subjective measures of energy hardship across income quintiles. Households in the lowest income quintile are more likely to experience these measures for all but one of these subjective measures, highlighting the intersection between energy 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

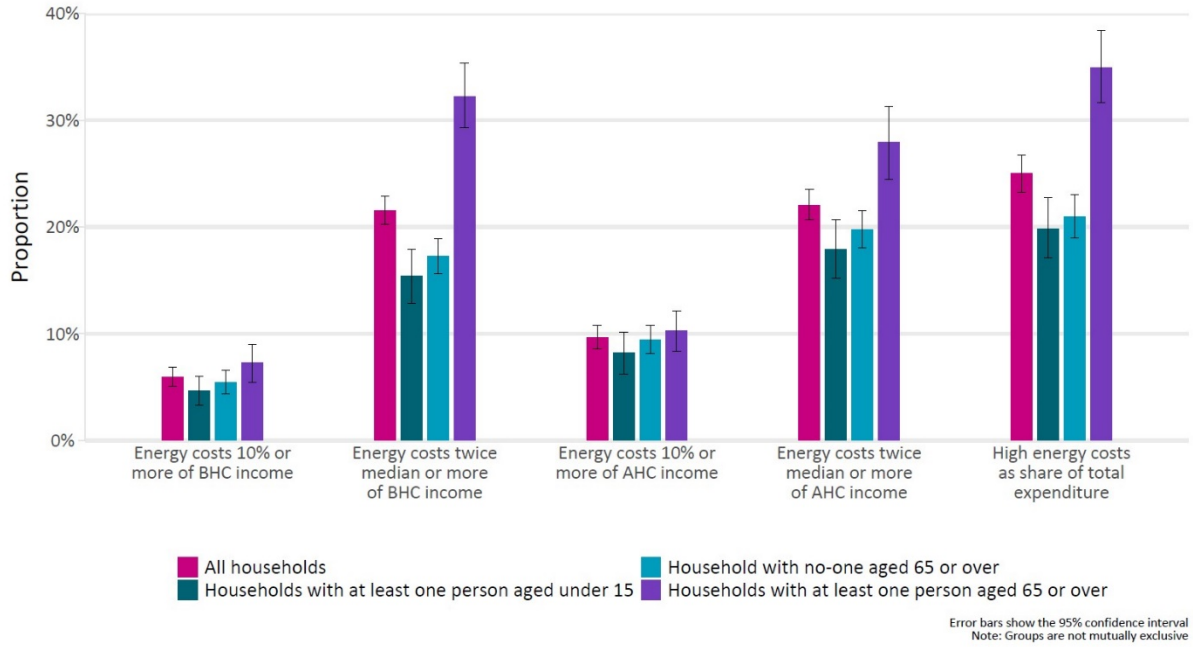
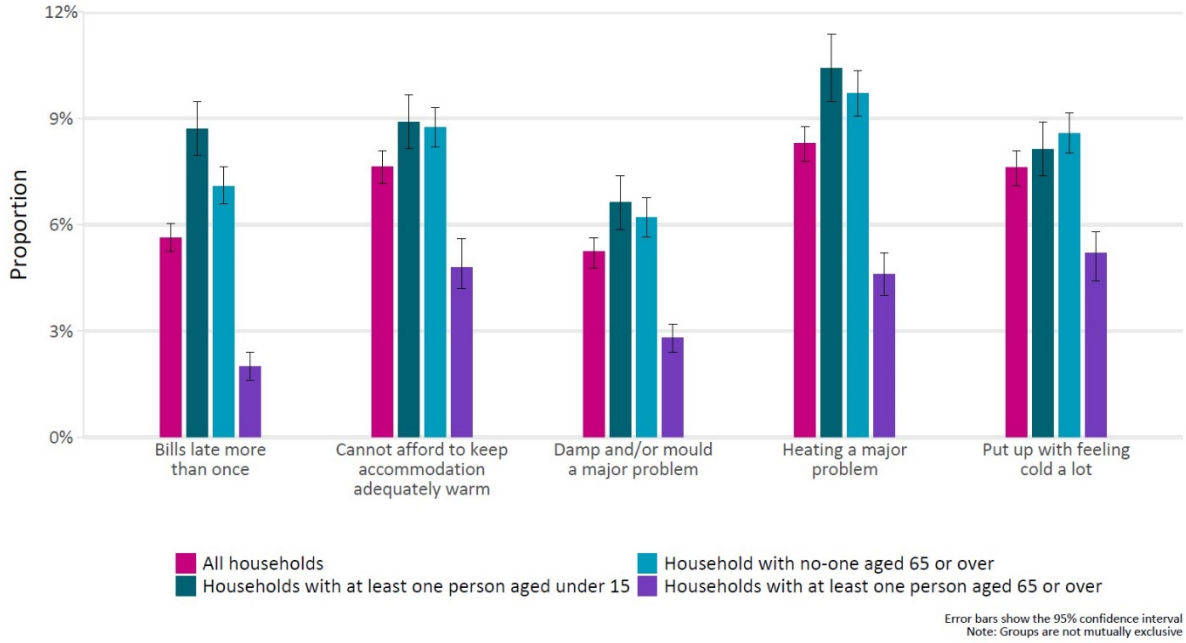


Figure 6 shows the results for objective measures of energy hardship across the different household age profiles. There are no significant differences between the groups for the stricter 10 per cent or more of income measures (for both BHC and AHC income). However for the twice median measures, and high 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)

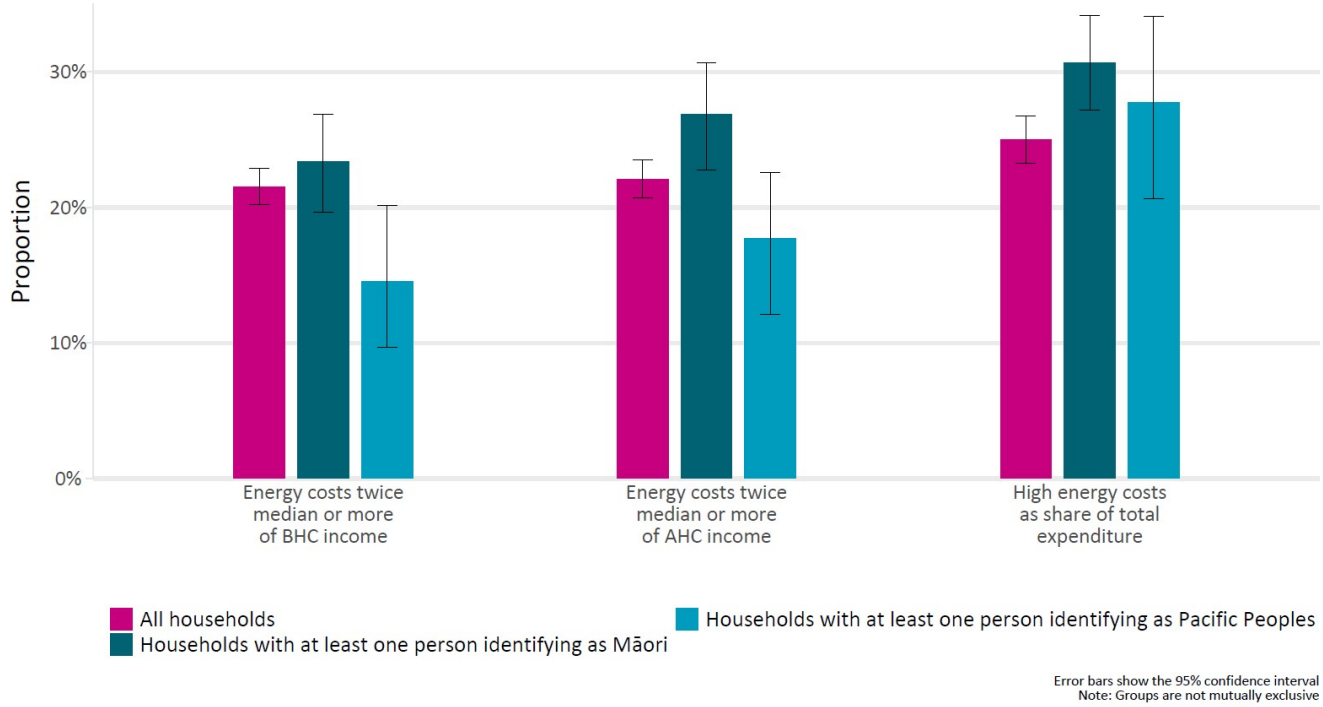
Measure	All households	Households with at least one person aged under 15†	Household with no-one aged 65 or over†	Households with at least one person aged 65 or over
Domestic energy costs are 10% or more of household income	6.0 (5.1 - 6.9)	4.7 (3.3 - 6.0)	5.4 (4.3 - 6.6)	7.3 (5.4 - 9.0)
Domestic energy 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

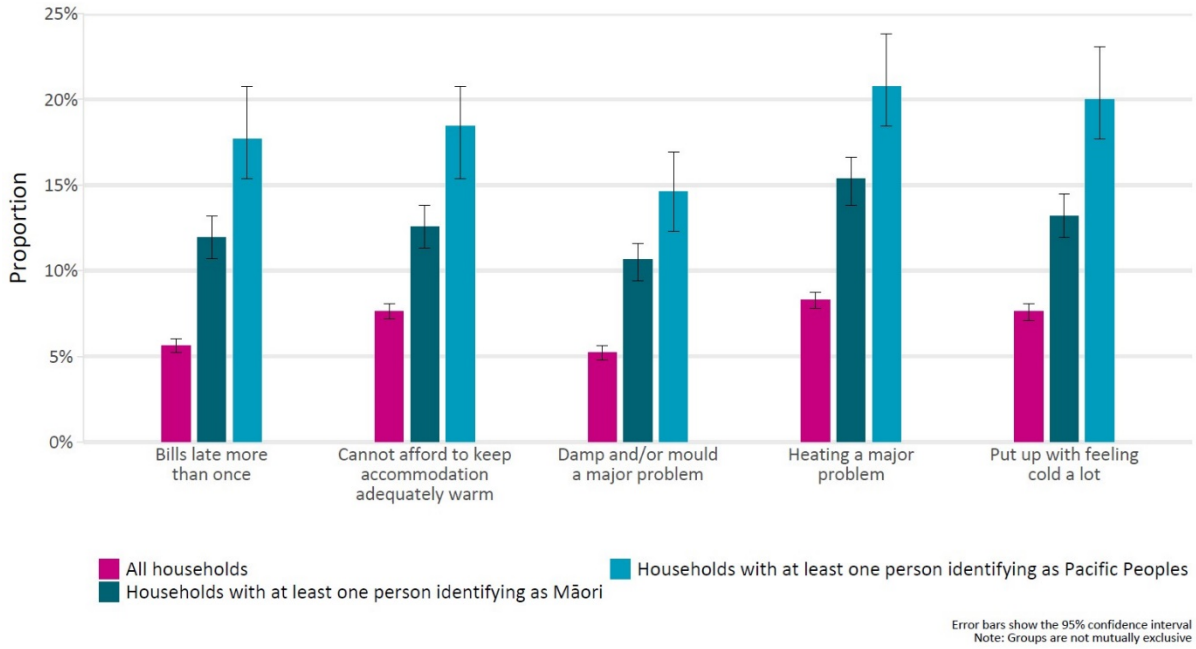
Figure 8 shows results for objective and subjective measures of energy hardship by selected household ethnicities. This compares all households with households where at least one person in the household is of a particular ethnicity.

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)

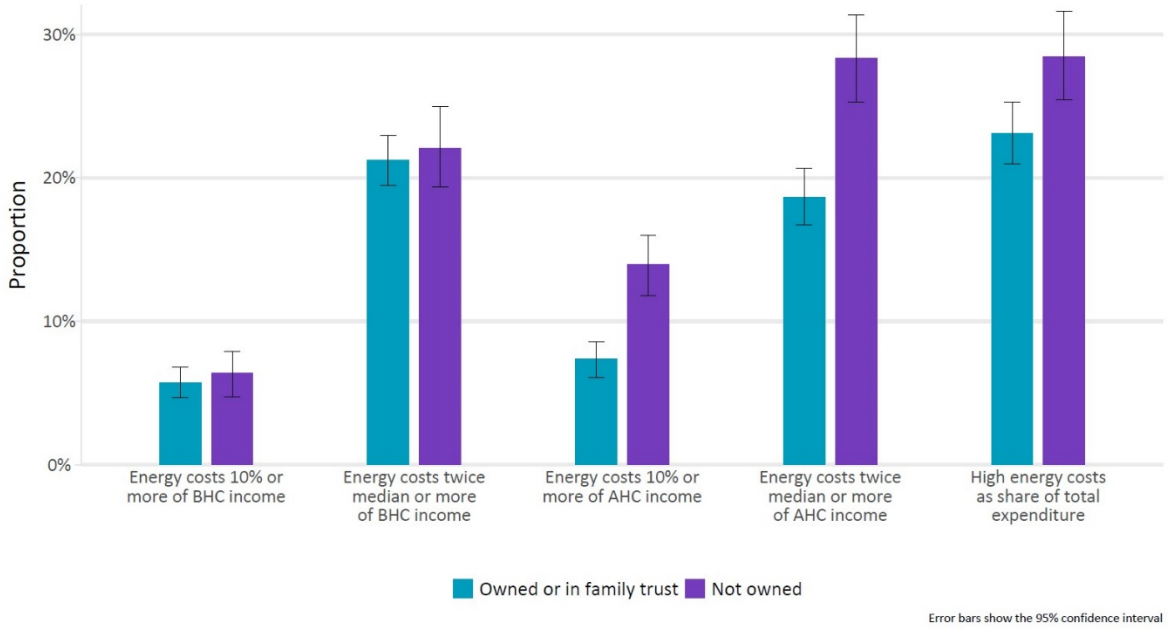
Measure	All households	Households with at least one person identifying as Maori[†]	Households with at least one person identifying as Pacific peoples[†]
Proportion of BHC household income spent on domestic energy is twice the median or more	**21.5 (20.2 - 22.9)**	**23.4 (19.6 - 26.9)**	**14.5 (9.7 - 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

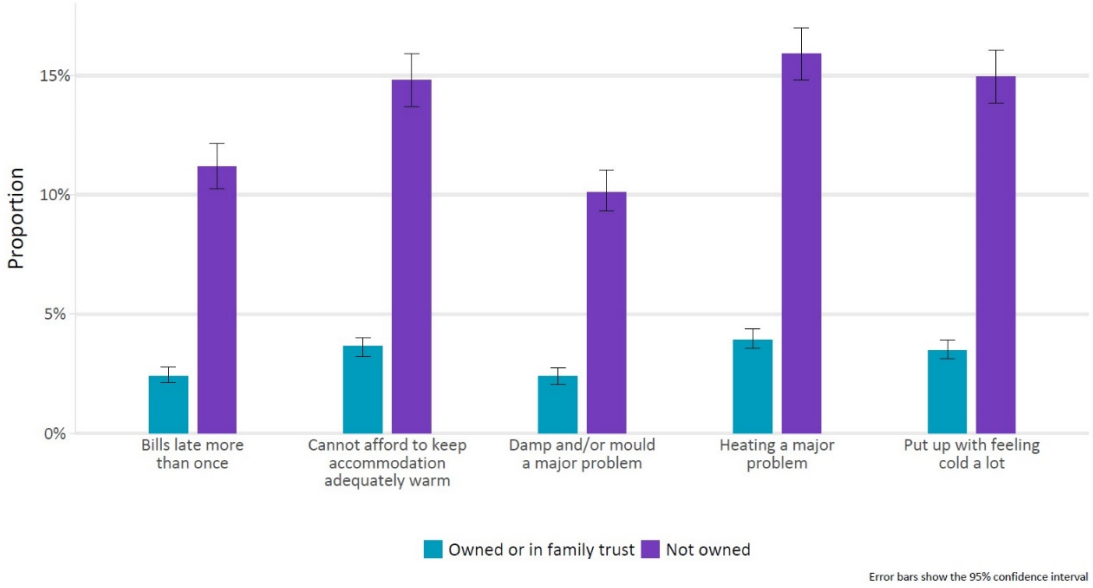
Figure 8 and Figure 9 show the results of energy hardship measures comparing whether the household lives in an owner-occupied dwelling or not. Note that while the category 'not owned' includes a small proportion of households who don't own or pay rent, for convenience we will refer to them as renting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

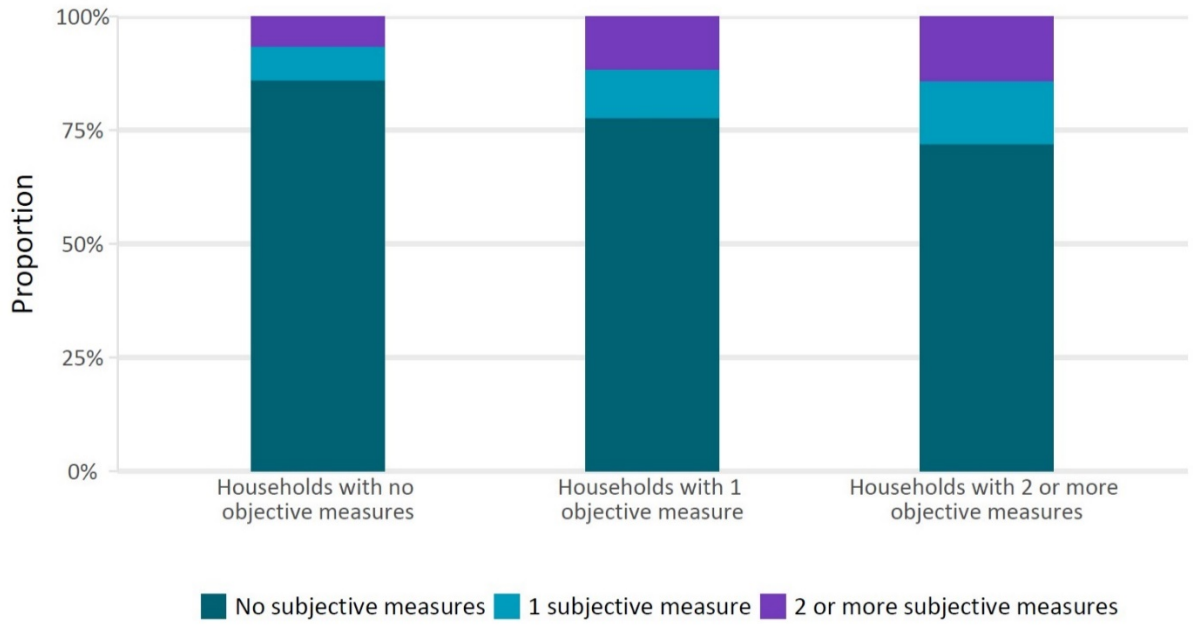
Depth of energy hardship

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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Appendix E: Case studies of experiences of energy hardship

Figure 6 Conceptual framework for energy wellbeing and hardship

This framework has been created to help map out which factors shape the energy wellbeing of an individual, household or whānau. Factors can interact with each other in a number of ways, so that individual households have different experiences of energy hardship.

As examples, we have republished these scenarios which were originally discussed in the Electricity Price Review's First Report for Discussion[152]. These are based on interviews with budgeting advisors and consumer advocates and some of the situations faced by real households.

Grandparents feel burden of family

Mr. and Mrs. N are an elderly couple living in a one-bedroom rental in Porirua. They are so frugal with their power they often turn off the hot water cylinder and don't heat the flat. They frequently have coughs and colds, especially during winter. They know this is not ideal but simply can't afford to use more power. They are wary of asking for advice, and certainly don't want a stranger telling them that what they are doing is wrong. By keeping a tight rein on expenses, foregoing other essentials and paying other bills late, the couple managed to keep up to date with their power bills. As devoted grandparents, they cannot say no when their mokopuna ask to stay. Before the children arrive, Mrs. N turns the heating up and the hot water back on – and then she takes a deep breath, knowing their power bill will go up. They say nothing to their whānau about the extra cost of their grandchildren staying. The koha helps feed the extra mouths, but the higher power bills have proved too much, and Mr. and Mrs. N have fallen behind with payments. They haven't contacted the power company because they don't want to draw attention to themselves. Recently they came home to discover their power had been disconnected, but are too embarrassed to tell anyone.

Solo mum left without power

Ms. Y, a solo mother in her early 20s, rents in South Auckland, earns the minimum wage and gets no help from the father of her young child. Money is very tight, and she had to borrow from credit companies to help pay her bills, including day care. The house she rents is cold and damp, the curtains are threadbare and there is no insulation. She's too scared to ask the landlord to do anything because it might push up her rent. Her debts grew so big she struggled to repay her loans and ended up with a bad credit rating. She missed several power bills after friends told her electricity companies didn't cut off consumers immediately. But this was not the case for Ms. Y. When she called several other power companies, they refused to connect her because of her bad credit rating. For technical reasons she couldn't sign up for a prepay meter. She became worried as winter approached. The only way out was to get a family member to complete the application. Her former partner's sister agreed to help and put the account in her name. This worked until the two women fell out, after which she found her account had been cancelled. Ms. Y tried every electricity company in her area, but again without success. She now has no power and no idea what to do next.

Working family feel the squeeze as costs pile up

Mr. and Mrs. Z live in their own home in Christchurch with their four school age children and Mr. Z's father. The couple are both contract workers, so their income varies, and the family budget is always stretched. They have a big mortgage and four children to feed, clothe and educate. Plus there are the rates bills and higher insurance premiums after the earthquakes. Petrol keeps going up, and grandad's medical bills add to the strain on the finances. As careful as they are, they find their power bill is always huge during the winter because the house is large, all the heating is electric and grandad is home all day.

[152] Electricity Price Review, 2018.

They know that properly insulating the house and installing heat pumps would make a big difference, but they have no spare cash for such improvements and they can't take out another loan. They've looked at switching retailers but can't find a better deal. They use too much electricity to get any benefit from being on a low fixed charge tariff plan. They don't qualify for income assistance or the new winter energy payment. They are falling further behind with all their bills and can't see how they will make it through winter.

Appendix F: Child poverty measures

https://www.stats.govt.nz/methods/measuring-child-poverty-concepts-and-definitions

These 10 measures must be reported on annually by the Government Statistician. The reports must specify the percentage of children living in households in New Zealand in each financial year who fell in these categories.

a) Low income: less than 50% median equivalised disposable household income before housing costs (BHC) for the financial year

b) Low income: less than 50% median equivalised disposable household income after housing costs (AHC) for the base financial year

c) Material hardship

d) Poverty persistence [Note: definition not required until the financial year beginning 1 July 2025]

e) Low income: less than 60% median equivalised disposable household income before housing costs (BHC) for the financial year

f) Low income: less than 60% median equivalised disposable household income after housing costs (AHC) for the financial year

g) Low income: less than 50% median equivalised disposable household income after housing costs (AHC) for the financial year

h) Low income: less than 40% median equivalised disposable household income after housing costs (AHC) for the financial year

i) Severe material hardship

j) Low income and hardship: less than 60% median equivalised disposable household income after housing costs (AHC) for the financial year and material hardship.

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