



RESEARCH BULLETIN

Energy, the Challenge of Fuel Poverty, and Wellbeing: A case study of 18 low-income households

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This bulletin presents findings about fuel-related stress in very low-income households living in dwellings less than 12 years old that meet the current energy and thermal performance requirements of the New Zealand Building Code.

A household's ability to affordably heat and cool the home, as well as maintain other essential energy services, such as hot water, lighting and appliances, has significant implications for individual physical and mental health and wellbeing (Howden-Chapman *et al.*, 2012). In addition to often experiencing financial stress, low-income households tend to be characterised by health vulnerabilities and sometimes the presence of seniors or babies and children. The very young and the old, as well as disabled people, are particularly susceptible to cold or excessively hot housing environments. Internationally, it is well established that social housing residents proportionally pay more of their household income on energy, yet they are least able to afford it, and have little ability to make changes to improve energy efficacy (Meehan & Bryde, 2015). It is in the context of problematic stock performance and financial stress among lower income households, that the concern about household fuel poverty has arisen.

The households

In-depth interviews were conducted with adults in 18 households living in social and affordable housing in a New Zealand city, in climate zone 2, with a winter temperature falling to an average of around 10^o Celsius.

Most of the participants are eligible for the Income Related Rent Subsidy (IRRS) and pay an income-related rent, i.e., a rent not exceeding 25% of their income. The remaining participants either pay an affordable rent and receive the Accommodation Supplement, or in one case, are in a shared-ownership scheme for low-income households.

The households range in size from single-person households to large family households (four or more children). The average number of household members is three. The stock is relatively new, between one year and 11 years old, and comprises a mix of stand-alone, semi-detached and multi-unit townhouses.

Most dwellings are multi-level. Dwellings range in size from studio units to four-bedroom dwellings, with most of the stock being two- and three-bedroom dwellings. Householders were asked a range of questions about dwelling functionality, performance, design, and residents' satisfaction with their homes.

This bulletin comments on residents' perspectives on how their dwellings performed in relation to thermal comfort and energy costs. All of the households in this study use electric heating, either heat pumps or panel heaters supplied with the dwellings. Some households supplement these fixed heating systems with their own portable electric heaters. Hot water cylinders are heated with electricity. Households are also equipped with electric cooking appliances and rangehoods in their kitchens. Extractor fans are in all bathrooms.

Defining fuel poverty

There is currently no nationally accepted definition or method of measuring fuel poverty in New Zealand. As noted in the 2018 Electricity Price Review (EPR), "without [a definition] and regular monitoring, it is difficult to establish the scale of the problem or the success or otherwise of various policies targeting the problem" (New Zealand Government, 2019). The EPR made clear recommendations to Government to address this gap, and those recommendations have been broadly accepted.

The importance of having an accepted definition of, and approach to measuring, fuel poverty has been long recognised in other countries, with the United Kingdom's "10% definition" frequently cited in the literature. This definition, which stems from research in the United Kingdom in the 1980's, defined a household as fuel poor if it spent more than 10% of income on household fuels. This was based on actual expenditure data at the time: the poorest 30% of households were spending 10% of their income on household fuels and this equated to twice the national median expenditure. The 10% threshold and definition were adopted by the England House Condition Survey in 1991. However, it later evolved from using a measure of actual expenditure on fuel, to a measure of the fuel expenditure required to achieve a minimum heating regime and other basic energy services (lighting, cooking and appliance use).

This is a critically important distinction: fuel poverty (or energy hardship) by this definition is not about what the household is actually spending but what they would need to spend to maintain those services and achieve adequate warmth. If a simple fuel cost to household income measure is used in NZ, 2018/19 Household Expenditure Survey data suggests that 9.7% of households expend more than 10% of their after-housing costs (AHC) incomes on energy in their households. Over this period the median share of energy expenditure as a proportion of AHC income across all households was 3.1%. An estimated 370,000 households (22%) spent twice the median share of energy expenditure or more as a proportion of their AHC income.

If the twice median or more measure is used as the threshold, approximately 200,000 more households are defined as experiencing fuel poverty than would be using the 10% threshold (162,000 households) (MBIE, 2021).

These simplistic measures of actual household energy spend relative to income are problematic for two reasons:

- Firstly, the impact of expenditure on a critical bundle of goods is always more burdensome on low-income households than higher income households. In absolute terms the residual income for a high-income household expending for instance 15% of income on household energy is higher than the residual income of a low-income household expending a similar proportion of income.
- Secondly, fuel cost to income measures do not take into account the amenity that households may receive or miss out on. We know that there can be substantial differences in, for instance, winter temperatures depending on dwelling size, design, maintenance and the type of heating appliance used. As a consequence, a household's low energy costs may be associated with very different comfort and health outcomes.

Fuel poverty is a complex, multifaceted issue. The design, location, size and energy performance of the dwelling, including how well it retains heat in winter and stays comfortably cool in summer, energy prices, household income and differences in household energy needs are all factors that expose or protect households from fuel poverty. How much a household pays per unit of energy (kWh) consumed will vary at the household level and relate to factors such as payment method (e.g., direct debit or prepay), energy retailer and payment plan and location.

Notably, while there is a common belief, often publicly expressed, that the behaviour of individuals within a household is the primary driver of energy consumption and fuel poverty, issues of design and dwelling performance, energy prices and household incomes are typically the most important (O'Sullivan & Viggers, 2021). In relation to energy prices, where there is a complex electricity market, householders need to have the time as well as financial, energy and technical literacy to navigate, find and access the most suitable and affordable plans and tariffs for their situation.

Participant households, their energy costs and thermal comfort

The most common problem householders in this study identified was the cost of electricity.

They reported electricity bills, typically covering one month, ranging from around \$100 per bill (a single-person household) to \$800 per bill for one family. Some households spoke of being in arrears with their bills. Comments included:

Having to pay it off in instalments. Our power doubled from last year. First year manageable, second year costs have nearly doubled. \$249 last bill, \$302 the month before (Family A, 3 people).

Worryingly high. Pay \$60 direct credit and still a surplus of about \$160 a month [to find] on top of that ... Fridge and washer are new and should be energy efficient ... Power still high \$200-\$300 every time. All year round (Family B, 2 people).

Householders attempted to manage their high power costs by setting aside a regular amount, often through a direct debit. Typically, they found that such amounts were inadequate. Apart from a financial savings approach, households also talked about reducing their use of appliances in an attempt to reduce costs.

Notably, there was little focus on changing power supplier, although two householders expressed their intention to switch:

Before, I was with [supplier X]. When I come here, I see the power is with [supplier Y], but it's too expensive. Sometimes [in the past] I would get a bill \$150, \$120 from [supplier X]. Since the time I live here \$260, \$240... [My] social worker said I have to call them to see about going to another company (Family C, 4 people).

Have to pay \$400 off [power bill] and work out how to pay it. Normally paying \$200-\$250. Looking at changing [supplier] because it's too much (Family D, 4 people).

Getting value from energy use

Energy efficiency and performance of a dwelling and its appliances are contributing factors to a household's experience of fuel poverty. Moreover, fuel poverty can exist even when energy expenditure is low. A robust understanding of fuel poverty needs to look beyond how much a household is actually spending and consider also the level of energy services (such as achieving a healthy indoor temperature) they are receiving for that expenditure. A household with very low expenditure due to self-rationing may appear 'not-fuel poor' but their energy needs are far from being met.

Electricity is a considerable on-going cost for these low-income households. For households in this study, energy bills are significant financially and an unaffordable burden. However, the level of expenditure was still not enough to achieve a comfortable living environment. While reporting that their energy costs were unaffordable, some households also struggled to achieve comfortable living temperatures and reported that their home is 'not always easy' or 'rarely easy' to heat. In addition, some households were rationing their energy consumption to reduce energy costs.

Difficulties in achieving thermal comfort is not uncommon in New Zealand, even in relatively new dwellings (James *et al.*, 2018). Research has shown New Zealand houses are often colder than the minimum recommended indoor healthy temperature and there is a tendency for spot-heating as opposed to whole-house heating (Isaacs (ed) *et al*, 2010). In this study it was common for residents to remark on heating difficulties, and they found typical New Zealand practices of 'spot-heating' unsatisfactory in a multi-level dwelling:

Warm enough in winter except downstairs, very cold ... Heat pump is very close to the stairs, doesn't heat the living areas well. Heats me when I'm cooking, doesn't heat the living room (Family E, 4 people).

Doesn't distribute heat through the lower level. The person sitting on the couch closest to the heater is okay, but on the other couch, no (Family F, 3 people).

In winter, the upper level is fine, it's warm when the balcony is closed. Middle level is not bad, we have to have the lounge door shut for the heat pump to work. Very cold downstairs and no heating ... Very hard. Very hard. Can't afford it, another payment coming up, got to talk to them (Family G, 8 people).

In the summer households found it hard to keep their homes cool enough, despite the use of windows for ventilation, as these two participants recounted:

In summer it's too hot ... Can't sleep in the bedroom. We have a portable fan ... we move the bed into the lounge and have the sliding door open at night so we can sleep (Couple).

It's ridiculous in summer. Way too hot. I don't even open the curtains upstairs during summer. Windows don't open wide enough, the whole upstairs is hot. If we've been away, come home and it's stinking [hot]. Have to have all the windows open. The stairwell is ridiculously hot in the afternoon. Gets stifling hot on the deck (Family B, 2 people).

Casting a light on energy efficiency, amenity and fuel poverty

Space heating and cooling are significant energy end-uses in New Zealand homes. Along with lighting, cooking and water heating they are part of a bundle of expenditure that New Zealand households have relatively little ability to avoid. This raises two separate, albeit connected issues: firstly, the issues that arise when New Zealand dwellings deliver poor amenity value in relation to energy consumption; and, secondly, the extent to which energy costs present an affordability burden for households.

The World Health Organisation recommends a *minimum* of 18°C in any occupied areas of the home, or warmer for some people such as young children, seniors, or those with an illness. How much energy is required to achieve that minimum will depend on the energy performance and condition of the home. A well-insulated, well-maintained dwelling, designed and oriented to maximise solar gains in winter, minimise over-heating in summer, fitted with the most efficient and cost-effective appliances, will cost less to run to a healthy standard (per unit floor area) than a dwelling lacking these features.

Research in New Zealand has demonstrated that, despite often commonly expressed views, it is these factors – the design, orientation, construction and condition of dwellings, as well as appliance efficiency – rather than occupant behaviour, that have the greatest influence on the energy performance of New Zealand houses (Bunker *et al.*, 2021). This is the case, even in new-builds, which meet the current Building Code.

Moreover, while many refer to New Zealand homes as cold and damp, there is evidence that newer homes with large amounts of glazing to the north and west can be too warm (Jaques, 2000). Excessive solar gain, very 'tight' construction and designs providing for inadequate ventilation can lead to over-heating which, like cold and damp, is also associated with health problems (Lomas & Porritt, 2017).

The inability of occupants to effectively modify temperatures to ensure comfort in all seasons can be associated with under-consumption of energy. For instance, accepting undesirably low indoor temperatures has been previously evident across income strata (Isaacs (ed) *et al.*, 2010). It has been noted in past research that some houses are simply not susceptible to heating due to poor insulation, inefficient appliances and poor solar gain. These factors have encouraged a culture of spot heating and under-heating in both lower and high-income households (Isaacs (ed) *et al.*, 2010; Jaques *et al.*, 2017). Results from the Warm-Up New Zealand: Heat Smart programme also provided evidence of this.

Findings from an evaluation of the programme indicated that households used much of the energy savings from their newly installed heating and insulation to *increase* the temperatures in their

homes, rather than reduce their energy payments (Grimes *et al.*, 2011). This suggests that householders living in poorly performing dwellings wanted warmer homes but, prior to receiving the energy efficient improvements, were unable to afford them and hence suffered a cold home.

Another facet impacting on energy use is inertia which leads household consumers to stay with their energy supplier. In his study of supplier switching in Wellington, McLean has shown that minimising energy costs through selecting a different energy supplier is by no means straightforward (McLean, 2016). McLean concluded that the “switching behaviours of fuel poor and non-fuel poor households, based on actual energy expenditure” are similar (McLean, 2016 p139) even when it might be more economically rational for a fuel poor household to switch. McLean argues that there are various non-financial reasons for switching or not switching, including the inconvenience of switching and level of customer service. Indeed, the only variable that significantly improved the odds of switching was “seeing one’s breath indoors” (McLean, 2016 p124). McLean’s analysis is based on a self-complete questionnaire. Its conclusions are enriched by the data presented here, about households in relatively newly built affordable rentals. Participants demonstrated not only spot heating and under heating, but also the challenges they perceived in switching energy supplier.

Conclusions

Two themes have dominated research about household energy consumption in recent years. One is household behaviour. The other is dwelling performance. In general, it can be concluded that across the dwelling stock the value of energy consumption delivered to occupants reflects the latter. Resident behaviour may affect energy consumption and costs, but effects are complex and dynamic. What is clear but somewhat neglected, is that energy pricing has a significant impact on the overall affordability of energy consumption.

When considering fuel poverty in this country, evidence suggests there are still a significant number of dwellings that could benefit from energy efficiency improvements, such as insulation and installing more efficient, fixed heating appliances. As those dwelling performance issues become gradually resolved through retrofit and with improved performance requirements associated with new builds, it appears likely that under-consumption of energy, or unaffordable energy bills, may be more directly a matter of energy affordability. In that context low-income households are likely to be particularly vulnerable.

Exploring fuel poverty is, however, by no means straightforward. There are a set of confounding factors and iterations between dwelling performance, energy pricing and low incomes. For instance, low-income households are more likely to depend on rentals (Statistics NZ, 2020). The rental stock in New Zealand has a long tail of older, often poorly maintained housing (White *et al.*, 2017). Even when accessing the Accommodation Supplement, comparatively high proportions of low-income households in rentals suffer housing affordability stress, and many suffer severe housing affordability stress (Saville-Smith & Mitchell, 2020). These households are likely to be vulnerable to fuel poverty, due to both poor dwelling performance and low and precarious incomes. In addition, ample overseas evidence shows that private rental tenure is an impediment to tenants improving their thermal comfort, because of landlord reluctance to upgrade and retrofit dwellings to increase energy efficiency (Liu, Judd, & Santamouris, 2019).

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