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Six ways to help fix energy hardship in New Zealand

Abstract

Energy hardship is caused by the interaction of factors including housing quality, appliance efficiency, energy source and price, and occupant needs and income. Multiple policy approaches are needed to address these varied causes of energy hardship, and the lack of an official definition and a measurement strategy in Aotearoa should not preclude policy action to address this critical social determinant of health. Here we outline six ways to help fix energy hardship in New Zealand.

Keywords energy poverty, energy efficiency, health, equity, just transition, co-benefits

The term energy poverty (increasingly known in New Zealand as energy hardship) describes the inability of households to access and/or afford sufficient household energy to meet the needs of occupants (including maintaining healthy indoor temperatures) (Bouzarovski and Petrova, 2015). While there has been a focus on the need to achieve affordable warmth, from the earliest definitions there has always been an acknowledgement that energy poverty encompasses all energy use within the home (Boardman, 1991, 2010). Energy hardship is caused by several interacting factors, including inadequate energy efficiency of both the building and appliances, energy service needs of the home and its occupants, and access to and the cost of household energy (Bouzarovski and Petrova, 2015; O'Sullivan, 2019). Health consequences are both acute and chronic, including the physiological health risks of exposure to cold indoor temperatures, such as respiratory and cardiovascular impacts and exacerbation of chronic health conditions, and poor mental health outcomes, including stress, depression and anxiety (Jessel, Sawyer and Hernández, 2019). Broader impacts include negative effects on education and nutrition, demonstrating that energy hardship acts as a social determinant of health and deserves significant policy intervention (Free et al., 2010; Jessel,

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Sawyer and Hernández, 2019; O'Sullivan et al., 2017; O'Sullivan, Howden-Chapman, Stanley et al., 2013).

Energy hardship differs from general income hardship as the major contributing causes of energy poverty – dwelling design and housing quality that determine the energy requirements of the dwelling, as well as energy source and price – are largely external and outside the control of occupants. Increasing household income is rarely enough to lift a household out of energy hardship, as capital expenditure to address housing and appliance energy efficiency is usually required (Riva et al., forthcoming). Were increasing income and energy use the sole method used to address energy hardship, the additional carbon expenditure to reach the energy requirements for the dwelling and occupants would pose future risk and costs. Other policies, such as improving housing and heating appliance energy efficiency, have proven co-benefits and provide better value for money (Fyfe et al., 2020; Grimes et al., 2012; Preval et al., 2010; Preval et al., 2017).

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New Zealand national law did not require insulation in new dwellings prior to 1978, and requirements increased slightly in the 1990s and again in the mid-2000s (Viggers et al., 2017). At the time of the 1976 census there were 926,484 private dwellings counted, and 1,276,329 at the time of the 2001 census (Statistics New Zealand, 2015). Many of those dwellings are still occupied today, and unless retrofitted will still require as much energy to heat as they did in 1975 or 1995. Retrofitting programmes, including those run by the government, typically focus on the easy-to-reach parts of a dwelling, such as ceiling insulation in pitched roofs or underfloor insulation for suspended floors.

Prior to Covid-19, energy poverty had gained traction as an issue for the political and policy agenda in New Zealand over the past ten years, with policies to address the critical driver of improving home energy efficiency gaining cross-party support. It was estimated to affect around a quarter of New Zealand households in 2008 (Howden-Chapman et al., 2012), and around one third in 2017 (Statistics New Zealand, 2017). However, the Covid-19 pandemic and its economic and social fallout is likely to have caused increased energy hardship, at least temporarily (Rotmann et al., 2021). The Electricity Price Review (Electricity Price Review, 2019) has strengthened previous evidence-based calls that we must define, monitor, and find ways to reduce energy hardship in New Zealand (Howden-Chapman et al., 2012; O'Sullivan, Howden-Chapman and Fougere, 2011, 2015). Here we suggest that specific policies that are intended to reduce energy hardship be targeted to specific groups or locations and time frames. We outline six policy fixes that could contribute to the suite of policy initiatives required to address this complex problem:

- improve the minimum energy efficiency of dwellings;
- introduce mandatory energy performance certificates for housing;
- ensure equitable energy pricing;
- increase visibility of energy use;
- manage electricity infrastructure investment to support residential consumers; and
- monitor energy poverty, and target remediation policies.

Improve the minimum energy efficiency of dwellings

The economic, environmental and wellbeing benefits of insulating homes are well-established (Grimes et al., 2012; Howden-Chapman, 2017), and successive governments have committed to improving the energy efficiency of existing homes through continuing work programmes to retrofit insulation, as well as installing efficient heating. While these programmes have made significant progress, insulating 300,000 to date, an estimated 900,000 homes still require upgrading (Energy Efficiency and Conservation Authority, 2017). These programmes for existing housing should be continued and extended as much as possible; this should include both insulating more dwellings and ensuring that the level of insulation installed maximises long-term wellbeing.

In addition, the required energy performance of new housing should be increased to reduce future energy costs for occupants. The insulation levels required under the current Building Code are lower than in many appropriate comparison countries: for instance, required insulation values of new dwellings in the coldest part of New Zealand are only about half those required in Scotland (Scottish Government, 2019; Standards New Zealand, 2009). Unless the quality of new housing increases, expensive and potentially difficult retrofit procedures will still be needed many years into the future. Of particular importance is that areas of a dwelling where it is difficult to retrofit insulation, such as under a concrete pad or inside walls, should have a high minimum requirement for compliance unable to be traded off at the design stage for improved values in parts of the dwelling which would be easier to upgrade later. Updates to the Building Code are currently under discussion (Ministry of Business, Innovation and Employment, 2021b). While the proposed insulation options are improvements on

the current situation, some still lag behind international standards. The proposed changes lack the aspirational vision required to meet the climate challenge in that they do not even mention approaching near-zero-energy housing, and do not appear to consider requirements for thermal comfort in summer.

In the era of climate change it will be increasingly important for buildings to be designed to cope with extremes of both heat and cold. Buildings should ideally be designed to be free-running (with passive heating and cooling) for as much of the year as possible with natural ventilation. There are considerable tensions between the desire to minimise costs when designing buildings suitable for today's environment, and ensuring that buildings built now will remain suitable for the environment 50 years hence. There is a need for cradle-to-cradle assessment of the role of buildings in driving or reducing carbon emissions, as acknowledged in the recent advice to the government from the Climate Change Commission. In addition, urgent consideration should be given to how much of the housing stock it makes sense to retrofit, or what to do when the energy and carbon costs of improving some dwellings far outweigh the benefits (Boardman, 2012; Boardman et al., 2005). Co-benefits of reducing carbon emissions include improved thermal comfort and reduced energy requirements, providing health gains and easing energy hardship.

Introduce mandatory energy performance certificates for housing

The healthy homes standards recently introduced under the Residential Tenancies Act require, where feasible, some basic measures for rental properties, including mechanical ventilation, ceiling and underfloor insulation, adequate drainage, and a form of fixed heating in the living room. However, the standards apply only to rental properties, and do not give the prospective tenant any direct information on the likely cost of adequate energy services for the property. Energy performance certificates are used in a number of jurisdictions (Viggers, Keall and Howden-Chapman, 2021), and a recent review found that despite some methodological problems, dwellings with higher rated performance generally attracted a price premium (Daly et al., 2019).

There is considerable information asymmetry between landlords and prospective tenants, and vendors and prospective buyers. Energy performance certificates are one way for buyers/tenants to more fully understand the potential thermal performance of a dwelling and therefore assess more accurately the costs of energy services inherent in living there. Currently, without a formal mechanism for this, potential inhabitants are reliant on their previous experiences in dwellings of apparently similar design. This estimation leaves substantial room for error, and can be particularly problematic for migrants without long experiences of New Zealand's housing styles and weather conditions (Teariki, 2017).

Energy performance certificates enable landlords and developers to better value the energy gains for prospective inhabitants of their dwellings, reducing the split incentive for energy efficiency investment. This encourages building and retrofitting above the bare minimum required by regulation.

In order for an energy performance certificate to be reasonably accurate in predicting a dwelling's energy use under standard conditions, a substantial modelling exercise would need to be undertaken. This would include both the gathering of dwelling-specific information, and the development of a modelling process and protocol to cover the whole country. Under the Ministry of Business, Innovation and Employment's Building for Climate Change programme (Ministry of Business, Innovation and Employment, 2020) such modelling is proposed at the consenting and compliance stages, which will support the government's signalled intention to introduce energy performance certificates (Energy Efficiency and Conservation Authority, 2020). This modelling could be designed to be suitable for energy certification. Although the 2020 proposal covered only new buildings, feedback from the consultation was in favour of existing buildings also being included (Ministry of Business, Innovation and Employment, 2021a), which would allow a natural extension of the energy performance certificates.

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Ensure equitable energy pricing

While energy poverty includes all energy used within the home, by far the most important in the New Zealand context is electricity, with an estimated 69% of all household energy powered through electricity. Electricity pricing in New Zealand presents several challenges for addressing equity while also meeting environmental and demand-side management needs. The price of electricity, to the residential consumer, is made up of the cost of electricity generation and transmission, the cost of electricity distribution, taxes to government, metering charges, and a levy paid to the Electricity Authority. The generation and distribution charges make up the bulk of the cost of most electricity bills.

The cost of electricity generation varies through the day and year as the viability of cheap generation methods, often renewable, to meet the country's demand changes with both the demand and weather conditions. Many retailers average out this cost to

present householders with a flat cost per unit of electricity, but some include price signals – 'time-of-use pricing' – to indicate when the electricity is most costly to generate. This provides a useful monetary incentive for households with the capacity to shift their load away from peak times, which should help to reduce the need for additional 'peaking' generation capacity. Yet time-of-use pricing also presents significant challenges for families, who often have energy schedules that are difficult to shift (for example, laundry, with complicated schedules for clean school or sports clothes (Anderson, 2016), or 'dinner, bath and bed' routines (Nicholls and Strengers, 2015)), and can contribute to gender imbalances, with 'more work for mother'. Other households have people with health needs or engaged in shift work, meaning that household schedules cannot be easily altered.

The distribution charges are the costs of delivering the electricity from the grid exit point to the household through the local lines network. These costs vary sharply across the country, dependent on the local geography and the number of consumers to support the network. There is no opportunity for a household in a given location to switch between distribution networks. Some lines companies offer a discounted cost for electricity delivered outside peak periods, although retailers may or may not average this out across the bills they deliver to households. In addition, some lines companies offer lower rates for households which use some demand shift technologies, such as cycle timing ('ripple control') for hot-water tanks, which the company can control during peak periods. Residential consumers, being large numbers of small users typically without the time or expertise to engage fully with the market, share the distribution network with commercial and some industrial consumers. One feature noted by the Electricity Price Review was that distribution cost allocations for residential consumers tended to be at the higher end of the 'fair' range, while those for business consumers were at the low end (New Zealand Government, 2018).

There is considerable tension between pricing to encourage load shifting away from peak demand periods, to reduce the need for further investment in expensive generation or distribution assets, and pricing to ensure that households with little flexibility are not disadvantaged further. However, some technologies (e.g., timing of freezer de-icing) could usefully shift some peak-time load with no difficulty or input from households.

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Comparisons are often drawn between the costs of residential electricity in New Zealand and overseas, highlighting New Zealand's cheaper electricity (Electricity Price Review, 2019), but these comparisons fail to take account of New Zealand's high dependence on electricity rather than cheaper fuels (Howden-Chapman et al., 2012) for space conditioning, and the way costs from those fuels are externalised in terms of greenhouse gases. A more comprehensive comparison would demonstrate support for higher use of renewable electricity.

The use of prepayment metering to pay for electricity provides a means of extending electricity services to those with poor credit history, as well as usually increasing visibility of home electricity use, the frequency of payment and sense of budgetary control for these households (O'Sullivan, Howden-Chapman, Fougere et al., 2013; O'Sullivan, Viggers and Howden-Chapman, 2014). When comparing equivalent plans and usage, most prepayment options remain more expensive in New Zealand than standard post-payment plans (O'Sullivan, Howden-Chapman and Fougere, 2011), except Globug, a prepay product offered by Mercury Energy to customers eligible for a community services card discount. We have long argued for better consumer protections for prepayment consumers, as well as reporting and monitoring of 'self-disconnections' on prepayment connections in order to understand the extent to which prepayment disconnections are problematic or pose health risks (ibid.; O'Sullivan, Howden-Chapman and Fougere, 2015).

The low fixed charge tariffs introduced by regulation in 2004 allow, with some restrictions, households which use less than 8–9,000 kWh/annum to opt for a tariff with lower daily fixed charges, but typically a higher charge per kWh unit, giving an overall cost saving. Although instituted in response to consumer concerns about fixed cost increases, the legislation's primary stated objective was energy conservation. The tariffs were signalled for removal by the Electricity Price Review, and this change is currently in progress (Electricity Price Review, 2019; Woods, 2020). Basic zero-sum modelling suggests that if the tariff is removed, very low users might pay up to about $300 more per year, average users a similar amount to what they pay currently, and high users save about $150 per year (Viggers, 2021). While the low fixed charge tariffs are not perfect, they act as a way for income-constrained households to control their energy costs, so we suggest that they should not be removed unless and until there is suitable replacement policy or regulations in place for these households.

There is inherent tension in pricing, largely through market mechanisms, for electricity, which is essential to participating fully in modern life (Viggers, Amore and Howden-Chapman, 2021). Other options for pricing include progressive pricing, where the unit price of the first consumption block has a lower tariff, the second block, which meets the average consumption, has a higher unit price, and subsequent blocks have increasing tariffs, which has been proven to encourage

electricity conservation (Prasanna et al., 2018; Youn and Jin, 2016). This approach would also potentially support some energy-poor households who have lower energy needs. Progressive pricing could be introduced with or without a component of 'free basic electricity', as used in South Africa (Ruiters, 2011), or in conjunction with other measures to reduce the impact of income and electricity cost on New Zealand energy poverty levels: for example, bulk purchasing of electricity for supply on a reduced 'social tariff' to a subset of households, such as those receiving government income support, eligible for a community services card, in state-, city- or community trust-owned housing, eligible for winter energy payments, or with incomes below a certain level. Another solution used in several states in the US is the 'percentage of income payment plan', where eligible low-income consumers pay a percentage of their income towards electricity (or gas), with the remainder of the bill offset through a charge to all consumers – although reforms to these programmes have been suggested to encourage conservation while preserving affordability (Migden-Ostrander, 2021).

Increase visibility of energy use

The goal of making household energy use visible is to allow households to make choices about the energy services they purchase for the money they spend on electricity at the time the energy is used. There is a classic analogy between receiving an electricity bill a month after energy has been used, and receiving an un-itemised bill from a supermarket without labelled prices a month after getting the groceries home (Gellings, 1985). Visibility of energy use has the dual benefits of encouraging households to improve their energy literacy by giving rapid feedback on the effects of their actions, and giving the energy literate sufficient information to make more informed choices to prioritise their required energy services.

Energy literacy is often touted as a means of reducing energy consumption and energy poverty. However, for those in energy poverty, increasing energy literacy is more likely to result in consumers having better understanding to enable more choice when it comes to shifting load from one form of energy service to another (O'Sullivan, Viggers and Howden-Chapman, 2014). It is also important to understand the trade-offs in these choices, otherwise apparently 'low-hanging fruit' may be rotten – for example, where turning off a light increases risk of falls, resulting in higher expense overall once health costs are included. However, increasing energy literacy without increasing the ability of people to act on it is pointless and disempowering; that is, in the case of those who are already severely restricting energy use but have no ability to improve the other factors contributing to their energy poverty (ibid.). We expect that minimal overall reductions in energy use can be harnessed through improving energy literacy among those experiencing energy hardship. However, for some groups, such as migrants from either low- or high-income countries who have limited knowledge of the home heating advice in the local climate, or for those who are newly energy poor (Ashby et al., 2020), increasing energy literacy may usefully result in either a decrease or increase in energy use.

For households in energy hardship, data visibility or feedback needs to be free, fast and intuitive. For example, households should be offered as a standard option a weekly billing cycle, or one that matches their income cycle. A clear benefit of prepayment metering is that it increases the visibility of household energy use, in part by giving pricing signals that are closer to real time, something that is increasingly a feature of energy retail packages and is possible with the use of apps, and may extend to using smart controls – although it is important to recognise that households without access to devices and data are less able to access these benefits. Customers on post-payment plans will also reap some of these benefits if billing cycle lengths are reduced. Increasing the visibility of energy use will also help households notice and assess the relevance of installing energy efficient appliances and/or insulation for themselves.

Although some retailers are giving consumers easy access to their data, data ownership has not been fully discussed or contested, and there are several government departments, non-government organisations and consumer advocacy groups that should be able to offer useful perspectives on this. As something that could contribute to reducing energy poverty, this should be addressed swiftly, and reviewed at regular intervals as technology continues to advance in this area.

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Manage electricity infrastructure investment and incentives to support residential consumers

There are considerable issues around fair profits and regulation of distributors who act as monopoly agents in their areas. Distribution costs are a significant proportion of most electricity bills, and the profit incentives of distributors are not necessarily aligned with the price concerns of residential consumers. The ongoing discussion of regulation of electricity is instrumental in achieving fair distribution pricing.

Large-scale demand control response could reduce the need for additional infrastructure and therefore the cost of the distribution network. Traditional demand response tools – e.g., controlled hot water heating – provide one means of smoothing demand, and extending these to strategic charging–discharging control of grid-connected electric vehicles will be critical for managing the expected increase in demand with energy transition and decarbonisation of transport (Solanke et al., 2020). However, this is one area where the short-term benefits to wealthy and energy-vulnerable households could diverge, with wealthy households more

able to afford the cost of small distributed generation assets or electric vehicles which have the potential to create extra grid costs. Emerging technologies are expected to have increasingly active uptake and there is a need to proactively avoid unintended consequences of them. Urgent consideration must be given to how to pay for transmission and distribution costs of maintaining the national grid and fair contributions for households to make to paying for it, whether they are high users, low users, use the grid only as a back-up, disconnect, or never connect.

The regulatory and pricing environment suitable to encourage innovators and early adopters to invest in little-known technology – such as early photovoltaic solar panels or electric vehicles – which the existing grid was well able to service may not be suitable for the volume of electricity that will be generated or used by fast-followers and the early majority as they take up the technology. The additional grid load these technologies have the potential to create in both local generation and peak use could create a need for significant new investment by distributors, which must be paid for. A fair solution would be to incentivise and eventually require owners of these technologies to also acquire at an individual or community level mitigating technologies, which might include storage batteries, home energy management systems, or controlled charging time devices or similar. Research exploring how local communities can fairly share both the costs and benefits of small-scale local generation would support policy development and help to achieve a just energy transition.

It is important for both increasing resilience to natural disasters and decarbonising the economy to encourage the use of small-scale renewables, but those in energy hardship must not disproportionately bear the extra costs placed on the grid by these new investments. Removing low fixed charge tariffs will remove an incentive for small-scale distributed energy and it may be necessary to introduce a replacement incentive in order to support the uptake of these important technologies. An appropriate incentive might be to support the households with small-scale generation in also acquiring storage batteries.

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Delaying and reducing the need for expensive new network and grid assets, with flow-on effects on prices, is necessary for ensuring that vulnerable households do not move into energy hardship.

Enabling community-distributed energy in more remote locations, and encouraging and supporting households with very high grid costs to either disconnect from, or never connect to, the grid is another tool for reducing energy poverty, particularly for rural households. Further research and policy development to investigate future-proof options for grid management and energy distribution are urgently needed.

Monitor energy poverty, and target remediation policies

Recommendations from the Electricity Price Review and initial work in this area suggest that official monitoring of energy poverty rates will begin soon, as we have called for based on our research for a decade (Howden-Chapman et al., 2012; O'Sullivan et al., 2011; O'Sullivan et al., 2015; O'Sullivan, Howden-Chapman, Fougere et al., 2013). Households with children and young people are particularly vulnerable to energy poverty (O'Sullivan et al., 2017; O'Sullivan, Howden-Chapman, Stanley et al., 2013), and the government remains focused on reducing general poverty and improving living standards among children. Current research suggests that winter energy payments, currently provided to those eligible for New Zealand Superannuation (those aged over 65 years) and several other social welfare benefit payments, have broad public support, with useful nudge or labelling effects that increase home heating use (Viggers et al., 2019), and would be beneficial if extended more widely, particularly to households with children (Shorter et al., forthcoming). Targeting energy poverty remediation policies, including energy payments (winter, Covid-19 support, or otherwise) and energy efficiency and heating programmes to households with vulnerable children or elders makes sense economically and socially. There will always be some households who require extra help, and finding and supporting them financially, as well as with energy efficiency measures, and ensuring energy literacy so that they can make clearer choices about energy use at home should remain priorities as part of a policy package for energy poverty reduction.

Conclusion

None of the solutions suggested here are likely to work fully in isolation; they are complementary, with the potential to augment each other synergistically. If planning for these six interventions began immediately, the effects are unlikely to be fully realised for over a decade. We argue that enough is known to begin making these changes now; waiting longer leaves those already in energy hardship, particularly young children, at risk of lifelong negative health and wellbeing consequences. The first effects would be noticeable through targeted policies such as the winter energy payment allowing those in current critical need to afford energy services; as the

visibility of home energy use increased – perhaps through weekly billing becoming standard – many households would increase their energy literacy, and value energy-efficient appliances more highly. In the medium term, energy performance certificates might allow price premiums for more efficient dwellings, in turn increasing demand for retrofits of existing dwellings and deeper retrofits. The increased number of energy-efficient appliances would include demand response options in their programming and allow the roll-out of large-scale demand response programmes; this could be coupled with time-of-use pricing to encourage take-up of the demand response programmes. In combination with these other interventions, equitable energy pricing would ensure that households in long-term disadvantage could access cheaper social rates, as well as dedicated housing quality improvement programmes. Over a longer timescale, as new dwellings were built to increasingly high standards less energy would be required, providing important co-benefits. Increased use of load shifting would allow network planning for lower peak loads, lowering the costs for peak demand infrastructure and allowing lower distribution costs. Open discussion would take place over whether preference should be given to residential or commercial customers, acknowledging the importance of electricity as an essential service to support wellbeing. While these interventions were implemented, energy poverty would be monitored and reported on to allow policy evaluation.

While the Covid-19 pandemic is likely to have increased the burden of energy poverty in New Zealand in the short term, we have an opportunity in the medium- to long-term recovery to significantly reduce the problem. Solutions to energy poverty include improving housing quality, through retrofitting insulation and efficient and affordable heating systems, and further increasing the value and visibility of these improvements through the introduction of an energy performance certificate scheme. Continued action to improve energy affordability through regulatory oversight of pricing, as well as sector-led initiatives in this area to enable consumers to make informed choices about the energy services they want to prioritise, will remain important. Crucially, the introduction of robust measurement and monitoring of the number of households living in, or transitioning into or out of, energy poverty will enable both policy targeting and evaluation to ensure that the size of the problem is being reduced.

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