Understanding the energy consumption choices and coping mechanisms of fuel poor households in New Zealand

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Abstract
One in four households in New Zealand are fuel poor. A growing body of evidence links the technical and economic aspects of this phenomenon, however comparatively little research has focused on the wider social impacts. The behavioural and social interactions associated with fuel poverty have not taken centre stage in the literature. This study presents, through fuel poor households' voices, the realities of living in energy hardship, and the impact on day to day lives. Our research finds that fuel poverty impacts widely on the quality of life of participants, and highlights the barriers and support systems in place that may hinder or help their circumstances. This in-depth, multi-faceted portrayal of fuel poverty will aid in policy development and contribute to efforts to curtail fuel poverty in New Zealand.

Keywords: fuel poverty, energy hardship, lived experiences of fuel poverty, energy cultures

Introduction

Energy is embedded in all aspects of our daily lives (Lutzenhiser, 1993; Shove, 2003). Affordable and accessible energy is a necessity for households and communities (Lutzenhiser, 2014). For some segments of the population energy is either not easily affordable or not easily accessible (Lloyd, 2006). *Fuel poverty* occurs when households need to spend more than 10% of their household income on energy bills (Boardman, 2010; Lawson and Williams, 2012). One in four households in New Zealand were assessed to be in fuel poverty in 2012 (Howden- Chapman et al., 2012). Fuel poverty is a public health issue that has been associated with adverse effects on physical health and mental well-being (Liddel, 2010).

Literature on fuel poverty has concentrated on the physical aspects of buildings and appliances, the economics of household expenses on energy, and the epidemiological aspects of health and energy use (Hills, 2012; Clinch and

Healty, 2001; Harrington et al., 2005). The behavioural side of energy consumption is under-studied (Wilhite et al., 1996; Patterson, 1996). While economic measures are useful to portray the extent of fuel poverty, they do not adequately capture the wide ranging social impacts of fuel poverty (Harrington et al., 2005; Liddel, 2010). By focusing on the perspectives of the households in fuel poverty this study will provide an opportunity to better understand the broader aspects of fuel poverty (Sovacool, 2014; Stern, 2014; Harrington et al., 2005).

This study will use the practice-based energy-cultures framework (PBECF) (Sweeney et al., 2013) as a theoretical lens to explore the energy consumption habits and coping mechanisms of people living in fuel poverty. We explore the potential of this framework in the fuel poverty context by applying it to in-depth interviews carried out with households in energy hardship in New Zealand. The research will offer a range of experiences of fuel poverty to be captured, and will add a rich body of evidence to the fuel poverty literature by highlighting the wider social impacts of fuel poverty.

Fuel poverty in New Zealand

In New Zealand, residential energy prices are rising faster than income levels, intensifying the problems of fuel poverty for many households (Lloyd and Callau, 2009; Rashbrooke, 2013; Eaqub and Eaqub, 2015; Services et al., 2007; Ministry of Social Development and the Energy Efficiency and Conservation Authority, 2010). This is exacerbated by a widening gap in income and wealth inequality, making it harder for some households to have access to affordable energy (Wilkinson and Pickett, 2009; Rashbrooke, 2013). For these households energy bills take up a high portion of their household income, yet their energy sources are inefficient and they live in cold, damp homes (Barton, 2010; Geller, 2003).

Fuel poverty leads to two important effects. People suffering from poor health due to inadequately heated housing, or having to sacrifice other basic needs in order to afford thermal comfort (Howden-Chapman, 2005). The current dominant measures of fuel poverty have not adequately captured this variation in choices and practices households adopt to cope with energy hardship (Lawson and Williams, 2012).

Lewis (Lewis, 1982) originally defined the concept of fuel poverty as the inability to afford adequate warmth in the house. The most commonly used definition of fuel poverty is the 10% definition. (Boardman, 1991). Using this

definition, an estimated one in four households in New Zealand were in fuel poverty in 2012 (Howden-Chapman et al., 2012). However, this approach has been criticized for focusing on what households would need to spend in order to achieve acceptable warmth levels instead of what households are actually spending on keeping their dwellings warm (Hills, 2012; Heffner and Campbell, 2011; Fahmy, 2011). A more recent definition for fuel poverty has been adopted (DEFRA, 2001), Hill's measure of fuel poverty (Hills, 2012), which classifies low income households with high energy needs as being fuel poor, if spending on their fuel needs puts them below the poverty line. While Hill's measure takes into account household needs, both the Hill's measure and the 10% measure, based on economic terms, fail to adequately capture the broader experiences of fuel poverty (Royston, 2014; Middlemiss and Gillard, 2015).

Several factors contribute to the relatively high levels of fuel poverty in New Zealand. The poorly insulated housing stock in many parts of New Zealand adds to the hardship faced by their inhabitants. Minimum insulation standards for housing in New Zealand were not introduced until 1978 (Services et al., 2007). Many houses built prior to 1978 – the bulk of existing housing stock in some parts of the country – lack sufficient insulation (Shen, 2004). New Zealand has a small population dispersed over the two main islands. There are significant variations in temperature in the North and South of the country, leading to discrepancies in fuel poverty levels between the North and South island (Lloyd and Callau, 2009). Natural gas is not reticulated in the South Island and central heating is rare in New Zealand houses (Isaacs et al., 2006). These factors contribute to the prevalence of fuel poverty in New Zealand.

The demographics of New Zealand households have changed as well, contributing to changing habitual patterns of energy use and fuel poverty levels (Ministry of Social Development and the Energy Efficiency and Conservation Authority, 2010; Eaqub and Eaqub, 2015). Projections in 2015 by Statistics New Zealand forecasted that an increasing number of households, including families and older people, would shift to living in rental housing in the coming years (Eaqub and Eaqub, 2015). Rental properties in New Zealand have on average lower standards than owner occupied properties (BRE (Building and Research Establishment), 2006). As a consequence some households in rental housing are more vulnerable to suffering from fuel poverty (Barton, 2010).

The changing demographics of consumers and habits of energy usage, along with the need to capture the wider impacts of fuel poverty present opportunities

and challenges for fuel poverty research in New Zealand (Stern, 1984; Pereira et al., 2011; Heffner and Campbell, 2011). This creates a need to focus on the underlying choices and behaviour patterns which affect the way households use energy, and also paves the way to critically analyse how fuel poverty has been conceptualized.

Contextualizing fuel poverty

Since the 1980's, researchers have recognized the need to address the behavioural and social elements of energy (Lutzenhiser, 1993; Patterson, 1996; Stephenson et al., 2010). A growing body of researchers have taken a particular interest in how energy consumers act in their environment and how their behaviour interacts with the environment to shape energy use (Lutzenhiser, 1992; Stern, 1977; Lutzenhiser, 2014). Research on energy conservation first started to look at the link between attitudes and energy behaviour (Stern, 1977; Heberlein and Warriner, 1982; Seligman et al., 1979). Early studies focused on changing energy behaviour by motivating people based on monetary savings or environmental concerns (Moezzi and Janda, 2014). These perspectives do not consider the culture that shapes the habits and practices behind energy use (Moezzi and Janda, 2014; Sovacool, 2014). To fill this gap researchers have looked for a social link to examine the relationship between the user and the built environment (Wilhite et al., 1996; Stern, 2014; Pereira et al., 2011). Researchers, such as Shove, call for a socio-technical approach that is engrained in the daily routines around energy and their interactions with technology (Shove, 2003).

These different perspectives highlight the main challenge of identifying and measuring fuel poverty. Energy has multiple drivers of behaviour which are not easily captured in one indicator (Stephenson et al., 2010; Wilson and Dowlatabadi, 2007; Verhallen, 1981; Black et al., 1985). While there is extensive literature on energy end user behaviour, there is relatively limited research on exploring the values and decisions that drive this behaviour (Lutzenhiser, 1993; Wilson and Dowlatabadi, 2007). Shove (2003) and Bell et al. (1996) stress that the wider beliefs about energy usage should be considered alongside the technical aspects (Bell et al., 1996; Shove, 2003). This was echoed by Hedges (1996) who noted that the perspectives of people in fuel poverty were missing from the discourse, and that there is a need to tap into the understanding of households in energy hardship (Hedges, 1996).

Several leading researchers in this field have called for a multidimensional view of energy behaviour research that is embedded in the larger systems that influence energy consumption (Osbaldeston, 1984; Stern, 1986; P.C. and Oskamp, 1987; Sovacool, 2014). It is a combination of these issues – income, built environments, social and behavioural factors – which has to be combined to adequately conceptualize fuel poverty (Pachauri and Spreng, 2011; Sovacool, 2014). While previous research has looked at the social and behavioural impacts of energy consumption (Stern, 1984; Shove, 2003), there is a need to better understand the factors that influence these variables and the interactions between them.

This study is an in-depth qualitative analysis, aided by the Practice-based Energy Cultures Framework (Sweeney et al., 2013), to conceptualize the experiences of fuel poverty in New Zealand. The practice-based energy-cultures framework (PBECF) extends Stephenson et al.'s (Stephenson et al., 2010) Energy Cultures Framework. The Energy Cultures Framework was developed to factor in the broad range of variables that influence energy behaviour – from the material conditions of the house, values, beliefs and knowledge of consumers, to the wider social and cultural systems that impact on energy decisions (Stephenson et al., 2010). Sweeney et al. (Sweeney et al., 2013) proposed that energy uptake is also shaped by the level of motivation, barriers and support occupants face.

In Figure 1, the individual in the middle is driven by motivation to change, whereas the outer level is comprised of material culture, norms and practices that influence the broader social and cultural interplay in energy usage. The PBECF identifies barriers that may prevent particular energy behaviour. It also brings together the support systems which may overcome such barriers, and help inhabitants achieve the desired energy practices (Sweeney et al., 2013), for example, the level of thermal comfort of a house is connected to the norms and aspirations around heating that households place on them. The material cultures could also be limited by the external environment, for example, the level of insulation in a house may depend on the government subsidies available for retrofits. Barriers such as limited capital towards home retrofits may worsen fuel poverty while support systems like help from family and friends could ease the energy hardship experienced by inhabitants.

Sweeney et al.'s framework brings together the interactions between technology, social structures and behaviour. To see how well this framework

could be applied to fuel poverty it was used in this study as a conceptual tool to study energy hardship in New Zealand. We used the different elements of the framework to design the methodology and identify any barriers or support systems in place which might influence the fuel poverty levels of inhabitants.

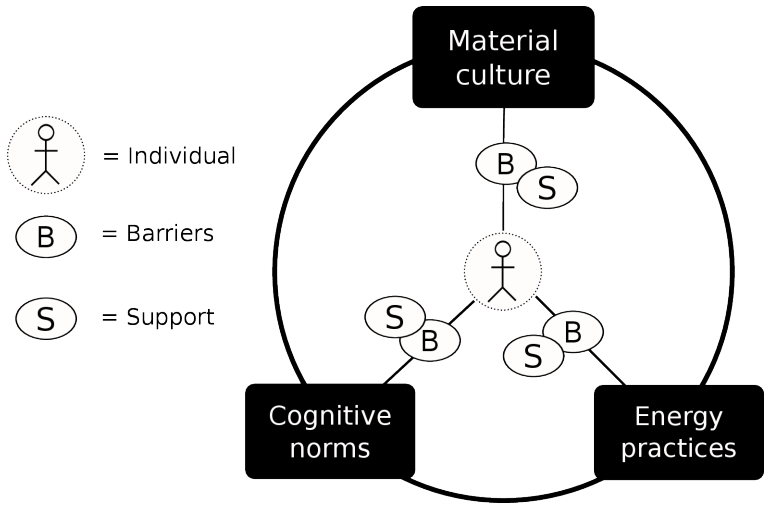


Figure 1: The practice-based energy cultures framework, Sweeney et al., 2013

Methodology

This study was based in Dunedin, New Zealand. Dunedin (Māori name Ōtepoti) is the second-largest city in the South Island of New Zealand. Dunedin was chosen because of its older housing stock and cooler climate. Mean annual temperature ranges from 10°Celsius in the South to 16°Celsius in the North of the country (Shen, 2004). This difference is reflected in the number of heating days and energy expenditure between the South and North island. In cooler regions such as Dunedin, space heating makes up about 50% of the total energy use in winter (Isaacs et al., 2006). Eighty six percent of houses in Dunedin were built prior to 1977, and few legal requirements for insulation or efficient heating exist for these old housing stock (Povey and Harris, 2004). Fuel poverty levels were higher for the South Island, with figures for Dunedin City at 32% in 2009 (Lloyd, 2006). This is quite high compared to Auckland in the North Island that has fuel poverty levels of 14% in 2009 (Lloyd, 2006).

Participants were invited for interviews from a range of Dunedin suburbs. Suburbs were chosen to maximise diversity in terms of socio-economic indicators, decile rankings[1] (Ministry of Education, 2007), as well as

[1] Decile ranking, ranging from 1-10, is a ranking system used by the New Zealand Ministry of Education that reflects the socio-economic level of the community from which a school draws its student body.

neighbourhood and household characteristics. Participants were identified with the help of community, religious and health organizations. A total of 32 semi-structured interviews were completed for this study. Semi-structured interviews were chosen as they provide the participants' perspectives and views (Silverman, 2000). The primary goal of this study was to understand how households perceived and coped with energy hardship. The interview was framed by the question: 'Can you describe your experience of living in energy hardship? '. The interview transcripts were analysed for emergent themes (Braun and Clarke, 2006) based on Sweeney et al.'s model (Sweeney et al., 2013), and organized into common themes across participants' narratives (Glaser and Strauss, 1967).

The informants

Most of the participants in this study were of New Zealand European (15) and Māori ethnicity (11). The ages of the participants ranged from 23 to 71 years, with half (16) of the participants in the 25 to 44 age group. Seventeen occupants interviewed in this survey lived in private rental properties while there were eight participants living in Housing New Zealand properties [2].

Table 1: Description of study participants (n=32)

Gender	N
Males	16
Females	16
Household type	N
Single occupant/Student	4
Single parent	13
Two parent household	7
Retired	8
Employment type	N
Working full-time	2
Working part-time	13
Unemployed on benefit	17
Tenure type	N
Owner occupied	7
Private rental	17
Housing New Zealand	8
Main method of heating	N
Heat pump	8
Portable electric heater	15
Wood/Fireplace	9
Suburbs represented	10
Decile rating of suburbs	2-7
Age Range	23-71 (mean age 43)

[2] Housing New Zealand is the government subsidized housing.

The main method of heating amongst the participants interviewed were portable electric heater (15), followed by open fires (9). For most participants the power bill in winter ranged between $100-$150 per month (18). The demographics of the participants are outlined in Table 1.

A limitation of the study was the small number of participants which did not allow for any sub-group comparative analysis. In line with qualitative research methodology, the study was confined to a small number of participants, which will facilitate transference of knowledge, but not generalisation. A second limitation is the recruitment of participants from one city, which misses opportunities to compare participants from other locales across New Zealand. The experiences of people from different parts of the country may highlight region specific concerns of fuel poverty which were not captured by this study.

Findings

The themes were categorized into material culture, norms, practices, barriers and support systems aided by Sweeney et al's PBECF. Three main themes emerged from the experiences of living with energy hardship. The themes were the strong association of the material conditions of the house and heating structure with energy hardship (which acted as barriers to overcome fuel poverty); direct and indirect effects of energy hardship on quality of life; and the various coping strategies, and support systems used by participants to deal with energy hardship. The narratives portrayed the connections between the different values and norms inhabitants placed on energy usage, and how these interacted with the practices and coping mechanisms to influence their energy cultures. The themes are explained in more detail below.

Material culture and barriers

Energy hardship was closely associated with the material culture of the dwellings. The material conditions of the house and the energy efficiency of the appliances used in the household had a strong influence on the way inhabitants used energy, and often magnified the experiences of fuel poverty (Stephenson et al., 2010; Sweeney et al., 2013). Thirty of the 32 participants reported how the lack of proper insulation and energy efficient heating in their house added to their energy hardship. The participants who lived in rental properties (17) and Housing New Zealand properties (8) described their indoor environments as cold. Many of these properties did not have adequate insulation and the positioning of their house did not allow for much sun in winter. Participants also

described presence of mould and the constant feeling of dampness inside the house (24). One of the main methods of heating used by the participants were open fireplaces (9), which was a feature of many of the houses built in the early 1900s (Services et al., 2007), and portable electric heaters or oil heaters (15), which are on average not as energy efficient as heat pumps (Services et al., 2007). Participants described how it felt like to live in these cold houses:

> It's a battle to stay warm …this house is badly positioned, we get maybe 2 hours of sun a day …there's very little insulation …this house is always way colder inside than the outside …so if it's cold outside, it's bloody cold inside - Elderly couple.

> It's very cold and damp in this house…the window frames are old and draughty…you can actually feel the draught coming in through the windows…it takes a lot of heat to warm up this house…even then sometimes it feels like an icebox inside the house…recently I took the old open fire place out and put a wood burner in by going to the bank and begging for an extension on my mortgage - Single father with three children.

> We have a fireplace in the house, but we don't use it because of the cost…we have a little electric heater that we move from room to room as it's needed…when my son goes to bed I usually put it (heater) in there for a little while to warm up his room…we have no insulation so as soon as you turn the heating off, the heat just disappears - Single mother with one child.

As many participants noted, the material culture of houses contributed to experiences of fuel poverty. They further described the effect of energy hardship on their overall quality of life.

Impact on quality of life

Living in energy hardship affected the participant's quality of life in many ways. It limited their ability to continue with day to day activities and their capacity to participate in society. Spatial confinement, where participants indicated that they had to confine themselves to one room, heating just one room of the house to minimise energy usage, was a recurring narrative in the interviews (28). Participants also shared how they were staying in bed for extended amounts of time to keep warm (21), and instances of children and parents co-sharing a bed to keep warm (10).

> There was no quality of life…isolation, staying in bed, confining myself to one room…my life shrank to one room…I don't think people realise how important it is…just to have a little bit (of money left) over to make you feel that you are still human - Retired, elderly woman.

> My son doesn't spend any time in his room in winter because it's too cold there…when it gets really cold, we'd get dressed in layers…pile clothes on…stay in bed reading…trying not to think about the cold…trying to escape to another world - Single mother with one child.

The way households consumed energy was influenced by the norms and values they placed on thermal comfort (Stephenson et al., 2010; Sweeney et al., 2013). This was clearly evident when different household members brought in conflicting aspirations about how much energy they should use.

> You've got to conserve power…unless you want either your power disconnected or have a massive power bill at the end of the month which you can't afford…so yeah, I would reduce the power I use …sometimes - Single occupant in shared accommodation.

> My wife and I are from different cultures …we have different ideas on how warm we wanted to keep the house …she wanted to have the house warm all the time, while I was raised to put a jersey on before turning the heating on …so yeah we were always fighting over the heat pump …eventually we separated because of that - Single father with two children.

The energy choices households made put a constraint on spending for other basic necessities (Sweeney et al., 2013). Participants reported that during the winter months they were cutting back on spending on food (27), especially cutting back on fruit and vegetable consumption.

> You feel deprived and you can't do anything…you are constantly going without…either it's without power or without food…and you are always cold…there was a time when I only had six dollars a week for food…I was too ashamed to tell anyone…I did it because I went without food to pay the power bills…I had to prioritise, and power was a priority over food - Elderly man living alone.

Food was not the only thing affected by the energy choices households made. Prioritizing energy bills hindered participants ability to seek medical attention, with some participants stating that they delayed going to the doctor even for

urgent health matters (12), delayed or avoided getting prescriptions (24), and stopped using non-emergency procedures such as getting eye and dental check-ups in winter (24).

> In winter I'm trying to survive from week to week…I'm always thinking about how much money is left and where I can spend it…we try hard not to get sick so we don't have to go to the doctor …if you have to constantly calculate how much (money) you have left, that's a very stressful way to live - Two-parent household with grown-up children.

All of the participants highlighted that social relationships are important for a good quality of life, and shared instances of how living in energy hardship limited their ability to create and maintain social relations. Indirect effects of fuel poverty such as emotional distress and constant worry over power bills were evident among the participants interviewed (9). Arguments over power bills and energy usage changed the dynamics of the household, with participants sharing that this resulted in strained relationships with other members of the household (13).

> We changed to GloBug (pre-payment meter)…we went on it because it was the only option available for us…the first two weeks were fine…but after that we were constantly topping it (meter) up…we couldn't keep up with it…it kept turning orange (indicating that power was about to be disconnected) …it was very stressful and I was constantly worrying about when we'll get disconnected - Single mother with one child.

Living with energy hardship was hardest on households with young children. Participants with families highlighted that children often felt left out of the social connections at school as they were not able to participate in extra-curricular activities their peers were engaged in (12).

> Little things like taking my son out for a meal or a movie…I couldn't do that…I couldn't even afford to buy him a birthday present …he's not involved in any school activities because of the cost…it's quite embarrassing for him…sometimes he gets bullied or alienated because he can't do the things other kids are doing - Single father with young child.

For some participants social isolation was self-imposed. They described the shame and hesitation they felt in inviting people over to their cold house (14),

and the extent they would go to, to hide the cold living environment from their friends and family (18).

> I was ashamed of the way I was living…hiding in the cold…I rarely have people over because it's just too cold in the house…when my daughter came over to visit I made sure that I turned the heating on before she came…she didn't have a clue about how I was living…I was too ashamed to tell her - Elderly woman with grown-up children.

The "time poverty" issue raised by some participants compounded the difficulties associated with fuel poverty. These participants (5) spent a significant amount of their time searching for, cutting, and tending to firewood or other sources of heat. Participants shared how this impacted on the amount of time available to spend with family or pursue social activities.

> The first winter I was here, I was paranoid about using the heat pump and avoided turning it on…I used the fireplace a lot and I had to cut firewood all the time…the fire goes on 24 hours in this house …all the routines were around the fire…I didn't have time to spend with my kids…I am out all weekend scavenging for free wood - Single father with two kids.

Many participants highlighted living in fuel poverty impacted on their quality of life in a wide array of ways, including social isolation and ability to participate in what other members of the society are engaged in. This often resulted in participants resorting to numerous coping mechanisms to adapt to living in energy hardship.

5.1.3 Barriers and support systems to coping with energy hardship

The participants described a variety of strategies they utilized to cope with living in energy hardship. A range of techniques were used to deal with maintaining their everyday life and restoring a level of normality to the quality of their lives. This included managing the various barriers and support systems that influenced their energy consumption choices (Sweeney et al., 2013). The poor conditions of the house and energy inefficient appliances were noted by many participants as their biggest barriers to a warm and dry house.

> This is a big, old house …even if we heated it the heat goes out so fast through these draughty windows …in the past I've had to ask my daughter for help in paying the bills…it's a terrible way to live asking your children for help - Elderly couple with grown-up children.

> This is a badly positioned house …we get maybe three to four hours of sun a day in winter …there's nothing I can do to warm up this

> house …it's freezing inside…on top of that the heat pump is in a silly place - Single father with one child.

One of the coping mechanisms to energy hardship was to tap into the support systems available for these households (Sweeney et al., 2013). Asking for help from family and friends (6), or pursuing external funding for paying electricity bills (11) were highlighted as temporary solutions to coping with energy hardship. Increased use of food banks (24) were also noted as a way of managing the household budget during winter.

> This week I spent on a second-hand winter jacket…and now I don't have money for food…I've got to get to the Food bank and ask if I can get a food parcel this Friday…the Food bank has been great…I don't know what I would have done without them this winter…I've been so nervous about losing power that I've been topping up the card (for the pre-payment meter) and not having money left over for anything else - Retired, elderly woman.

While participants shared the barriers in place that were hindering their ability to minimize being in fuel poverty, they also shared the support system in place that helped them. Support such as help from family and friends, and external agencies were particularly noted.

> Once the gas bottle runs out, it runs out…it had run out in the past and I've just survived with extra clothes on…sometimes my mum helps to fill up the gas bottle which is a big help - Single male, living alone.

Discussion

This study focused on the wide ranging impacts of living with energy hardship. Our findings contribute to the literature by showing that the experiences of fuel poverty influenced broad aspects of participants' lives and were closely related to their overall quality of life (Harrington et al., 2005; Liddell, 2008). The social disadvantages households face on a daily basis, and the sustained challenges that fuel poverty imposes on their capacity for participation and inclusion in society were highlighted (Rashbrooke, 2013; Eaqub and Eaqub, 2015).

Building on the PBECF (Sweeney et al., 2013), our study reveals that fuel poverty is affected by the material conditions of the house (whether dwellings have insulation, energy efficient heaters or the type of electricity scheme used); norms and beliefs held by the inhabitants (if the householders believe it is important to keep the house warm, and expectations around energy usage amongst inhabitants); and the daily practices householders perform (such as

coping mechanisms of putting on more layers instead of turning the heating on). In addition to these, participants focused on the barriers they faced such as energy inefficient appliances, and the support mechanisms like help from family that eased the energy hardship experienced by them. Table 2 summarizes these different variables identified through the narratives. Figure 2 presents a schematic diagram that captures these diverse choices and coping behaviours of households in fuel poverty. It also emphasizes the barriers and support systems which influence the energy choice of inhabitants, and shows the interlinked relationship of the themes identified in this study.

Table 2:**Conditions of house and appliances**

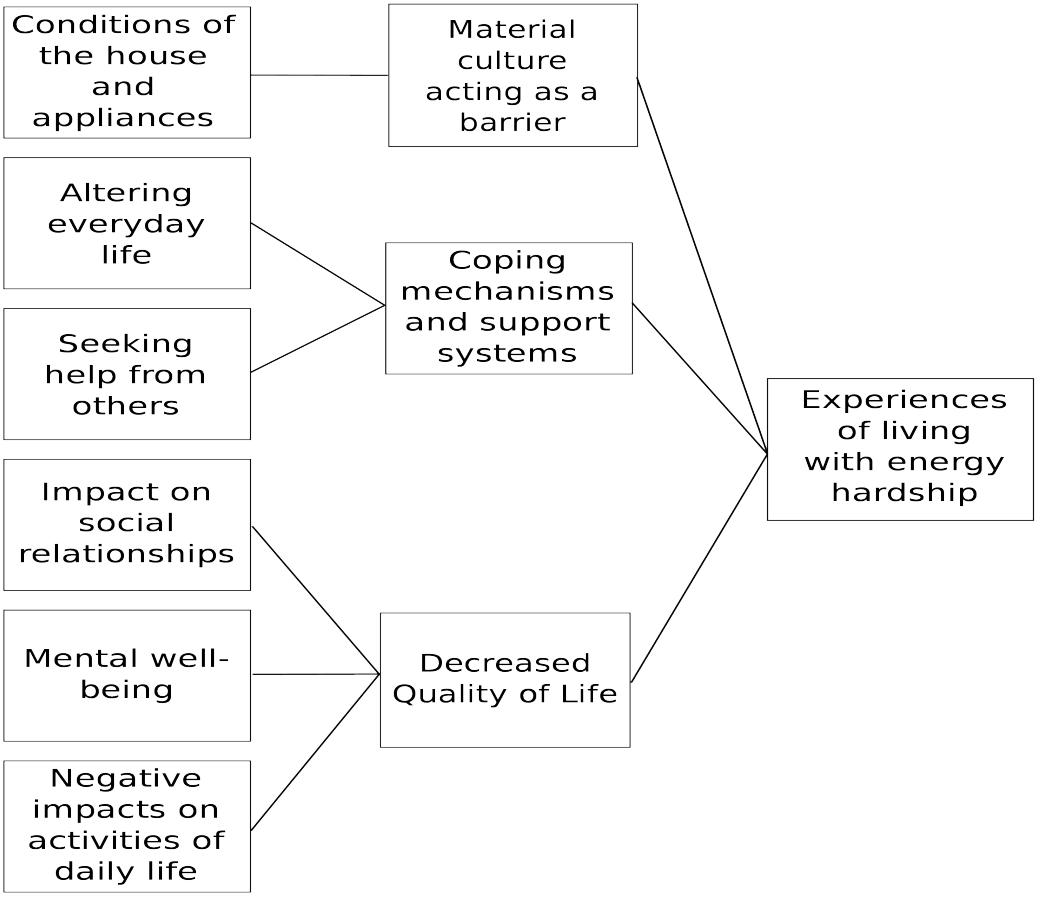
Lack of proper insulation (30)
Living in rental properties (17)
Positioning of the house/lack of sun (8)
Heat pump not in the most effective place (6)
Single paned windows (30)
Absence of thermal curtains (28)
Draughty doors and windows (24)
Presence of mould and condensation (24)
Open fireplaces (9), Portable electric heaters (15)
Altering everyday life
Decreased spending on food (27), doctor's visits (24) and prescriptions during winter (24)
Confining activities to one room (28) or staying in bed to stay warm (21)
Limiting energy use such as not turning on the heater until it is very cold (26), heating one room (25) or limiting hot water use (17)
Decreased socializing (14), going out for meals (20) or having people over for meals during winter (17)
Going to extreme lengths to hide the cold house from others (18)
Cut back on transportation to allocate money for energy bills (8)
Impact on social relationships
Social isolation, ashamed to invite people over to cold house (14)
Changed social relationships, not being able to participate in activities others are doing (20)
Increased amounts of time spent sourcing for wood/ways to pay power bills, resulting in less time with family (8)
Seeking support from others
Increased use of foodbanks during winter (24)
Asking for help from family members or friends (6)
Tapping into external funding sources to pay power bills (11)
Being aware of the various electricity and insulation schemes (6)
Impact on mental well-being
Constant worry and distress over power bills, budgeting for other expenses, and not being able to save money (23)
Sense of inadequateness and isolation, and arguments over power usage and bills (13)
Sense of frustration and anger over lack of control of thermal comfort of the house (9)

NB: Variables influencing the experiences of living with energy hardship. Numbers in parenthesis indicates the number of participants who identified with the experience.

Stephenson et al. (2010) and Sweeney et al. (2013) concluded that energy consumption is influenced by the internal and external physical, cultural and

social components around individuals (Stephenson et al., 2010; Sweeney et al., 2013). Similar to Sweeney et al. (2013)'s findings, participants in our study reported that the conditions of their material culture and the cost of electricity limited their energy choices. While Sweeney et al. (2013) found reducing the impact on the environment to be an important motive for reducing energy consumption, for the participants in our study, limited income largely restrained how they chose to use energy.

Figure 2: Major components of energy hardship experiences



Barriers such as the poor condition of the dwelling and energy inefficient appliances, limited income, and the high costs associated with upgrades were

preventing participants from making the necessary changes to make their house warmer and drier. For example, several participants reported that the heat pump was not located in the most ideal place. Instead of the heat pump being in a place where occupants spend most of their time, it could be in a hallway or in a bedroom which was not as effective. Many participants also noted that being in a rental property acted as a barrier to the changes they can make to improve the energy efficiency of the house. Barton (2010) supported this by concluding that renting could be a barrier for many tenants as some landlords had little incentive for investing in extra insulation or energy efficient appliances (Barton, 2010).

Participants shared how the social and economic factors linked to energy hardship exacerbated the hardship and exclusion they felt. Energy restrictions deprived people from access to many resources and opportunities that other households were engaged in. For example, prioritizing energy bills may restrict the financial means for upskilling, which in turn restricts the prospects for advances in employment. Without access to these resources and opportunities, climbing up the social ladder is even more challenging, a notion echoed by research in inequality (Wilkinson and Pickett, 2009). The consequences for the low income households are made worse with limited income being used on low quality energy appliances used at low efficiency, reducing their ability to accumulate the resources they need to upgrade to energy efficient appliances or dwellings.

Differences in values and norms amongst householder members were also identified as a barrier to energy usage. This was most prominent amongst students flatting together or amidst families where household members brought in conflicting expectations and goals. The importance values play in relationships have been highlighted by Schwartz (2012), stressing how different values are interconnected and influence each other (Schwartz, 2012). The beliefs participants held around the importance of a warm home impacted on how they used energy, as well as how they interacted with other household members. Similar findings were reported by Harrington (2005) showing how experiences and expectations influence tolerance to living in cold homes (Harrington et al., 2005). Research in India by Poortinga (2004) found that values around energy are strongly linked to specific beliefs held by inhabitants (Poortinga et al., 2004). Similarly Wilhite (1996) showed how cultural factors shaped differences in energy end use patterns in Japan (Wilhite et al., 1996). An example noted was the Japanese bathing routine, which is very important to the

Japanese lifestyle, and at the same time very energy intensive. As Stephenson et al. (2010) and Sweeney et al. (2013) observed in their findings, the role of values and expectations were clearly evident in the current study as well. Participants recalled how differences in beliefs around energy consumption resulted in stress and conflict in relationships with household members.

It was also clear from our findings that the norms and practices around energy consumption were closely related to the household situation. For example, families shared how they prioritised keeping the house warm for their children, and would only turn the heating on before the children came home from school. This is consistent with findings from Harrington (2005) (Harrington et al., 2005) and others (Action, 1999; Anderson et al., 2012) who found similar results showing that families with young children are more willing than others to go into debt to stay warm.

Participants also highlighted the various means of support that were available to them. Help provided by family and friends, as well as social institutions were acknowledged. The food bank and the curtain bank offered significant help for the participants during the winter months when power bills were prioritized over food. Participants noted the benefits of being aware of the various insulation schemes and electricity supplier schemes which helped them cope better with energy hardship. For example, some participants were on the 'smooth pay' electricity scheme which allowed them to pay a smaller fixed amount towards energy bills every week instead of a bulk monthly bill, making it easier to budget household expenses. It is also important to note that several participants were not aware of the insulation schemes, especially help available for those living in rental properties. This finding complements similar research showing that information limitations act as a constraint for households in fuel poverty, and often the advice given to such households does not take into account the wider lives of those in fuel poverty (Harrington et al., 2005; Hedges, 1996; Sadler, 2002). The results of this study conclude that a cold home cannot be evaluated in isolation from its social factors, and a better understanding of the wider socio-technical systems that influence fuel poverty need to be incorporated in future measures.

Conclusion

The findings of this study signify that fuel poverty has wider implications than previous literature indicates, affecting many aspects of participants' daily lives,

their participation in society and quality of life. This in-depth understanding of fuel poverty and the different mechanisms of coping with it would aid in designing interventions to tackle fuel poverty. Policy makers could consider the variability of energy usage in relation to family type, health needs, cultural and social contexts of households. Respondents identified the indirect effects of living in energy hardship, such as worry, social isolation and impact on relationship. Policy makers need to recognize these equally damaging broader consequences of fuel poverty. As a result of this study, detailed knowledge of the experiences of energy hardship has emerged. While the PBECF framework provided a rich set of data by bringing together the wider aspects of fuel poverty, future research could focus on how the various elements of the framework are embedded in the broader systems, such as policy and environmental stimuli that influence energy consumption.

This article contributes to the field of fuel poverty research by providing an in-depth look at the wider social implications of fuel poverty through the voices of fuel poor households. We demonstrated how the energy cultures of inhabitants shape and influence their energy choices, and how the barriers and support systems impact on fuel poverty levels. Policy makers may benefit from understanding the interaction between the behavioural, social and environmental factors to devise programmes and policies to alleviate fuel poverty in New Zealand. Energy hardship is complex and has wide ranging consequences for family and society. Providing a voice for fuel poor households will enable better informed policy-making and add significant value to expanding fuel poverty research.

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References

Action, N.E. (1999) Measuring the difference. *Technical report, National Energy Action.* Newcastle upon Tyne.

Anderson, W., White, V., and A., F. (2012) Coping with low incomes and cold homes. *Energy Policy 49*.

Barton, B. (2010) Energy efficiency and rental accommodation: Dealing with split incentives. *Energy Policy*.

Bell, M., Lowe, R., and Robters, P. (1996) *Energy efficiency in housing.* Ashgate Publishing. Aldershot.

Black, J., Stern, P., and Elworth, J. (1985) Personal and contextual influences on household energy adaptations. *Journal of Applied Psychology. 70, 3-21.*

Boardman, B. (1991) *Fuel poverty: from cold homes to affordable warmth*. Belhaven Press.

Boardman, B. (2010) *Fixing fuel poverty: challenges and solutions*. Earthscan.

Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative research in psychology*.

BRE (Building and Research Establishment) (2006) *Fuel poverty methodology documentation.* Technical report, BRE.

Clinch, J. and Healty, J. (2001) Cost-benefit analysis of domestic energy efficiency. *Energy Policy*.

DEFRA (2001) The united kingdom fuel poverty strategy: First annual progress report. *Technical report, Department of Environment, Food and Rural Affairs,* London.

Eaqub, S. and Eaqub, S. (2015) *Generation Rent: Rethinking New Zealand's Priorities.* Bridget Williams Books.

Fahmy, E. (2011) The definitions and measurement of fuel poverty. *Technical report, Consumer Focus Briefing Paper.*

Geller, H. (2003) *Energy revolution: policies for a Sustainable future*. Island Press.

Glaser, B. and Strauss, A. (1967) *The discovery of grounded theory: strategies for qualitative research*. Aldine: Chicago.

Harrington, B., Heyman, B., Merleau-Ponty, N., Stockton, H., Ritchie, N., and Heyman, A. (2005) Keeping warm and staying well: findings from the qualitative arm of the warm homes project. *Health and Social Care in the Community, 13(3), 259-267*.

Heberlein, T. and Warriner, G. (1982) The influence of price and attitude on shifting residential electricity consumption from one to off-peak periods. *Journal of Economic Psychology (4)*

Hedges, A. (1996) *Attitudes to energy conservation in the home: report on a qualitative study.* Department of Environment, HMSO, London.

Heffner, G. and Campbell, N. (2011) Evaluating the co-benefits of low-income energy-efficiency programmes. *Technical report, International Energy Agency.*

Hills, J. (2012) Getting the measures of fuel poverty: final report of the fuel poverty review. *Technical report, Centre for Analysis of social exclusion.*

Howden-Chapman, P. (2005) *Unequal socioeconomic determinants, unequal health*. Oxford University Press.

Howden-Chapman, P., Viggers, H., Chapman, R., O'Sullivan, K., Telfar Barnard, L., and Lloyd, B. (2012) Tackling cold housing and fuel poverty in New Zealand: a review of policies, research, and health impacts. *Energy Policy*.

Isaacs, N., Camilleri, M., French, L., Pollard, A., Saville-Smith, K., and R, F. (2006) Energy use in New Zealand households: Report on the year 10 analysis for the Household Energy End-use Project (HEEP) *Technical report, New Zealand: BRANZ*, Judgeford Ltd.

Lawson, R. and Williams, J. (2012) The nature of fuel poverty in New Zealand. *Australia and New Zealand Academy of Marketing (ANZAMAC)*

Lewis, P. (1982) *Fuel Poverty can be stopped*. National Right to Fuel Campaign.

Liddel, C. (2010) Fuel poverty and human health: a review of recent evidence. *Energy Policy 38*.

Liddell, C. (2008) *The impact of fuel poverty on children*. Save the Children.

Lloyd, B. (2006) Fuel poverty in New Zealand. *Social Policy Journal of New Zealand, 14*.

Lloyd, B. and Callau, M. (2009) Retrofit interventions to enable healthy living conditions in existing New Zealand houses. *Technical report, Energy efficiency and conservation authority.*

Lutzenhiser, L. (1992) A cultural model of household energy consumption. *Energy, 17 (1)*

Lutzenhiser, L. (1993) *Social and behavioural aspects of energy use*. Annual Reviews Energy Environment.

Lutzenhiser, L. (2014) Through the energy efficiency looking glass. *Energy Research and Social Sciences, 1 (141-151)*

Middlemiss, L. and Gillard, R. (2015) Fuel poverty from the bottom-up: characterising household energy vulnerability through the lived experiences of the fuel poor. *Energy Research and Social Sciences 6 (146-154)*

Ministry of Education (2007) *The New Zealand curriculum.* Wellington, NZ: Learning Media Ltd.

Ministry of Social Development and the Energy Efficiency and Conservation Authority (2010) *Household Energy Affordability: A Literature Review*. Ministry of Social Development and energy Efficiency and Conservation Authority.

Moezzi, M. and Janda, K. B. (2014) From "if only" to "social potential" in schemes to reduce building energy use. *Energy Research & Social Science 1, 30-40*.

Osbaldeston, J. (1984) Fuel poverty in UK cities. *Cities 1*.

Pachauri, S. and Spreng, D. (2011) Measuring and monitoring energy poverty. *Energy Policy 39*.

Patterson, M. (1996) What is energy efficiency? concepts, indicators and methodological issues. *Energy Policy 25 (5)*

P.C., S. and Oskamp, S. (1987) *Handbook of environmental psychology*, chapter Managing scarce environmental resources. Wiley, NY.

Pereira, M., Freitas, M., and de Silva, N. (2011) The challenge of energy poverty: Brazilian case study. *Energy Policy*.

Poortinga, W., Steg, L., and Vlek, C. (2004) Values, environmental concern and environmental behaviour: A study into household energy use. *Environment and behaviour journal. 36 (1) 70-93.*

Povey, D. and Harris, U. (2004) Old, cold and costly? a survey of low income private rental housing in Dunedin in 2004. *Technical report, Presbyterian Support Otago.*

Rashbrooke, M. (2013) *Inequality: A New Zealand Crisis*. Bridget Williams Books.

Royston, S. (2014) Dragon-breath and snow-melt: Know-how, experience and heat flows in the home. *Energy Research Energy Research and 2 (148-158)*

Sadler, R. & Hammersley, G. (2002) *Report on the quality of energy efficiency advice provided by gas and electricity suppliers.* Ofgem, London.

Schwartz, S. (2012) An overview of the Schwartz theory of basic values. *Online Reading in Psychology and Culture 2(1)*

Seligman, C., Kriss, M., Darley, J., Fazio, R., Becker, L., and Pryor, J. (1979) Predicting summer energy consumption from homeowners' attitude. *Journal of Applied Social Psychology (9)*

Services, E. H. M., the Centre for Research, E., and Assessment., S. (2007) Final report: The energy efficiency characteristics of New Zealand houses and household receptivity to a home energy rating scheme. *Technical report, The Energy Efficiency and Conservation Authority.*

Shen, M. (2004) Efficacy of the energy efficiency upgrades in public housing in southern New Zealand. *Master's thesis, University of Otago.*

Shove, E. (2003) *Comfort, cleanliness and convenience*. Berg: Oxford.

Silverman, D. (2000) *Doing qualitative research: A practical handbook*. London: Sage Publications.

Sovacool, B. (2014) What are we doing? analyzing fifteen years of energy scholarship and proposing a social science research agenda. *Energy Research and Social Sciences. (1) 1-29.*

Stephenson, J., Barton, B., Carrington, G., Gnoth, D., Lawson, R., and Thorsnes, P. (2010) Energy cultures: A framework for understanding energy behaviours. *Energy Policy 38*.

Stern, P. (1977) Energy behaviour. *Environment (19)*

Stern, P. (1984) *Energy Use: the human dimension*. Washington DC. Nat. Acad. Press.

Stern, P. (1986) Blind spots in policy analysis: what economics don't' say about energy use. *Journal of Policy (5)*

Stern, P. (2014) Individual and household interactions with energy systems: Towards integrated understanding. *Energy and Social Sciences 1. 41-48*.

Sweeney, J., Kresling, J., Webb, D., Soutar, G., and Mazzarol, T. (2013) Energy saving behaviour: Development of a practice-based model. *Energy Policy 61, 371-381*.

Verhallen, T.M.M & Van Raaij, W. (1981) Household behaviour and the use of natural gas for home heating. *Journal of Consumer Research 8, 253-257.*

Wilhite, H., Nakagami, H., Masuda, T., Yamaga, Y., and Haneda, H. (1996) A cross-cultural analysis of household energy use behaviour in japan and Norway. *Energy Policy. 24(9) 796-803*.

Wilkinson, R. and Pickett, K. (2009) *The spirit level: why equality is better for everyone.* Penguin books.

Wilson, C. and Dowlatabadi, H. (2007) Models of decision making and residential energy use. *Annual Review of Environment and Resources 32, 169-203*.

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