

# Power and Control:

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## A multiphase mixed methods investigation of prepayment metering and fuel poverty in New Zealand.

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## Abstract

Fuel poverty, (the inability to afford adequate household energy services, including healthy indoor temperatures) is a significant public health problem currently estimated to affect 25% of households in New Zealand and the cost of electricity is a key driver. Despite widespread international recognition, fuel poverty is not officially defined, measured, or explicitly targeted by government policy in New Zealand. Prepayment metering is an electricity payment method used predominantly by low-income consumers. It carries the risk of users not crediting their electricity meter or 'self-disconnecting', which may have serious health implications. Official figures suggest around 3% of households may be using prepayment metering, although there is no routine collection of data.

This thesis examines the relationship between prepayment metering, in its present form, and fuel poverty in New Zealand through four discrete phases of research. This multiphase mixed methods programme of research draws from pragmatism, translational research, and socio-technical systems theories.

A price comparison analysis found that using prepayment metering for electricity was always more expensive than other payment methods in four cities.

A national-level postal survey of 768 electricity prepayment metering consumers was conducted in 2010 (response rate 48%). The survey found that households using prepayment meters are typically on low-incomes, Māori and Pasifika households are over-represented, and 54% of include children. Major findings were that 52% of respondents self-disconnected at least once in the past year; of concern, one third of these respondents were without electricity for  $\geq 12$  hrs, and 17% self-disconnected six or more times.

A follow-up postal survey with the same cohort in 2011 (n 324, response rate 61%) investigated patterns of self-disconnection over time and home heating practices of

this vulnerable group. Key findings were that self-disconnection remained problematic over time, that prepayment metering encouraged restriction of space heating in already cold homes, and over two thirds experienced shivering indoors at least once during the winter.

An integrative analysis of the survey results compared the outcomes for households with and without children, responding to policy discussion. This found that households with children experienced greater hardship and were significantly more likely to restrict grocery expenditure in order to afford prepayment meter credit.

A final study used qualitative description to explore household management of electricity expenditure and consumption through in-depth longitudinal interviews with 12 households. Extensive descriptions of advantages and disadvantages of prepayment metering, budgeting for electricity and of electricity end-uses, and socio-technical interactions between householders and their prepayment meters were attained.

Overall, this research shows prepayment metering consumers are at greater risk of fuel poverty than the general population. Rationing electricity consumption below requirements for maintaining health and wellbeing is a significant problem; yet despite this, self-disconnection remains a consequence of fuel poverty for many households. Government intervention could reduce the risks and capture the benefits of prepayment metering. Other policies could enhance housing energy performance and reduce fuel poverty. An approach to defining and measuring fuel poverty is indicated. Policy recommendations for reducing fuel poverty, with particular attention to prepayment metering, are developed from this research.

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David, thank you. Arohanui.

Hugo, thank you for sharing this journey with me and for providing the best motivation I could have to finish my 'moring' work. 'Mum-on', let's go play.

Kimberley O'Sullivan, December 2012





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## Personal Preface

I would like to preface this thesis with a personal reflection explaining my pathway to this research. Before embarking on this PhD journey, I had eclectically gathered triggers for my interest in fuel poverty from a number of sources. Before studying public health I had been interested at the lack of basic infrastructure and services in towns and cities I had visited in southern India. Returning home, I explored a new aisle of my public library, and became intensely interested in public health after reading Laurie Garrett's *Betrayal of Trust: The collapse of global public health* (1).

I began working in the Office of the Minister of Energy as a Ministerial Assistant, where my job involved taking calls, and tracking correspondence from the public. I was struck by the number of complaints the Minister received from older people struggling with unaffordable electricity bills, and cold homes. This was a problem I had previously thought limited to students, and particularly 'scarfies'<sup>1</sup>, having experienced the grim reality of living in a cold indoor environment whilst studying undergraduate papers in Dunedin.

Simultaneously, I commenced study in postgraduate public health. While studying Public Health and Social Policy, taught by Professor Philippa Howden-Chapman, I became interested in investigating further the problem of unaffordable electricity in New Zealand from a public health perspective. For my Master in Public Health research, I completed the qualitative component of the Warm Homes for Elder New Zealanders: Pilot Study, a narrative interview study, in which I spoke with nine older Māori people suffering Chronic Obstructive Pulmonary Disease (2). For this study participants received \$500 *credited* to their electricity accounts to assist them with achieving healthy indoor temperatures. My Master's research explored

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<sup>1</sup> Students of the University of Otago, in the South Island city of Dunedin are known as 'scarfies', after their typical winter scarves, often worn indoors in cold student flats. See <http://www.teara.govt.nz/en/otago-places/7/2> (accessed 21 October 2012) for a poster picturing typical student housing in Dunedin.

the social implications of fuel poverty in New Zealand, and found that fuel poverty is a real problem experienced by the participants in the study and in their community, and that electricity vouchers are a useful tool that could be used as part of a range of policy options to reduce fuel poverty.

This study also sparked an interest in the use of prepayment metering to pay for electricity, as one of the families I had spoken to were regularly switching their mains electricity supply off at the meter board during winter days while the children were at school, in order to ration the credit on their prepayment meter. Kahu and Howard<sup>2</sup> were raising their three grandchildren, and the family income was made up of sickness and invalids benefits due to their poor health. At one point when they had run out of credit the day before their benefit payments were due, Kahu, who used a nebuliser to assist her breathing at night, was admitted to hospital until their electricity was reconnected through crediting the meter. They told me that they would prefer to continue rationing their electricity using the meter board mains switch rather than access an unaffordable loan from Work and Income to credit their prepayment meter in advance of their benefit payments.

Following my Master's I investigated the portrayal in the newspaper media of the widely publicised death of Mrs Folole Muliaga, who used an oxygen machine due to her ill health and had died shortly after the electricity supply to her household was disconnected for non-payment. My interest in this case sprang from concerns among my research participants, who had raised her story unprompted, as her death had occurred just prior to my conducting the interviews for my Master's research. I undertook a thematic analysis, together with my PhD supervisors, and found that despite a large volume of public commentary, the public health voice was missing from the newspaper media, and Mrs Muliaga's death was not used as an example of the difficulties faced by households suffering fuel poverty (3).

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<sup>2</sup> pseudonyms



Enrolling in my PhD, I set out on my path with the ambitious idea of broadening my horizons and investigating not just fuel poverty, but multiple utilities poverty, having become interested in the situation of households who struggle to maintain access to other utilities such as telecommunications and water, in addition to household energy including electricity and gas. I was concerned for the additional difficulties that climate change and related policies would impose on these households, which might be marginalised from participating in 'normal' society without adequate access to utilities services. Facing some useful scepticism about the size of such a project from senior colleagues in my department, I revised this down to investigating the effect of paying for electricity and water utilities on New Zealand households.

I appreciated the interest in water issues shared by colleagues in the FRST-funded Community Vulnerability and Resilience to Climate Change, the project from which my stipend to undertake my PhD was gratefully received. As I investigated water payment issues, particularly those relating to the introduction of water metering and volumetric charging around New Zealand, I encountered several other researchers and postgraduate students interested in this area. The same could not be said for the area of fuel poverty.

I also struck a technical hitch when the study that I originally proposed, a face-to-face survey of prepayment meter users, proved impossible to design and implement in practice, and I was unsure what additional benefit over a postal survey design the complications of the former would yield. I was very keen to ensure that any data I obtained about the scope of prepayment meter use, especially with respect to self-disconnection outcomes, were nationally representative and could be translated to policy. For these reasons when it came to coordinating the postal survey and approaching and working with electricity retailers, the survey could not be overly long and complicated; the originally planned questions regarding water metering were cut to avoid geographical

differences in the questionnaires. Furthermore, the opportunity to extend the survey by using the results to inform the *Metered Out* interview study, which aimed to explore the use of prepayment metering and another form of in-home display on household management of electricity use, and could contribute a chapter to my thesis arose. This helped to crystallise my ideas about my thesis as a mixed methods investigation into fuel poverty and prepayment metering in New Zealand.

At this point the word of my long-time hero, the Lorax, seemed perfectly clear, for as the Onceler explained:

*“UNLESS someone like you cares a whole awful lot, nothing is going to get better. It’s not.”* (4, p58, original emphasis)

I did care, and still do as I am approaching the end of my PhD journey, a whole awful lot about the vexed problem of fuel poverty in New Zealand. I hope that the information that the research detailed here will help to begin fulfilling one of my career objectives; to complete quality research which usefully contributes to policy that enhances public health.

I am encouraged in my endeavours to suggest practical policy recommendations on the basis of this research, which will require government intervention in the electricity market to reduce inequalities, by the concluding remarks of Wilkinson and Pickett:

*“The culture of the last few decades has reduced us to closet egalitarians: it is time we came out of the woodwork and set a course for sanity.”* (5, p274)

Kimberley O’Sullivan, December 2012.

## Chapter One:

### Introduction

*“Medicine is a social science, and politics is nothing but medicine on a grand scale.”*

(Rudolf Virchow, 1957)

Fuel poverty has been defined as the inability of a household to afford adequate energy services for all activities within the home, including heating to healthy indoor temperatures, for 10% of income (6-8). Fuel poverty is distinct from poverty in general, as it takes into account the contribution of inadequate income, energy inefficient housing and heating sources (6), with fuel prices, and electricity prices particularly in New Zealand, being important contributing factors (9, 10). While recent estimates suggest that one in four New Zealand households may be experiencing fuel poverty (10), there is no official definition, measurement, or government policies specifically targeting fuel poverty (11). Fuel poverty is not mentioned in the Government’s most recent Energy Strategy, nor is there any indication that electricity services should be accessible across society in this key document (12).

Overseas evidence, and previous research with older people who were estimated to be in fuel poor situations, suggested that households using prepayment metering, a pay-as-you-go method used predominantly by low-income households, may be at particular risk of fuel poverty and the associated poor health and wellbeing outcomes in New Zealand (2). The present thesis follows a progressive multiphase mixed methods investigation of fuel poverty in New Zealand, focussing on prepayment meter consumers as an at-risk population, who could be easily targeted by policies that would improve outcomes and mitigate the extent of fuel poverty.

Each study reported was informed by the previous, and overall contributed to the inductive mixed methods analysis presented here.

Fuel poverty is a multi-sectoral problem, with several causal factors that are typically located within energy, housing, economic, and welfare policy settings. The outcomes of fuel poverty are also broad, but fit within the theory and practice of modern public health, discussed below to firmly locate this thesis.

### **1.1 Public health and the social determinants of health**

Public health has long held that reducing socioeconomic inequalities is critical for promoting and maintaining population health. Even during the nineteenth century when miasma was thought to be the cause of ill-health, and germ theory was developing, it was considered that the health risks of the poor were greater as was their exposure to both miasma and germs due to living standards (13). In the mid-nineteenth century, the research of Virchow in Germany, Villermé in France, and Alison in Scotland, highlighted socioeconomic policies and living conditions as factors of disease, and advocated welfare policies for those in need (14, 15).

During the twentieth century, public health was medicalised, with the focus in most OECD countries shifting away from 'social measures' to individual targeting using medical science, and it was believed that economic growth would bring improvements to population health (13). However, Szreter argued that *"in almost every historical case, the first and most direct effect of rapid economic growth has been a negative impact on population health"* (16, p424). Only in Sweden, where welfare infrastructure policies were administered in anticipation of economic growth, did population health benefit from industrialisation (16).

Newer evidence for public health policy to address the growing inequalities in health was provided by the 1980 publication of the Black Report in Britain. This report explained social class differences and health inequalities, refuting individual causation in favour of interactive social factors, but was rejected by the Thatcher government (17, 18). During the 1990s, socioeconomic determinants of health and health inequalities gained increasing attention with a wealth of research and commissioned reports, particularly in the United Kingdom, drawing conclusions that inequalities have negative health outcomes (18). Marmot and colleagues compared three large sample studies to show a *“consistent link between poverty and ill health”* with a clear social gradient favouring those in higher occupational classes (19, p906). Graham described *“pathways of disadvantage”*, that could be addressed by policies targeting life transitions that pose further risk to those in marginal positions in society (20). Howden-Chapman included *“a household income that is not markedly below the average, employment, safe working conditions, education, an adequate diet, warm dry housing and family support”* in a description of the necessary socioeconomic determinants for good health (21, p66).

Households that experience inequalities in housing, income, and other socioeconomic areas, are often exposed to fuel poverty. As a result of these interacting factors, the fuel poor are exposed to a broad range of negative health and wellbeing outcomes, making this a problem of health inequalities.

## **1.2 Public health in the 21<sup>st</sup> century: Focus and roles**

The early twenty-first century has provided further evidence that health inequalities are caused by unfair social inequalities (5, 22). The World Health Organization highlighted ten key social determinants of health and outlined policies to address these in 2003 (23), and later established the Commission on the Social Determinants

of Health to address widening inequalities within and between countries. One of the key recommendations to reduce inequalities from the 2008 report of the Commission was to *“Tackle the inequitable distribution of power, money, and resources.”* (24). Recent work of the World Health Organization has highlighted that public health must continue to focus on addressing the social determinants of health identified in order to improve population health in the twenty-first century<sup>3</sup>. Dew argues that the dual advocacy and academic roles of public health make it *“an institution that performs a moral regulatory function in contemporary society”*, acting to temper the different regulatory regimes of other institutions such as the state, the market, and public health academia itself with reference to health promotion practices (25, p146).

A lack of political will, vested corporate interests with lobbying power, and continued focus on economic measures of success have prevented what is known about the social determinants of health and inequalities from eliminating or even markedly reducing the problems. Crouch describes the political situation of the United States of America, and much of Western Europe as a state of *“post-democracy”*, where politics is shifting on a parabola away from maximal democracy (26). He maintains that *“powerful minority interests have become far more active than the mass of ordinary people in making the political system work for them”* and *“political elites have learned to manage and manipulate popular demands”* (26, p19). Starfield similarly asserts that *“Even the best evidence and most consistent public support fails to change policies when interests in maintaining the status quo have the power to thwart change”* (27, p654). These authors point to the contributions of corporate entities that lobby politicians and provide political funding, achieving policy agendas that are not in the public interest. Broader measures of success than simply gross domestic product or gross national product have been suggested as a means to shift the focus of governments to addressing inequalities affecting health (28, 29). Wilkinson and Pickett suggest that the way forward is to begin by addressing *“corporate power – the*

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<sup>3</sup> [http://www.who.int/social\\_determinants/en/](http://www.who.int/social_determinants/en/) accessed 18 September 2012

*elephant in the living room*", through alternative corporate structures such as employee-ownership models, which will help to reduce the wage gap between management and staff, and promote greater participation and equality in workplaces (5, p249).

Various strategies for public health to reduce inequalities have been put forward, with calls for greater involvement of the public health academia and practitioners in the media, political, and corporate realms that they have traditionally largely been uncomfortable entering. Reilly and McKee return to the ideas of Virchow in an analysis of economic and democratic political systems and put forward a similar argument that modern western political systems are better viewed as *"decipractic (Latin root word = deceptio, meaning to 'deceive')"*, with democratically elected leaders having unspoken agendas (30, p305). They argue that the decipractic state requires public health to engage through media and social media to quickly counter propaganda, helping to reclaim *"politics as a vehicle of change for the good"* (30, p306).

Mackenbach goes further, suggesting a *"ladder of political activism"* for public health professionals (31, p183). On the bottom rung, *"political passivism"*, public health would provide politicians with advice only when asked; on the second rung, public health practitioners would actively disseminate research to media and politicians; on the third rung public health practitioners would actively attempt to influence the political process; and on the fourth or top rung, public health practitioners engage in politics and gain political or government positions to achieve their aims (31).

This public health thesis seeks to fulfil an advocacy role, developing and disseminating suggestions for public policy which will improve health through the social determinants pathway. Where opportunities for activism have risen during the thesis, I have sought to place fuel poverty on the policy agenda.

### 1.3 Fuel poverty is a (de)regulatory issue

1.3.1 The electricity sector The deregulation of electricity markets as a result of neoliberal policies introduced in several countries has been provocatively described by Beder as a *“confidence trick, undertaken to swindle the public out of their rightful control of an essential public service; a trick conceived and perpetrated by vested interests that seek to gain from private control”* (32, p325). The deregulation of utilities markets, with a focus on using competition between companies to determine pricing, was shown by longitudinal surveys in the United Kingdom to have had negative distributional effects, when previous monopolies cross-subsidised prices to some household groups (33). Analysis of European deprivation statistics in relation to the privatisation of utilities markets has shown that unbundling vertical integration of electricity markets and privatisation of gas markets increases deprivation, measured by the number of households unable to pay utility bills by the due date (34). Increasingly, supply-side companies are under foreign ownership, or held by large multi-national corporations, which are further removed from any social effects of their actions in the local setting, and raises issues of not only social but national security (32, 35, 36). As fuel prices obviously influence the proportion of income required to achieve adequate energy services, the regulatory governance of liberalised energy markets plays a pivotal role in fuel poverty rates.

The deregulated electricity market is an example that illustrates that inadequate regulation is at least partly to blame for a large part of the fuel poverty problem in New Zealand. The notion of electricity as an essential service for modern living has largely been lost in the current governance model of ‘light-handed’ regulation; continued privatisation of the electricity market is further evidence of this. Electricity, once viewed as a public utility in New Zealand, is shifting further to the corporate domain despite public unrest and evidence of increasing inequality of access to sufficient energy services. The replacement of the previous regulatory body, the Electricity Commission, with the current Electricity Authority in 2010,



reflects this with a shift in mandate away from delivering electricity fairly across all consumer groups, to promoting competition and economic efficiency (10).

These issues, combined with the housing, income, and other socioeconomic inequalities fuel poor households are exposed to, contribute to the fuel poor paying proportionally higher household energy expenses than their higher income counterparts. Further inequalities are created through the use of subsidies, such as prompt payment discounts, and penalty fees, for disconnection and reconnection, that are unevenly distributed across different population and consumer groups.

### **1.3.2 The housing sector**

In a similar way, the lack of good governance of the building and housing sectors in New Zealand has resulted in a housing stock of poor thermal efficiency and quality. For example, insulation standards have consistently lagged behind international best practice, and recent strengthening of the required standards for new-build housing still leave room for improvement (10, 37). The recent 'leaky homes crisis', caused by inadequate building regulations and poor construction provides another good example of how inadequate government oversight has contributed to the poor thermal efficiency of the housing stock, resulting in a costly problem which contributes to poor health (38).

With regards to rental housing, there are no mandatory insulation or housing quality standards that landlords must comply with (10). There is also no requirement that a heating source be available in rental homes – an electric socket is considered all that is legally required as this provides a means for an electric heating appliance to be used (10). Increasing evidence is becoming available to show that the rental housing stock is of poorer quality (39, 40) and contributes to poor health (41).

These housing sector issues contribute to health inequalities (42), and as thermal efficiency and availability of heating appliances are key drivers of fuel poverty, also contribute to fuel poverty in New Zealand.

#### 1.4 Fuel poverty is a social justice issue

As Boardman argues, *“everyone needs to purchase fuel to provide essential energy services, such as warmth, hot water and lighting. These are not discretionary purchases but absolute necessities”* (7, p48). Beder similarly writes, *“electricity is not a commodity that consumers can choose to take or leave depending on price and supply; it is an essential service that is central to the maintenance of modern lifestyles”* (32, p334). Fuel poverty has thus been considered using human rights and social justice frameworks, which highlight the resultant environmental and social injustices fuel poverty and ill-managed fuel poverty and climate change policies cause, and also acknowledge the global injustice of access to quality energy services (43). Walker and Day comment that fuel poverty is fundamentally, and has most commonly been framed as, a distributional justice issue (43): consistent with the philosophies of Rawls, whereby energy services can be viewed as a primary good which should be distributed as considered fairly if a person was operating under a *“veil of ignorance”*, unaware of their position in society (44); and the *capabilities* framework of Sen, whereby energy services are required for achieving valued functionings in everyday life of modern society (45). However, fuel poverty is also usefully highlighted by Walker and Day as an issue of *‘justice as recognition’*, in that a lack of recognition of the problem for different vulnerable groups acts to create inequalities; and also as a procedural justice issue, where the interests of those experiencing fuel poverty have limited influence over decision-making, particularly as compared to those whose interests fall on the *‘supply-side’* of the energy industry. For these reasons they argue that: *“addressing fuel poverty has to involve seeking justice in terms of the cultural and political recognition of vulnerable and*

*marginalised social groups and pursuing procedural justice through opening up involvement and influence in decision-making processes.” (38, p69).*

## **1.5 Fuel poverty is a public health issue**

This thesis is located at the complex intersections between public health, governance, and corporate interests highlighted above. Fuel poverty fits within the current framework of public health, and is noted in the World Health Organization Commission on the Social Determinants of Health as a problem fitting within the Shelter/Housing determinant (24). The direct health effects of fuel poverty are also becoming better understood, though further research in this area is required (see Chapter Four).

Fuel poverty has gained further interest in New Zealand over the course of this thesis, partly in response to dissemination of the research presented here (46-49). However, as was highlighted during media coverage of the death of Mrs Folole Muliaga in 2007, discussion of fuel poverty is still limited, and public health practitioners have appeared reluctant to enter media debate on the issue (3).

This thesis belongs in the academic field of public health because of its dual functions as an academic investigation and a means of disseminating evidence-based policy recommendations to advocate for the reduction of fuel poverty.

## **1.6 Thesis Outline**

This public health thesis investigates fuel poverty in New Zealand, focussing on the operation of a market-based strategy for debt management in the electricity sector, prepayment metering, and its effects on access to electricity services. It seeks to clarify the advantages and disadvantages of prepayment metering for consumers, through engaging with the corporate sector, in order to provide robust evidence-

based policy solutions that will help to improve population health through mitigating fuel poverty, a factor contributing to the social determinants of health.

### **1.6.1 Thesis research problem statement**

This thesis sets out to investigate the following research problem:

*Fuel poverty is estimated to affect one in four households in New Zealand, although an official definition and sufficient data are unavailable for assessing the extent and experience of fuel poverty. Prepayment metering has been found overseas to be more expensive than other payment methods for purchasing electricity, and it is expected that low-income households experiencing or at risk of fuel poverty are more likely to be using prepayment metering. Very little is known about the characteristics or experiences of consumers using prepayment metering in New Zealand. In the absence of other data to identify households experiencing fuel poverty, an investigation of the advantages and disadvantages of prepayment metering from a consumer experience is warranted.*

### **1.6.2 Thesis aim**

The aim of the thesis is to:

To explore in depth the experiences over time for New Zealand households using prepayment metering, and examine whether they are at increased risk of fuel poverty.

### **1.6.3 Thesis objectives**

The specific objectives of the thesis overall are:

- To explore in depth the experiences over time for New Zealand households using prepayment metering;

- To examine whether prepayment meter users are at increased risk of fuel poverty compared to the general population of New Zealand;
- To use a multiphase mixed methods research approach to provide a broad range of evidence, with data from the research phases integrated to increase the value and function of the findings to specific sub-populations such as children;
- To provide evidence-based policy recommendations and advocate for the reduction of fuel poverty and improvement of public health;
- To use the knowledge gained from undertaking this thesis to indicate an approach to defining and measuring fuel poverty in New Zealand.

#### **1.6.4 Thesis research programme**

To fulfil the aim and objectives of the thesis, a multiphase mixed methods research investigation into prepayment metering is employed. The following diagram sets out the four discrete research phases and an integrative research phase, each with their own aims and specific objectives, which make up the overall mixed methods research programme of investigation.

**Overall thesis research programme aim:** To explore in depth the experiences over time for New Zealand households using prepayment metering (PPM), and examine whether they are at increased risk of fuel poverty.

**Study 1**

Price Comparison Analysis

**Research Aim**

To investigate whether PPM is a more expensive payment option in NZ.

**Specific Objectives**

- To determine whether PPM is a more expensive payment method in NZ.
- To determine whether further examination of the use of PPM in New Zealand is warranted when considering fuel poverty.

**Study 2**

Nationwide cross-sectional postal survey

**Research Aim**

To investigate the advantages and disadvantages of PPM for consumers.

**Specific Objectives**

- To investigate the advantages and disadvantages of PPM;
- To determine the number of PPM users who self-disconnect;
- To investigate the causes of self-disconnection and the length of time households who disconnect are without electricity.

**Study 3**

Follow-up Postal Survey

**Research Aim**

To investigate self-disconnection, heating, and self-reported thermal comfort among PPM users.

**Specific Objectives**

- investigate whether patterns of 'self-disconnection' change over time;
- explore self-reported thermal comfort and heating practices of households using PPM.
- *determine whether PPM encourages the restriction of space heating?*

**Integrative Analysis**

Examining PPM survey outcomes for children

**Analysis Aim**

To investigate whether outcomes of using PPM differ between households with and without children.

**Specific Objectives**

- To examine indicators of hardship in households with children using PPM for electricity;
- To determine whether households with children are more likely to report self-disconnection in the past 12 months;
- To examine indicators of thermal comfort among households with children using PPM for electricity.

**Study 4**

Qualitative interview study

**Research Aim**

To qualitatively explore PPM outcomes, and effects on household electricity use and budgeting.

**Specific Objectives**

- To further explore the relationship between household budgeting and PPM use; and
- To contribute deeper understanding of the advantages and disadvantages of using PPM from a consumer perspective highlighted by the postal surveys.

**Overall thesis research programme objectives:**

- To explore in depth the experiences over time for New Zealand households using prepayment metering;
- To examine whether prepayment meter users are at increased risk of fuel poverty compared to the general population of New Zealand;
- To use a multiphase mixed methods research approach to provide a broad range of evidence, with data from the research phases integrated to increase the value and function of the findings to specific sub-populations such as children;
- To provide evidence-based policy recommendations and advocate for the reduction of fuel poverty and improvement of public health;
- To use the knowledge gained from undertaking this thesis to indicate an approach to defining and measuring fuel poverty in New Zealand.

Figure 1.1: Multiphase mixed methods research programme of the thesis

### 1.6.5 Thesis structure

I have structured this thesis according to the chronological progression of the PhD investigation; with each chapter comes a narrowing of focus, and after linking the findings of the discrete studies, the discussion returns to the broader issue of fuel poverty in New Zealand, with a suggested approach for policy formulation.

The opening chapters review the academic literature, as well as the grey literature in this area. The abundance of grey literature reflects the long-held concerns of community advocates with regards to fuel poverty and prepayment metering, that largely continue. More recently academic investigations into fuel poverty, and prepayment metering, particularly as technology has developed, have flourished. The following chapter broadly examines fuel poverty and its consequences; definitions, measurement and policy strategies used in other jurisdictions; and the evidence of fuel poverty in New Zealand, culminating in a suggested definition and approach to measurement for the local environment. Chapter Three investigates prepayment metering and the international literature regarding the advantages and disadvantages of using prepayment metering from a variety of perspectives. It provides a detailed price comparison analysis of different electricity payment methods undertaken in the early stages of this thesis (Study One in the diagram above).

Chapter Four explains the theoretical positioning of this research and outlines the general mixed methods approach taken to the thesis. Practical methods of each of Studies Two to Four are explained in Chapters Five through Eight. Chapter Five discusses a nationwide postal survey of electricity prepayment meter consumers undertaken in 2010 (Study Two), with Chapter Six detailing a follow-up postal survey undertaken in 2011 (Study Three). Chapter Seven combines results from both of these surveys to examine the outcomes for households with children using prepayment metering (Integrative Analysis). Chapter Eight provides further social

context of the advantages and disadvantages of prepayment metering through a qualitative descriptive analysis using data from a longitudinal interview project, and investigates how prepayment meters act to assist with household budgeting for and management of electricity (Study Four). Chapters Five through Eight fulfil the first and third overall thesis objectives identified above, and also begin to address the second and fourth objectives.

The second, third and fifth overall thesis objectives are met in Chapter Nine. Further integration of the data and conclusions of the individual research phases investigates the extent to which those using prepayment metering in New Zealand are fuel poor using three different methods for estimating rates of fuel poverty. This chapter also sets out my suggested approach to defining and measuring fuel poverty in New Zealand, based on the knowledge gained through undertaking this thesis.

Finally, in Chapter Ten, key findings of the thesis overall are summarised. Discussion of the implications of the thesis as a whole, including the public health implications, and evidence-based policy recommendations are provided, meeting the fourth overall thesis objective.



## **Chapter Two:**

### **Fuel poverty: Literature review and local overview**

#### **2.1 Outline**

This chapter opens with a detailed discussion of the issues involved in defining fuel poverty. These issues have been the topic of recent debate, particularly in the United Kingdom, where the current definition is under Government review. Discussion of definition and measurement strategies used in other jurisdictions follows, before commentary on the local setting is provided.

The consequences of fuel poverty are subsequently outlined, focussing on the literature investigating coping strategies of the fuel poor, and the health effects of adverse indoor temperatures.

The remainder of this chapter will explore the limited current evidence of fuel poverty in New Zealand in the absence of an official definition or measurement of this problem. Drivers of the fuel poverty problem in New Zealand, which are influenced more heavily by the structure of the electricity market than in many other settings, will be outlined.

#### **2.2 Defining and measuring fuel poverty**

##### **2.2.1 Quantitative definitions and objective measures of fuel poverty**

Fuel poverty presents a challenge, because it is caused by energy inefficiency of the housing stock and available heating sources, which require policy coordination of capital investment to rectify, combined with income poverty, that prevent fuel poor

households from achieving adequate energy services and healthy temperatures (6, 50). Other drivers of fuel poverty include fuel prices, and under-occupancy of housing, particularly among elderly people remaining in family sized homes (7). Those most at risk of fuel poverty include families with young children (51-53), older people (54-57), people with disabilities or ill-health (58), and the unemployed (59), as these groups spend most of their day at home so require heating for longer than people at work or school. For these reasons, policy definitions need to enable measurement of the extent of fuel poverty, and also be operationally useful for finding fuel poor households in order to rectify the causes of fuel poverty and effectively reduce the problem. It is the operational use of definitions of fuel poverty that has proven particularly problematic, and has recently caused Boardman, who initially highlighted the research area, to question whether fuel poverty *can* be practically defined (60).

### *Boardman's definition*

The most widely used definition of fuel poverty arises from Boardman's 1991 PhD thesis, although early descriptions of the experience of fuel poverty in research from the United Kingdom appeared in the 1970s (8, 61). Boardman defined fuel poor households as those households *"unable to obtain an adequate level of energy services, particularly warmth, for 10 percent of its income"* (6, p207). Several other scholars have used, or drawn upon this definition, which was adopted as the official definition for fuel poverty by the United Kingdom in 2001 (62). The United Kingdom's current legislation and policy targets to eradicate fuel poverty *"as far as reasonably practical"* are presently tied to the 10% income threshold (62, 63). Boardman subsequently published a book in 2010, 20 years on from her original work which, while retaining this same definition, summarised the present situation and critiqued policy actions in the United Kingdom (7). An important concept of the definition is that the 10% threshold is what a household would *need to spend*, rather than their *actual* household energy expenditure, as low-income households often spend proportionally more of

their income on energy, and may still be unable to achieve adequate energy services (6, 7). This also allows for inclusion of households who routinely underspend on household energy, for example by self-rationing or forgoing heating due to financial constraints, a practice which the literature has found to be very common among low-income households, when measuring rates of fuel poverty (7, 8).

### *Defining adequate warmth and energy services*

Temperature ranges are included in most definitions of fuel poverty, particularly in the United Kingdom where the Fuel Poverty Strategy uses temperature thresholds of 21°C for the living room and 18°C for other rooms (62). The World Health Organization recommended 18-24°C temperature range is generally accepted by those interested in fuel poverty as the range at which thermal comfort is achieved, being the range in which sedentary, healthy people, wearing adequate clothing avoid physiological stress (64-66). Use of the term 'thermal comfort' is complicated by the interpretation of the word 'comfort'; for example in other disciplines including building sciences, industrial research, and geography (67-71), using the term does not always align with the World Health Organization's recommended temperatures to protect health, reflecting the different priorities of different paradigms.

While the use of the World Health Organization's temperature range for the definition of fuel poverty has been questioned (72), there is recent evidence that supports continuing this advice (73-75). For example, living in homes with a living room temperature of less than 21°C for at least nine hours per day has a direct effect on the health of patients with Chronic Obstructive Pulmonary Disease, a respiratory condition (76). Improving heating appliances and raising indoor temperatures have both health and social benefits, reducing the respiratory symptoms of children with asthma, and days off work and school (77, 78). The effects of adverse indoor temperatures are further discussed in section 2.4.

Another issue in defining adequate warmth is that it requires detailed knowledge of the energy efficiency of the housing stock. This is also necessary to determine the other energy use required to achieve adequate energy services, which include not just heating, but also refrigeration, cooking, water heating, lighting, and entertainment, among other energy services. This has been achieved in the United Kingdom through a Standard Assessment Procedure scheme, where buildings are given an energy efficiency rating of 1 (not energy efficient) to 100 points (net zero energy use), (79). The Standard Assessment Procedure ratings are included on Energy Performance Certificates that are required by the European Union when a new occupant enters a business or residential property, including rental occupants (66, 79). The scores are based on floor area, which allows easy comparison between buildings, and recommendations are provided to indicate what the most cost-effective efficiency measures (of the energy services covered) would move the building up the scale into the next of seven bands (79).

### *Defining household income*

Another issue to consider is whether measures of “income” used in the definition should be gross household income, or an income measure that better reflects disposable household income such as income after housing costs, and also whether income should be equivalised for household size (61, 72). Similarly, since the cost of energy must be included in the definition, it needs to be calculated and there are different factors involved in calculating energy costs. For example, the heating regime(s) used when estimating energy required, and whether average or median energy costs, and annual or monthly energy costs are included in the calculation of energy costs, will affect rates of fuel poverty (61). Moore advocated a “*budget standard*” approach that would use minimum income standards and total required energy costs to identify households as fuel poor when their total required fuel costs are greater than their remaining net income, after housing costs and all other minimum living costs have been met (61).

### 2.2.2 Debating the United Kingdom definition of fuel poverty

The original rationale for the 10% threshold used by Boardman was that at that time it was twice the median household energy expenditure of United Kingdom households, and was also the mean expenditure of 30% of households with the lowest incomes (8). It was also close to the expenditure threshold of earlier definitions of fuel poverty, and was consistent with the use of twice-median measures of deprivation in other settings (8). There have recently been rigorous academic and policy debates about the implications of the 10% income threshold on the measurement and monitoring of fuel poverty (8, 61, 72, 80). These debates have been particularly marked in the United Kingdom, where the Parliament agreed with all-party support to eradicate fuel poverty as far as reasonably practical by 2016, and despite policy attempts to reduce fuel poverty, is unlikely to achieve this (7, 72).

An independent review of fuel poverty in England was recently commissioned by the Government and led by Professor John Hills of the London School of Economics, and was completed in March 2012 (63, 72). The purpose of the review was to investigate the causes and outcomes of fuel poverty and confirm that it is a problem distinct from general income poverty; and to evaluate the current definition and develop a future definition and measurement approach for policy (63, 72). At the time of writing, the Government has proposed to adopt the definition developed by the Hills Review, which uses a “Low Income/High Costs” approach, whereby fuel poor households are those who have both required energy costs above the median level and incomes low enough that purchasing the required energy would result in an income below 60% of the median income after housing costs and equivalised for household size and composition, but not dwelling size (63, 72). This is therefore a relative measure of fuel poverty, as opposed to an absolute threshold measure, and will therefore be less affected by fluctuations in energy prices (61). A severity index is included in this definition with the calculation of the “fuel poverty gap” for households, being “the difference between a household’s required fuel costs and what these

*costs would need to be for it not to be in fuel poverty”* (63, p15), it is suggested that this is used for setting operational targets for policy. A count of individuals in fuel poverty, as well as the number of households in fuel poverty is also suggested, and reporting of fuel poverty figures using the current 10% threshold definition is proposed to continue alongside the proposed figures for reporting (63, 72).

There has been much criticism of the review and its findings, particularly by fuel poverty advocates (61, 81), given that the United Kingdom Government is currently legally obligated to eradicate fuel poverty, as far as reasonably practical, by 2016 (7, 79), and changing the definition as recommended and proposed will significantly reduce the number of fuel poor households (61). Under the current United Kingdom definition, almost four million households were in fuel poverty in 2009, and under the central projection, 8.1 million households are expected to be in fuel poverty in 2016, although the projections vary widely from 3.1 to 9.2 million households (63, 72). Using the proposed definition, 2.7 million households were in fuel poverty in 2009, and under the central projections, 2.9 million households are expected to be in fuel poverty in 2016. Moore compared fuel poverty rates in England using 2008 data and five different definitions to illustrate that the differences in fuel poverty definitions can produce significant variation in rates (61). Figures ranged from 3.3 million households or 15.6% of the population calculated using full income before housing costs and a 10% required expenditure threshold, to nearly 5.5 million households or 25.5% of the population using a minimum income standards definition with a twice-median required expenditure threshold (61).

### **2.2.3 Defining fuel poverty in other areas**

Liddell and colleagues suggest that although in the English setting the 10% threshold has been approximating a twice-median expenditure (8), the broad use of the 10% threshold across different regions in the United Kingdom’s Fuel Poverty Strategy (62), has shifted the focus of the definition from a relative measure to an

absolute one. They argue that this has contributed to policies and implementation being only weakly related to the definition because the current measurement is too broad and targeting of policy does not successfully reach those most in need (8, 82). Therefore, they make the case that fuel poverty should be defined using a regional twice-median “needs to spend” definition, which will allow for international comparisons, while providing better targeting of fuel poverty policies at a local level using the example of the current twice-median expenditure in Northern Ireland of 18%, as compared to the 10% figure in England (8, 82). However, they caution that a twice-median “needs to spend” definition does not capture changes in energy prices, and therefore suggest using an affordability index ratio of *household energy expenditure: income* to observe changes over time (82).

Scotland further refined the United Kingdom definition of fuel poverty by using a scale and applying a severity of need index to policy (8). The Scottish scale defines “fuel poverty” as needing to spend between 10-15% of income, or approximately two to three times the median; “severe fuel poverty” as needing to spend 15-20% or between three and four times median; and “extreme fuel poverty” as needing to spend more than 20% or over four times median (8).

There is currently no official European-wide definition of fuel poverty, although there is a growing awareness of the problem, reflected in several European Council directives to member states that call for long-term policy measures to address the problem, and statistics collected that would enable measurement of the scale of fuel poverty (83, 84).<sup>4</sup>

Of particular relevance to this thesis, Liddell and colleagues specifically comment, based on the lessons learned from the policy experience in their own region, that

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<sup>4</sup> <http://fuelpoverty.eu/2012/02/10/is-the-eu-doing-enough/> – accessed 10 October 2012

defining fuel poverty in this manner will be useful in the New Zealand setting (82, p84):

*“For regions focusing explicitly on improving energy efficiency (as is the case in most of Europe, New Zealand, Canada, and beyond) changes in twice-median over periods of several years more clearly reflect the impacts of policy; this is because a twice-median metric is not confounded by changes in income or energy prices over time.”*

#### **2.2.4 Qualitative definitions and subjective measures of fuel poverty**

Assessing fuel poverty as defined quantitatively in a population setting is difficult as it requires information on the contributing factors: income, housing efficiency, heating appliances and fuel sources, energy costs, and indoor temperature. A qualitative definition was first used by Lewis (1982, as cited in 64, p331) and has been used in a modified form in Irish studies where fuel poverty was defined as: *“the inability to heat the home adequately because of low household income and energy-inefficient housing”* (50, 64). Recent studies, particularly qualitative studies of the experience of fuel poverty, are increasingly turning to ‘subjective’ indicators of fuel poverty.

Subjective measures of thermal comfort such as self-reported problems with the indoor temperature, or responses to cold strain such as shivering, have been used to approximate inadequate indoor temperatures and sometimes also to infer fuel poverty (64, 66, 75). Shivering is a physiological thermoregulatory response which increases metabolic heat production (85). The temperature at which shivering occurs differs across populations as physiological responses to cold vary with factors such as body mass, age, and diet (85, 86). Repeated exposure to cold temperatures can induce physiological adaptations to modify responses to cold exposure, changing the temperature threshold at which an individual may experience shivering (85, 87). However, it is unclear whether repeated exposure to cold (but not extremely cold)



indoor temperatures at home are enough to induce these changes (65). Nevertheless, experiencing cold strain severe enough to induce shivering indoors is unlikely to occur at healthy indoor temperature levels. A cross-sectional face-to-face survey undertaken in Ireland with 1,500 participants, which used both self-reported indicators of thermal comfort and objective measures of fuel poverty, found that 56.6% of fuel poor households reported shivering indoors compared with 15.8% of other households (64). Fuel poor households were 6.7 times more likely to experience shivering for 11-30 minutes than other households, and 84.4% of the other households that reported shivering did so for a very short period (1-10 minutes). Fuel poor households were also more likely to live in colder homes with temperatures below the World Health Organization recommendations than other households.

The World Health Organization *Large Analysis and Review of European housing and health Status* study found significant associations between self-reported thermal discomfort, reported by respondents as feeling “too warm”, “too cold” or “both” and both self-reported health and a number of specific diseases across eight European cities after adjusting for age, gender, socioeconomic status, and smoking (75). Similar questions have been used in other studies reporting on the experiences and effects of fuel poverty (88, 89). Self-reported thermal indicators have also been used in official data collection, for example in standardised European Union Statistics on Income and Living Conditions surveys, which have been used to compare rates of fuel poverty across member states (90), and recently updated, finding higher rates in Eastern and Southern European states (84). Based on these measures, among the EU25 countries, rates of fuel poverty are lowest in Denmark (2.7-4.8% of households) and Finland (3.8-4.7%), while the highest rates of fuel poverty are found in Cyprus (17.8-23.8), Bulgaria (30.5-31.1), and Romania (24.0-24.6) (84).

However, it is not clear that these subjective measures of fuel poverty are as accurate as quantitative measures for identifying households that are quantitatively defined as fuel poor. Waddams Price and colleagues report that asking households whether they feel able to afford the fuel required for heating, water heating and cooking, gave a lower estimate of fuel poverty than using an expenditure-based definition (80).

### 2.2.5 Pairing conceptual and operational definitions

Stepping away from the more concrete definitions used in the United Kingdom, the recent Grenelle 2 law in France defined “*précarité énergétique*” (“energy precariousness”) as:

*“anyone who meets, in its [sic] home, particular difficulties to have the necessary energy to meet its basic energy needs because of the inadequacy of resources or of its housing conditions”* (as cited in 91, p111).

For operational policy purposes, a “*practical*” definition, although not included in the law, uses the more concrete actual energy expenditure threshold of 10% to define fuel poor households (91).

Similarly, in a recent cross-sectional survey undertaken in the United States as part of a continuing survey programme in five locations investigating child nutrition, *Household Energy Security* was conceptually defined as (92, pe869-70):

*“consistent access to enough of the kinds of energy needed for a healthy and safe life in the geographic area where a household is located. An energy secure household’s members are able to obtain the energy needed to heat/cool their home and operate lighting, refrigeration, and appliances while maintaining expenditures for other necessities (eg, rent, food, clothing transportation, child care, medical care). A household experiences energy insecurity when it lacks consistent access to the amount or the kind of energy needed for a healthy and safe life for its members.”*

A Household Energy Security indicator was developed and tested and the authors concluded that four simple survey questions could be used to identify Household Energy Security. The indicator used included the following questions, with negative responses to all four questions classifying a household as “energy secure”, while a positive answer to question one identifying “moderately energy insecure” households, and positive answers to question one in addition to any of questions two to four identifying “severely energy insecure” households (92, pe870):

1. *Since [current month] of last year, has the [gas/electric] company sent [you/the primary caregiver] a letter threatening to shut off the [gas/electricity] in the house for not paying bills?*
2. *In the last 12 months since last [current month], [have you/has the primary caregiver] ever used a cooking stove to heat the [house/apartment]?*
3. *Since [current month] of last year, were there any days that the home was not [heated/cooled] because [you/the primary caregiver] could not pay the bills?*
4. *Since [current month] of last year, has the [gas/electric/oil] company [shut off/refused to deliver] the [gas/electricity/oil] for not paying bills?*

#### **2.2.6 Definition and measurement: The policy point**

As these debates and examples have illustrated, the crux of the policy problem in relation to these definitional and measurement issues is the translation of these definitions into workable policy implementation, as the identification of fuel poor households is key to the success of policies attempting to reduce fuel poverty (91). Indeed a large focus of the Hills Review is the identification of fuel poor households in order to improve policy implementation as the previous methods have not achieved the policy aims, and this provides the rationale for the recommendations to the United Kingdom government to redefine fuel poverty and adopt a low income/high costs measurement strategy (72). One issue to consider is whether the

aim of policy is to remediate quantitatively defined fuel poverty, or to address subjectively and, or, self-identified problems with fuel poverty. Although these are contested issues, the debate highlights the difficulties of translating positive policy to positive policy outcomes and suggests that using mixed approaches to both measure fuel poverty and identify fuel poor households may provide a way forward when grappling with such a multi-faceted problem (see Chapter Nine, Section 9.2 for further discussion).

## 2.2.7 Current discussions of a fuel poverty definition for New Zealand

### *New Zealand government discussion of the problem*

When explicitly discussed, fuel poverty has most recently been termed “*Household Energy Affordability*”, by government departments, and defined as “*the relative affordability of household access to energy services*” by the Ministry of Social Development and the Energy Efficiency and Conservation Authority. Use of this terminology has links to the concept of “affordable warmth” which was a key goal of defining fuel poverty outlined in Boardman’s 1991 thesis (6). The most recent New Zealand Energy Strategy’s only real mention of affordability in a fuel poverty context was: “*Insulation and clean home heating improvements support better health outcomes and **home energy affordability***” (12, p23, emphasis added). Other mentions of affordability were in the context of affordable energy sources within the fuel mix as a justification of continued use of coal, gas, and thermal generation in addition to using renewable sources, or alongside comments about market competition (12).

The Ministry of Social Development and the Energy Efficiency and Conservation Authority began in 2008 a programme of research into fuel poverty in New Zealand, the *Household Energy Affordability Project*, funded by a Cross-Departmental Pool research grant from the then Foundation for Research Science and Technology, with fuel poor households said to be experiencing “*Energy Hardship*” (93). The rationale

for this definition of household energy affordability, according to these departments was that this (93, p7-8)

*“acknowledges that:*

- *household energy affordability relates to the wellbeing of all households, not just to those in energy hardship*
- *the term ‘relative’ conveys the idea that some households have more ability to afford energy services than others*
- *the focus on energy services reflects the reality that people are not interested in purchasing energy per se, rather they value the access they have to the services that energy provides.”*

Unfortunately, this research programme was prematurely ended, without producing some of the planned outputs. Neither a formal definition of fuel poverty, nor any measurement of the scale of the problem in New Zealand was put forward. The only publicly available documents that arose from the programme were a literature review, and a report of some qualitative interviews undertaken as a scoping project for a planned quantitative survey that was never realised (93, 94). The report of the qualitative project commented on a forthcoming document *Measuring Energy Hardship* (94), which has not been made available and the project has since ended. The qualitative project used the same definition of household energy affordability above, and described it as a continuum, *“energy hardship”* describing households unable to afford *“sufficient energy services”* placed at the positive end (94). This document defined energy hardship as *“the inability to afford sufficient energy services”*, while sufficient energy services was not explicitly defined (94, p11). The document did comment that defining energy hardship in this way *“acknowledges that household energy affordability should be assessed based on a standard of sufficient energy services, and*

*not actual expenditure on energy”, and also that the Measuring Energy Hardship paper would describe “an approach that uses indicators of clearly insufficient energy use to help assess the sufficiency of energy services” (94, p11).*

Although this work did not produce an official definition or progress to measuring the scale of the fuel poverty problem in New Zealand, it is positive that these projects highlight an understanding of the importance of a *needs to spend* rather than *expenditure-based* definition, as described above. One thing to note is the apparent absence of a numerical threshold in the definition however, which as highlighted by Liddell and colleagues in particular (8, 82), is useful for evaluating both the relative and absolute levels of fuel poverty and policy outcomes. Another key point for ensuring a successful policy definition is to ensure that the definition adopted will enable targeting and identification of fuel poor households, resulting in successful policy implementation, as has been highlighted by the overseas examples discussed (72, 82, 91). The Scottish approach of including a severity scale in the definition and for targeting policy may be useful, particularly as a starting point for fuel poverty specific policies. Similarly, the approach of Cook and colleagues, which uses four self-reported questions to operationally define whether a household is experiencing *Household Energy Insecurity* (as detailed above), merits further investigation (92). The current scenario in New Zealand is that a lack of sufficient data collection especially around individual housing quality and energy requirements will restrict the ability to accurately define, measure, target, implement, and evaluate policy for fuel poverty. However, as Dubois points out (91, p109):

*“targeting is a necessary step, but as it is also costly, being as precise as possible is not necessarily optimal. The targeting of policies should clearly take into account the possible trade-offs between more precision and the various costs associated with it”.*

### *Naming the problem*

In a recent investigation of public policy in relation to fuel poverty in New Zealand, Ian McChesney, a long-time fuel poverty advocate who was involved in establishing Community Energy Action, a local fuel poverty advocacy organisation, suggested using the terms “*energy service deprivation*” and “*energy service sufficiency*” in New Zealand definitions of fuel poverty and its antonym (11). The use of these terms has some merit, in that they could be used to define a scale of fuel poverty, as noted by McChesney (11), and indicated as a policy preference by the Household Energy Affordability Project (93, 94). As noted above, this has been suggested as useful for policy implementation by observers in the United Kingdom (for example, 61, 82). This would also be consistent with the common approach of using scales of measurement when examining both income and non-monetary indicators of hardship, and the suggested approach of Cook and colleagues (92).

These terms also avoid the use of the word “*fuel*”, more commonly used colloquially for transportation fuels than household energy in New Zealand, and “*poverty*” which is a politically loaded term, while “*deprivation*” is more acceptable and is currently used in measurement of general poverty in deprivation indices. The concept of having “*sufficient*” energy services as the antonym is also consistent with the social justice ideas behind the Boardman definition of fuel poverty (6). Interviews with older New Zealanders experiencing or at risk of fuel poverty found that the term “*fuel poverty*” yielded mixed reactions, though the consensus was that having some term to describe the situation was useful (2). Even in the United Kingdom where “*fuel poverty*” has long been the favoured term, the Hills Review noted that during the consultation some respondents commented that there was stigma associated with the term which could inhibit policy take-up, or that it was inaccurate (72). It should be noted that the lack of access to energy services such as connection to networked electricity grids, is often described as “*energy poverty*” in developing countries, where “*fuel poverty*” is more commonly used in English-speaking nations,

stemming from the United Kingdom use of the term. However, the use of “*energy poverty*” is becoming more usual as a synonymous description of “*fuel poverty*” in Europe (83, 95, 96). “*Energy poverty*” has also been used in parts of North America, while the French term is “*précarité énergétique*” (*energy precariousness*) (83, 91, 97).

### 2.2.8 Terms and definition used in this thesis

In the absence of an official name and definition of fuel poverty in New Zealand, this thesis continues with the use of the term “*fuel poverty*”, with the less rigorous meaning that a household in fuel poverty is unable to afford sufficient household energy, including heating. Furthermore, this thesis focusses on electricity, as this is the predominant local household energy fuel, and the only one that can be purchased through prepayment metering currently, although other fuels contribute to household energy use in New Zealand. Strategies for defining and measuring fuel poverty in New Zealand are further discussed in Chapters Nine and Ten.

Where fuel poverty is discussed using the classic “Boardman definition”, that a household is fuel poor if it needs to spend more than 10% of its income on household fuel to obtain adequate energy services, including heating, this will be indicated. This definition, although under review, has been the definition used in the United Kingdom where the majority of literature and policy activity has been located. Although, as noted, the “Low Income/High Costs” definition (income below 60% of the median and required energy expenditure above the median) suggested by the Hills Review looks set to be adopted at the time of writing this thesis.

Although these definitional and measurement issues have clear implications for the monitoring and implementation of fuel poverty policy, these debates should not preclude preventive policy action. The following sections turn to the coping strategies of householders experiencing or at risk of fuel poverty, and demonstrate



serious health and wellbeing outcomes. Preventive policies can be used to limit the ill-health effects of fuel poverty, while the development of better indicators and tools to measure the scale of the problem continues.

### **2.3 Coping strategies of the fuel poor**

While fuel poverty research has been limited, the available literature highlights similar findings of the coping strategies of households for managing fuel poverty across the majority of the research. Typical measures taken by householders, identified by several studies, fall into three broad categories including: self-rationing of energy consumption, for example restricting heating, lighting, and use of hot water; financial redistribution through restricting other spending, for example limiting grocery spending; and in some cases debt and disconnection from energy or other services (references outlined below).

In this section I discuss in detail several of the available higher quality studies that have explored fuel poverty coping strategies in the past decade. While some of the studies included below are of robust quality, and report detailed methods of qualitative analysis where they are used, others present more limited methodological information, making it more difficult to assess the strength of the findings (eg (56, 97, 98)). In an extensive literature review of coping strategies of fuel poor households, which employed a robust search strategy to identify both academic research and grey literature, Gibbons and Singler found only four where the primary focus was coping strategies, at that time (99). These studies are included in the discussion below (56, 57, 100, 101), along with five later studies. It should be noted that in several of these studies households are not formally identified as fuel poor using the Boardman definition, although low-income, and sometimes households with an actual expenditure of 10% or more on fuel, have usually been investigated.

An in-depth interview study with 64 pensioners aged 60-90 years, 50% over 75 years in England, Wales, and Scotland provides some descriptive statistics along with qualitative interview findings (56). The study included face-to-face interviews including a quantitative questionnaire covering heating systems, insulation, income and expenditure on fuel in the preceding winter quarter, and an in-depth qualitative *“exploration of views and experiences of keeping the home warm in winter”* (56, p492). The study used three definitions of fuel poverty calculated by Standard Assessment Procedure ratings and energy billing information where possible, and found that 44% in fuel poverty based on at least one of three definitions used: 25% were fuel poor by the Boardman definition; 35% expenditure fuel poor (spending over 10% of income on household energy); around 25% had properties of low energy efficiency (Standard Assessment Procedure ratings of under 40). As details of the qualitative analysis methods were not provided, it is difficult to assess the methodological rigour of the study, however it was noted that the tape-recorded interviews were transcribed and analysed with a qualitative data analysis package.

The study reported on the energy self-rationing behaviours of participants, finding that it was common to restrict heating, usually by turning heating off during at least part of the day in winter and one in three households did not heat bedrooms (56). Energy self-rationing was influenced by the price and availability of different fuels (gas, electricity, or oil heating for example) contributed to whether rationing was required. Energy efficiency was a strong factor influencing fuel poverty and indoor temperatures among the participants. Other expenditure self-rationing to afford energy was not mentioned in the paper. The qualitative interviews also found that it was common to sleep with a bedroom window open and described contradictory attitudes to whether heating was healthy, illustrating the complexity of cultural and behaviour factors influencing heating practices.

Harrington and colleagues reported on a qualitative study undertaken as part of a broader evaluation of an energy efficiency retrofitting programme in North-east England (100). The sample of this study was 30 households randomly selected from a survey sample from an earlier study (the Warm Homes Project (102)). Purposive sampling may have been more appropriate for the qualitative study, although the authors noted that data collection was continued until data saturation was achieved. For this study, households were defined in fuel poverty with a required household energy expenditure threshold of 7.5% of disposable income after tax and housing costs (100). The authors explained that this allowed the inclusion of households living near Boardman-defined fuel poverty. The qualitative interview and analysis techniques described were rigorous; however stated aim of the analysis was “*primarily to achieve adequate description of the meaning of fuel poverty, corresponding to open coding in Strauss and Corbin’s (1990) grounded theory approach*” (100, p262). As the usual aim of grounded theory is to develop a model or theoretical explanation of the phenomenon under study (103, 104), the use of the method *qualitative description* (further detailed in Chapter Four), as described by Sandelowski (105, 106) and Neergaard and colleagues (107), may have been more appropriate.

Energy self-rationing, including restricted use of space heating, was reported as an outcome of extreme poverty (100). It was also noted that a small group self-rationed energy to prioritise spending on other activities. The majority were reported to keep warm by self-rationing of other expenditure, with the example of parents prioritising spending on heating for children, over luxuries and holidays. Debt accrual in order to afford energy was especially problematic for households with children. Usual coping strategies for cold indoor temperatures, including wearing additional clothing, going to bed early, or restricting household space use, were described. Participants also reported taking energy efficiency measures ranging from draft-blocking to double-glazing to try to increase indoor temperatures. The energy inefficiency of some housing resulted in some participants being unable to achieve

warmth despite substantial energy expenditure. The authors concluded that *“responses to fuel poverty are mediated by culturally and historically derived expectations”* (100, p267).

A qualitative study was undertaken in the United Kingdom with 10 women aged 61-64 to explore older women’s beliefs and experiences of fuel poverty (57), with a detailed methods section reporting rigorous application of Husserl’s phenomenological approach. The study does not report whether the women were formally identified as fuel poor. The results included reports of self-rationing energy, although heating was prioritised by most, above food and other necessities for example. Even so, heating was restricted to used rooms, and reduced temperatures or duration of heating was reported by some. Other expenditure was self-rationed, and two participants reported restricting grocery spending. Others were reported to highlight limited incomes and managing their finances carefully, though specific details of financial redistribution were not reported. The authors concluded that fuel poverty *“is an important health and financial concern for older women”* (57, p105).

A second study detailing a qualitative evaluation of an insulation and heating efficiency retrofit scheme (*Warm Front*), this time in Birmingham, Liverpool, Manchester, Newcastle and Southampton, England, was reported by Gilbertson and colleagues (101). This study included 49 households purposively sampled from around 3000 retrofit recipients, who were not formally defined as fuel poor, however the retrofit scheme was targeted towards fuel poor households (although as outlined above, policy targeting of fuel poor households has not been particularly successful). The authors mentioned using constant comparative methods in the analysis influenced by grounded theory, and the authors report a detailed and rigorous analytic strategy; however, as per the criticism above, it is not clear that this was a grounded theory investigation. The semi-structured interviews were

designed to evaluate the scheme rather than investigating fuel poverty coping strategies, however some of the results reflect reduced self-rationing of energy and other expenditure as a result of the retrofit. A key theme of the results was improved mental health as an outcome of the retrofit.

A longitudinal interview study published by a United Kingdom organisation (*Friends Provident Foundation*) with 109 households recruited through an energy advice helpline, budget advice, and other community agencies was described by the authors as using an *“in-depth qualitative methodology”* (98). However, the methods outline use of structured interviews, with 86 follow-up interviews completed 6-12 months following the initial interview, which ended with a tailored energy advice tutorial (98). Standard Assessment Procedure ratings were obtained for dwellings, and it appears, although it was not explicitly stated in the document, that the Boardman definition was used to assess fuel poverty. The study report blends information from the interviews with *“typologies of control”* of fuel poverty behaviours devised by the research team, with influence from relevant literature. A *“framework of fuel poverty indicators based on observations from the interviews”* is also presented, however the lack of detailed analytic methods makes it difficult to fully assess the study rigour (98, p7).

The study found that 45% of households reported energy rationing; around two thirds reported their home was cold or they had difficulty keeping it warm, just over one third reported dampness or mould (98). Other expenditure rationing to afford electricity was reported by 25% of participants, and previous energy debt had been experienced by 25% also. Based on their framework the authors concluded that financial behaviours and heating behaviours can directly result in fuel rationing or debt. These results should be treated with some caution however, due to the inadequate description of the methods and the limited other research that highlights

financial behaviours as a driver of fuel poverty (for further discussion of this point see section 2.6.4).

A recent mixed methods research study undertaken in Great Britain reports on the results of a survey of 699 households with an income below 60% of the national median, and an in-depth interview study of 50 households that were randomly sampled from 111 surveyed households that consented to follow-up (88, 108). Participants were not assessed for fuel poverty using the Boardman definition; nor were building energy performance and fuel expenditure details assessed. The study focussed on the experience of households coping with low incomes during the winter months and/or cold homes. The data collection and analytic techniques described appear robust, however no indication of the theoretical underpinning of the qualitative study was provided, making it difficult to draw conclusions about this.

The survey found that 47% reported cold homes; significantly higher rates of cold homes were reported by single adult households, and both one- and two-parent families. Energy self-rationing was reported in detail, 63% of surveyed households reported at least one of: turning heating off or down, heating only one room, restricting hot water, lighting, or hot food. It was reported that 40% used two or more of these energy self-rationing strategies and 21% three or more. Other expenditure self-rationing was also described, in particular the study highlighted that juggling between groceries and heating expenditure is common as the authors reported that “65% of surveyed households restricting heating were also cutting back on food and 59% of those cutting back on food were restricting heating” (88, p45). Although it is unclear from the report whether the following were because of fuel costs: 36% cut expenditure on non-essentials; 24% cut expenditure on essentials other than food and heating; 13% delayed payments on money owed; 13% of surveyed households had fallen behind on some bills or financial commitments; and

9% increased debt on credit cards, overdrafts, or took out additional commercial loans (88, p44). In addition, 79% of surveyed households agreed fuel bills were a financial burden.

Qualitative interview respondents reported a range of coping strategies for cold indoor temperatures including: wearing additional clothing, using blankets or hot water bottles, using only one room of the house, going to bed early, sharing a bed, exercising, having hot drinks, staying with relatives, closing curtains during the day, and lining curtains with thermal lining (88, p49). Some indicators that measured self-reported mental and physical health were also included in the survey; of those who reported cold homes, 47% reported it made them feel miserable, 30% that an existing health problem was worsened, and 17% did not feel able to invite friends or family to the house (88, p50). The prevalence of these indicators was statistically significantly increased among those who reported that their homes were much colder than they would prefer.

One recent study undertaken in Eastern North Carolina reports similar coping strategies and outcomes of fuel poverty (97). Fuel poverty in this setting is a year-round problem, with significant cooling requirements during summer in many homes, as well as heating requirements in winter. This study reports on qualitative data collected from 17 households that were the recipients of a Weatherization Assistance (retrofit) Scheme administered within the state (n not reported). Quantitative data collected by the scheme was also presented. No information about the qualitative analytic methods was provided, however the authors noted that the study methodology was influenced by geography and socio-technical systems theory. Participants were not defined as fuel poor using the Boardman definition, though households were of low-income and eligible for the scheme.

Most participants described high electricity bills as problematic, some noting they approached the level of their housing costs, one reported nearly losing his home “two or three times because the bills got so high” (97, p953). Energy rationing strategies described as common included: staying in bed during cold winter days, wearing additional clothing, and closing off portions of the home or limiting room use to limit space heating and cooling. It was noted that social interaction was restricted by inadequate heating and cooling. Other expenditure rationing included commonly restricting grocery spending, with some participants reporting restricting Christmas gift-giving. Utility bill non-payment was described as a common strategy. The study illustrates that housing quality particularly influences fuel poverty in this setting; 32-44% of the retrofit scheme recipients across the three counties served were living in mobile homes. The authors highlighted continually precarious life circumstances contributing to fuel poverty for many participants of the study.

A recent qualitative study undertaken in Vienna, Austria, with 50 low-income households at risk of fuel poverty with the specific aim of investigating coping strategies found similar results to the previous studies (109). Participants were not selected using the Boardman definition; however, of 37 that quantitative information allowed calculation using the Boardman definition, 43% were fuel poor. The method was based on Strass and Corbin’s grounded theory and methodology influenced by social theories including sociotechnical systems approaches and pragmatism.

Energy self-rationing was thoroughly investigated, with 60% of households reporting one or more coping strategies for restricting heating: 40% restrict heating to one room; one third reported wearing additional clothing, though this was reportedly “rarely sufficient” to achieve comfort; 12% reported going to bed during the day, and, or using electric blankets (109). Restricting lighting was also highlighted as an energy rationing strategy, including using fewer bulbs in fittings,



or smaller lights instead of large ones, using the TV for illumination, and, or lighting one room. The authors noted that there was a *"limited scope of action"* for reducing energy consumption, consistent with other literature (110).

Other expenditure was also rationed with some restricting grocery spending, or other bills to afford electricity. It was noted that rent and energy was prioritised first, and that heating was a priority for households with children. Over 25% had experienced disconnection of electricity for non-payment at least once. Reconnection usually occurred within a few days, though it was reported in the most extreme cases it may be years before reconnection occurred. It was reported that bill shock could *"seriously exacerbate the often quite delicate financial planning"* (109, p54). While this seems consistent with the other examples, the explanation that electricity was billed annually for most of the participants, and a supplementary payment on the actual reading is often required on top of estimated smoothed payments that have been made through the year, illustrates the problem of insufficiently frequent feedback (further discussed in Chapter Three) (111-113). Similarly to the other examples, *"multiple burdens"* of energy inefficient dwellings and appliances, financial hardship, and physical vulnerability were common problems.

Of all of the studies that were reportedly based on grounded theory, in addition to describing data collection and analysis methods consistent with grounded theory, this study takes the final analytic step of developing a theoretical framework expected as an outcome of this method. Four distinct typologies of households were characterised: *"the overcharged"* (fuel poor), *"the modest fuel poor"*, *"the modest non-fuel poor"*, and the ones *"on a low income"* (also non-fuel poor) (109, p57). It was suggested by the authors that fuel poverty policies be developed to be target-group specific based on these typologies.

As outlined in the introductory paragraph to this section and illustrated by the detailed accounts of the eight studies provided above, three major coping strategies are typically employed by the fuel poor: self-rationing of energy consumption; self-rationing of other expenditure; and sometimes debt and, or, disconnection from energy or other services. Despite the cultural and behavioural complexity of energy use and household expenditure (114-116), these coping strategies have been found to occur among fuel poor households across different countries. Similar coping strategies have also been found among fuel poor households in Central and Eastern Europe with the exception of restricting heating, as reported recently by a Hungarian study (95), and an earlier Macedonian study (117). This difference occurs in block housing types where the heating system is not able to be individually regulated within apartments, due to district heating systems managing the entire building. Coping strategies are fairly consistent over ranging demographics including age, employment status, and household compositions, for example single pensioners, young and/or sole-parent families; although the research also indicates that parents may take care to restrict the exposure of their children to cold indoor temperatures where possible. These strategies are also consistent across payment method, with those using prepayment metering also reporting similar experiences, with the added disadvantage of immediate “self-disconnection” when running out of credit on their prepayment meter (for an extended discussion of prepayment metering see Chapter Three).

### **2.3.1 Coping strategies for fuel poverty among children**

While the research detailed above highlights that children may be especially affected by fuel poverty and that parents in fuel poor households make difficult decisions about prioritising heat, food, and other necessities for their children, it also alludes to the lack of focussed research investigating the outcomes of fuel poverty for children. Very little research has been undertaken *with* children exploring fuel poverty, or living in cold homes (53, 99, 118, 119). A recent Welsh qualitative study that used

age appropriate informative and participatory workshops with children in primary and secondary schools is one of few exceptions, and highlights the ability of children to describe their experiences and coping strategies of fuel poverty (53). This study presented physical and mental health outcomes of fuel poverty described by children that included: increased risk of illness; increased family tension; disrupted sleep; social exclusion; increased risk of being bullied. Children noted that these problems affected school attendance and performance, which, through increasing the likelihood of low educational attainment, may affect them for many years. Coping strategies for dealing with fuel poverty and cold indoor temperatures identified by children were largely consistent with those outlined above. Most were based around increasing incomes or rationing expenditure and energy efficiency measures. Other strategies included: getting up during the night to sit in the living room and have a hot drink to warm up; getting dressed under the bedcovers because bedrooms were too cold; putting clothes at the end of the bed at night to keep them warm (53).

#### **2.4 Health effects of fuel poverty and adverse indoor temperatures**

The research presented in Section 2.3 above illustrates many of the broader outcomes of living in fuel poverty that may negatively affect health and wellbeing. In particular, it highlights the choices faced by many households to restrict spending on other necessities, often in addition, rather than as a complete alternative, to restricting heating. The adverse health effects of fuel poverty include both physiological and psychosocial effects of exposure to cold indoor temperatures (Liddell and Morris 2010; Marmot Review Team 2011; Hills 2012).

The World Health Organization has recommended maintaining indoor air temperatures of 18-24°C to protect health for the past 30 years, based on evidence

that indoor temperature levels outside this range have physiological effects (66, 120). These include, but are not limited to, respiratory distress (121), exacerbation of respiratory conditions including asthma (77, 122) and chronic obstructive pulmonary disease (76, 123, 124), exacerbation of arthritic/rheumatic symptoms (125), accidental hypothermia particularly among older people (126-128), increased risk of accidents in the home (128), and increased risk of cardiovascular events caused by defence mechanisms triggered when the body is cold, which thicken the blood and increase blood pressure (121, 129, 130). In elderly people, respiratory effects have been shown to occur below 16°C, (in those with chronic respiratory disease below 21°C), while increases in blood pressure are seen below 12°C, and risk of hypothermia increases below 6°C (65, 66, 73).

In a narrative synthesis of five intervention studies examining specific effects of cold housing on health, Liddell and Morris conclude that broader health and wellbeing measures, than clinical outcomes of physical health, may better capture the full range of benefits that improved housing conditions and heating are likely to have on human health (74). This is supported by recent findings from an evaluation of the English Government's Warm Front Scheme, which improves energy efficiency through retrofitting insulation and efficient heating systems, that demonstrated psychosocial benefits of the programme with recipients showing reductions in self-reported mental health problems and fuel poverty that were significantly correlated with improved health (89). The authors suggest that some health improvements from fuel poverty interventions may be mediated via a pathway of improved mental health (89). Fuel poverty and cold indoor temperatures contribute to excess winter mortality and morbidity, or increased morbidity and mortality occurring in winter months compared to summer months, especially in temperate countries (131, 132).

While most of the earlier studies investigating the physiologic effects of adverse temperatures on health focused on adults, there is some research highlighting the

outcomes for children. In children with asthma, increasing temperatures inside the home has been shown to reduce symptoms and days off work and school (77, 78). Reduced calorific intake in the winter in low-income families is evidence of the 'heat or eat' problem in the United States of America (51). A cross-sectional survey in the United States of America found that children from households receiving the Low-Income Home Energy Assistance Programme payments to assist with home energy costs were less likely to suffer under-nutrition, be overweight, or require acute hospitalisation (52). Child health and development in children less than three years of age is negatively affected by household energy insecurity, as described above (92). Adolescents living in cold housing are at risk of mental health problems and engage in increased antisocial behavior (74).

Excessive indoor temperatures also have a negative effect on health, which may become more problematic as climate change increases the need for affordable cooling to maintain healthy indoor temperatures. The physiological responses to heat include symptoms such as dizziness, weakness, fatigue, cramps, and fainting, through to the more severe consequences of heat stroke – multiple organ failure, coma, and death (133). The health effects of heat waves over the past thirty years have been extensively studied, and it is well accepted that heat waves cause many deaths (134). Risk factors for heat wave deaths include physiological factors such as age – either very young or old age, and illness or disability, and also factors relating to the built environment such as urban living and lack of access to air conditioning (133, 135).

Patients in hospital wards with air conditioning during the 2003 heat wave in Portugal had a 40% reduced risk death compared to those in wards without air conditioning (136). As with excess winter deaths, heat-related deaths are not restricted to heat waves, and occur less noticeably during the usual increased temperatures of the summer months (137). Ecological time-series data from England

and Wales showed that both heat-related and cold-related deaths occurred between 1993 and 2003, with older people living in rest homes at particular risk (138).

## 2.5 Policy addressing and influencing fuel poverty

In line with the contributing factors of fuel poverty, policies used to reduce fuel poverty in the United Kingdom, Europe and in parts of North America have included: home energy efficiency improvements in the form of insulation and heating retrofits (for example the *Warm Front* scheme in the United Kingdom, the *Weatherization Assistance Program* in the United States of America, the *Habiter Mieux* programme in France, and similar programmes in other European countries); subsidies for energy costs (for example the *Low Income Household Energy Assistance Program* in the United States of America, the South Australian Government's Energy Concession<sup>5</sup> and Medical Heating and Cooling Concession<sup>6</sup> for eligible low-income households in South Australia, the universal *Winter Fuel Payment* for pensioners in the United Kingdom, and similar programmes in other European countries); and regulatory measures such as social tariffs, free basic electricity, or other schemes in liberalised energy markets, which are often the mandate of strong independent regulatory bodies (for example the Office of the Gas and Electricity Markets in the United Kingdom) (7, 83, 96, 97, 139, 140).

There is a large body of literature that supports the use of energy efficiency programmes as part of a policy suite to tackle fuel poverty (7, 79, 141, 142). The advantage of universal payment schemes such as the Winter Fuel Payment, which is paid to pensioners in England for example, is that they are easily implemented.

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<sup>5</sup> <http://www.dcsi.sa.gov.au/pub/tabId/209/itemId/348/moduleId/795/Energy-bills.aspx> - accessed 24 October 2012

<sup>6</sup> <http://www.dcsi.sa.gov.au/pub/tabId/164/itemId/3391/Medical-Heating-and-Cooling-Concession.aspx> - accessed 24 October 2012

However, they do not resolve the root cause of energy inefficiency, and are poorly targeted; often benefiting many households not in fuel poverty while missing other vulnerable fuel poor groups. They also require on-going political support and use of public funding to maintain (7, 96). Indeed the European Union has indicated to member states a preference for long-term policy solutions that support energy efficiency of buildings, rather than the temporary relief provided by subsidising high energy bills to occupants (83).

Looking forward, households in fuel poverty will be especially vulnerable to climate change impacts (79). As pointed out by Dear and McMichael recently, *"we should not assume that because the planet is warming dangerously, cold temperatures will become a thing of the past"* (143, pd2808). These authors note that the IPCC (2007) anticipate greater variability along with global warming, providing another reason for addressing fuel poverty (143, 144). Climate change policies also have the potential to exacerbate current levels of fuel poverty, as the consequences of price increases due to electricity companies passing on the costs of carbon through emissions trading may be unfairly high for low-income consumers, without countervailing government regulation (145-147). Increasing fuel prices have not been accompanied by similar levels of increased household energy efficiency and therefore have resulted in increased rates of fuel poverty (79). More positively, measures to reduce fuel poverty which include improvements to the energy efficiency of the housing stock, for example the retrofitting of insulation and efficient heating appliances, have a broad range of co-benefits, including reducing emissions, which is urgently necessary to mitigate climate change (79, 96, 139, 141). When measuring co-benefits of housing interventions however, it is important to consider partial 'rebound' or 'take-back' effects. These terms describe the phenomenon that occupants that were experiencing fuel poverty or unsatisfactorily cold indoor temperatures prior to housing interventions have been shown to take some of the potential energy savings as increased heat for example (148-150).

Guertler argues that with careful policy targeting of household energy efficiency measures with the primary objective of reducing emissions, using the British Government's *Green Deal Finance* package, there is potential for reducing fuel poverty and its inherent inequalities as a co-benefit (151). However, as Ürge-Vorsatz and Tirado Herrero caution, retrofitting or installing in new buildings sub-optimal energy efficiency measures as opposed to the currently available state-of-the-art technologies which provide "deep efficiency" can "lock-in" a commitment to higher carbon emissions, and fuel poverty, over the lifetime of the building stock (96). Furthermore, there are global ramifications, as there is the potential for reducing fuel poverty as it is experienced among developed and transitioning countries as an issue of under-consumption of energy required for a modern lifestyle, to contribute to further emissions and global injustice (43).

## 2.6 Evidence of fuel poverty in New Zealand

### 2.6.1 Anecdotal evidence of fuel poverty

Stories of local families struggling to manage high electricity costs, cold homes, and low-incomes are not new, with several examples making media headlines in recent years (3, 46, 47). The establishment of Community Energy Action, a charitable trust aiming to reduce community fuel poverty, in the early 1990s gives some indication of how long the problem has been recognised by consumer advocacy and non-profit organisations in New Zealand. More recently, the formation of the Domestic Energy Users' Network, an umbrella group encompassing Age Concern, Grey Power Federation, Royal New Zealand Returned and Services Association, Rural Women New Zealand, Public Health Association, and the Child Poverty Action Group, reflects increasing concern about fuel poverty held by these groups.<sup>7</sup> The Domestic

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<sup>7</sup> <http://issues.co.nz/fairelectricity/DEUN+Campaign> – accessed 24 September 2012



Energy Users' Network campaigns for fair electricity prices and consumer protections through lobbying and media advocacy.

At the extreme end of the spectrum, unintentional domestic fires relating to fuel poverty are a risk, and fatalities have occurred in cases where electricity had previously been disconnected for late or non-payment. In a report investigating fatal unintentional domestic fires in New Zealand from 1997-2003, 131 deaths were identified in total, 10% of these were due to unattended candle fires, the third most significant risk factor for residential fire fatality (152). In three households the electricity had been disconnected for non-payment, another household had no electricity due to remote location (152). There were 13 deaths in eight candle fires during the study period and children were over-represented among the fatalities, with eight of these victims under 16 (152).

### **2.6.2 Cross-sectional survey data indicating fuel poverty**

The New Zealand individual deprivation index (153), a widely used survey tool for measuring the social deprivation of individuals includes a question measuring self-reported thermal comfort: *"In the last 12 months have you personally put up with feeling cold to save heating costs? (yes/no)"* (153, p1484). The most recent New Zealand Living Standards Survey found that 36% of households put up with feeling cold in order to save on costs, of these 10% reported economising a lot on heating in order to afford other basics, described by Perry as an *"enforced lack"* (154). Similarly 7% lacked the ability to keep the main rooms of the house adequately warm (154). The 2006 New Zealand Living Standards Report identified that 10% of Pakehā (New Zealanders of European descent) families, and 25% of Māori (indigenous) families could not keep up with electricity, gas, or water bills (155). In an earlier cross-sectional survey using face-to-face interviews, 213 inadequately housed individuals in Auckland and Christchurch were purposively sampled, and reported that problems with cold and

damp in their existing accommodation were commonly due to having no heating or being unable to afford adequate energy (156, 157).

A recent cross-sectional survey that investigated the role of housing quality and access to primary care in avoidable admissions of 100 children less than 15 years old to Wellington Hospital over a 10-day study period in 2012 found that over half (51.9%) lived in houses that their parents stated was colder than they would have liked (158). Most parents reported no problems with paying for electricity, however 14.2% of households had been unable to pay their bills by the due date (158), indicating “*utility stress*” (159) or “*utility deprivation*” (34). Furthermore, 7.5% of households had had their electricity disconnected due to late or non-payment of bills (158), which is around 4.2 times the national rate of disconnection for non-payment in 2011, based on the official disconnection figures (160), and officially estimated number of households to the year ended 2011.<sup>8</sup>

### 2.6.3 Other quantitative indicators of fuel poverty

New Zealand has a high rate of excess winter mortality compared with other OECD countries (161), and fuel poverty is a likely contributor to this (10). A study linking Census and mortality data showed a statistically increased risk of dying in winter among low-income people, those living in rented accommodation and those living in cities (162).

Analysis of national average household energy expenditure by average household income decile shows that households in the lowest income decile spent 13.1% of their total household income on household energy, compared with households in

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<sup>8</sup> [www.population.govt.nz/~media/Statistics/browse-categories/population/estimates-projections/dwelling-and-household-estimates/estimated-hh-private-dwellings-tenure.xls](http://www.population.govt.nz/~media/Statistics/browse-categories/population/estimates-projections/dwelling-and-household-estimates/estimated-hh-private-dwellings-tenure.xls) - accessed 19 August 2012

the highest income decile spending only 1.6% in 2010.<sup>9</sup> These figures provide only a crude comparison as incomes are not equivalised for household size, and use total household income, as opposed to disposable income which may be higher particularly among low decile households; however they usefully indicate the current inequalities present when considering affordability of household energy services across the population.

In May 2007, after the disconnection of the electricity to a household was linked to the death of a woman who relied upon a supplementary oxygen supply, all disconnections were briefly halted (3). But by 2011, more than 30,000 disconnections for non-payment were carried out by electricity retailers, with over 9,000 of these occurring in the winter months (July to September). This translates to around 1.8% of the number of households in New Zealand in 2011<sup>10</sup> experiencing a disconnection from electricity services, although the disconnection figures count each disconnection, and it is likely some households experience disconnection on more than one occasion throughout the year.

Based on a modelling study, Lloyd estimated that between 10-14% of the population of New Zealand may be living in fuel poverty, using the Boardman definition (163). Lloyd also found a strong regional effect, with rates of fuel poverty in Dunedin, the southernmost city included in the modelling, estimated at 26-32%, compared with 6-8% for the northernmost city Auckland (163). However, this study used 2001 income and electricity price data. A revised estimate calculated using 2008 electricity prices and income data from the 2006 Census estimated the potential level of fuel poverty at 25% nationally, while fuel poverty rates in Dunedin were estimated to have

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<sup>9</sup> These figures are based on Statistics New Zealand's data which are licensed by Statistics New Zealand for re-use under the Creative Commons Attribution-Noncommercial 3.0 New Zealand license.

<sup>10</sup> [www.population.govt.nz/~media/Statistics/browse-categories/population/estimates-projections/dwelling-and-household-estimates/estimated-hh-private-dwellings-tenure.xls](http://www.population.govt.nz/~media/Statistics/browse-categories/population/estimates-projections/dwelling-and-household-estimates/estimated-hh-private-dwellings-tenure.xls) - accessed 19 August 2012

reached 47% of households in 2008 (10). The caveats of this estimate are that: it is assumed that all space heating is electrically powered, which may overestimate fuel poverty; and that the floor area of all houses is 100m<sup>2</sup>, which is lower than average and may therefore underestimate fuel poverty. Despite these uncertainties, the estimates indicate that the scale of the problem in New Zealand is worthy of further investigation and policy attention.

#### 2.6.4 Qualitative research investigating fuel poverty

A large qualitative interview study was undertaken in 2009 in six regions across the country, as part of an investigation of fuel poverty by two government departments (94). The study included 46 interviews with stakeholders (from Work and Income, and non-government community budgeting organisations) working with households likely to be in fuel poverty. Subsequently, 44 interviews with low- to middle-income householders, who were identified by stakeholders as having current or previous difficulty with home energy bills or being at risk of fuel poverty, were also undertaken. The study found similar causes of fuel poverty to those identified above and also reported that stakeholders identified poor budgeting skills as a problem, which could be reduced by providing budgeting advice. The study reported finding that *“Stakeholders noted that some households are unaware of the importance of maintaining a warm, dry indoor environment”* (94, p7). However, the views of householders on this issue were not reported in a manner that supports this claim of stakeholders. Other research suggests that coping strategies of fuel poverty including restriction of space heating and wearing additional clothing for example, are culturally complex, and may reflect a lack of affordability or social norms rather than a lack of awareness of healthy indoor environments (2, 10, 88, 164-167). Other outcomes and coping strategies for living with fuel poverty were broadly consistent with the findings of other research, discussed previously. The findings provide useful descriptions of some local factors including regional price variation of different energy fuels and the contribution of this to hardship, and highlight private

rental landlords as a barrier to uptake of government subsidies for household energy efficiency improvements which would help to ameliorate fuel poverty.

Unfortunately there was limited description of the analytical methods used to unpack the interview data, including the production of *coding*, identification of *themes*, and elevation of *themes* to *categories* which were “*placed within a framework based on the objectives of this research*” (94, p13). There is also no description of the method used to formulate the “*case studies*” presented, although it is noted that these were sometimes “*composites of two or three households*”, (94, p10). The lack of this information raises questions about the methodological rigour of this study, as this cannot be easily assessed.

The report emphasises that poor budgeting is a problem for low-income households, however, this finding lacked justification as it is not widely attributed to the causes of fuel poverty in other research. While some studies have indicated that *some* low-income households (especially those headed by younger people) may have some difficulties with financial management that contribute to fuel poverty (98, 168), the majority of the literature reports that most low-income households have very careful approaches to budget management and that incomes that are simply not large enough to cover the expenses of necessary items (57, 168-170). Low-income households are more likely to engage in “*mental budgeting*” than households with less limited financial means, arguably because they have less need to control expenditure (171). For example, Doble commented that the majority of prepayment metering consumers interviewed “*led carefully ordered and well-organized financial lives*”, and displayed “*very little evidence of chaotic purchasing or financial crisis management*”. (169, p235) Despite these shortcomings, the short report provides some useful insights into both the lived experience of fuel poverty, and the experiences of those working with households who are likely in or close to fuel poverty.

A structural narrative analysis of interviews with nine older New Zealanders who had Chronic Obstructive Pulmonary Disease participating in the *Warm Homes Pilot Study: Qualitative Component* indicated that they were fearful of disconnection, and that they felt that fuel poverty was a problem in their communities (2, 172). This study was a pilot study undertaken in 2007 in the Hutt Valley area with participants recruited through *Tu Kotahi Māori Asthma Trust*. The main study, *Warm Homes for Elder New Zealanders*, is a randomised community trial currently underway, with the aims of investigating the efficacy and cost-effectiveness of using electricity vouchers directly credited to accounts to increase indoor temperatures for reducing the symptoms and outcomes of Chronic Obstructive Pulmonary Disease (173).

## 2.7 Drivers of Fuel poverty in New Zealand

New Zealand experiences the same drivers of fuel poverty found in other settings: poor quality of the housing stock; under-occupancy of housing; poor energy efficiency of heating and other appliances; income poverty; and energy prices (9, 10). This section will briefly outline the local context of these drivers, which contribute to the high rates of fuel poverty currently estimated among New Zealand households. What is particularly striking about fuel poverty in the New Zealand setting is the effect of the market-driven electricity system, examined in detail below, which is among the most deregulated in the OECD, and is likely to increase the problem as further planned privatisation occurs (32, 145, 174).

### 2.7.1 Housing stock

The majority (81%) of New Zealand's housing stock is made up of detached, timber-framed houses, which usually lack the thermal mass and energy efficiency required to maintain stable indoor temperatures (37, 175, 176). Floor areas are typically higher and space heating intensity lower than other OECD countries (177). The

average floor area of new homes built since 2010 has increased to 205m<sup>2</sup> from 142m<sup>2</sup> in the 1980s.<sup>11</sup> Historically, building and housing regulations and standards have been weak by international standards, and only recently have insulation requirements been improved (10, 37). In addition, due to poor construction and lack of regulation, New Zealand faces a large and costly problem with many houses built in the 1990s “leaky”, with water damage to the wall cavities resulting in mould and rot and requiring extensive repairs (38).

The 2006 Census reported 67% home ownership across the population, with 82% of those making rental payments paying a private landlord (Statistics New Zealand 2011). Although there are comparatively high rates of home ownership among older New Zealanders, those with limited incomes, usually New Zealand Superannuation, are unlikely to afford adequate home maintenance (178). Surveys have found that householders report maintenance issues and problems with dampness, draughts, and mould (179, 180). Other research has found that New Zealanders living in housing typical of low socio-economic status dwellings tend to overestimate their housing conditions (122). Only 18% of participants self-rated their dwelling in poor or very poor condition, however when a subsample were assessed by a qualified building inspector 53% of dwellings were in poor, or very poor condition (122).

The poor quality of private rental housing, and lack of regulation in this area pose a significant problem and contribute to fuel poverty (10). Private rental properties are predominantly older (41), and in worse condition than dwellings occupied by private owners (40). Tenants of private rental housing in New Zealand are more likely to report that their house is damp, too cold in both the bedrooms and living room, and expensive to heat than landlords of private rental housing (176). Despite the availability of a government subsidy for landlords retrofitting insulation of

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<sup>11</sup> <http://www.qv.co.nz/propertyinformation/KnowledgeCentre/Average+house+size+by+age10052011.htm> – accessed 25 September 2012

NZ\$1300 (33%), or 60%<sup>12</sup> where tenants have a *Community Services Card*<sup>13</sup>, landlords were willing to pay more for a heating appliance than for any improvements to insulation (176). While this may provide some benefit to tenants, it is not a sensible approach when considering either fuel poverty or environmental effects. Installing a heating appliance may not provide any benefit to a fuel poor household if they are unable to afford to use any heating at all.

Both the previous and current governments have supported energy efficiency schemes to improve the current housing stock (10), largely after robust evidence from randomised community interventions conducted in New Zealand showed that retrofitting insulation and efficient heating devices was cost-effective and improved health (77, 122, 181). The *Housing, Insulation, and Health Study* assessed the effectiveness of retrofitting a standard insulation package including ceiling insulation, draught stopping, under-floor insulated foil and a moisture-stop polyethylene ground-cover (149). The study found that the insulation package increased indoor temperatures in the main bedroom, though this was not statistically significant and mean bedroom temperatures remained under 15°C, and reduced relative humidity, and self-reported dampness and mould (122). Improved self-reported health measured by the SF-36 questionnaire, reduced days of school and work, visits to general practitioners, and a trend for reduced respiratory associated hospital admissions was also found. A second study, *the Housing, Heating, and Health Study*, showed that replacing existing inefficient heating with effective, non-polluting heating improved asthmatic symptoms of children (77), providing policy evidence for the government subsidy of household heating systems as a means of improving population health (182). A recent cost-benefit analysis of

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<sup>12</sup> <http://www.energywise.govt.nz/funding-available/insulation-and-clean-heating> – accessed 30 November 2012

<sup>13</sup> A *Community Services Card* assists eligible low- to middle-income individuals and their dependent children with health care costs. See <http://www.workandincome.govt.nz/individuals/a-z-benefits/community-services-card.html> – accessed 30 November



the current government scheme, *Warm Up New Zealand: Heat Smart*, found it to be highly cost-effective, with benefits including energy savings and improved health outcomes outweighing the costs 3.9:1 (183).

However, it should be noted that although the gains made by this programme are large, significant heating is still required for many improved households to achieve healthy indoor temperatures (37). Lloyd and colleagues investigated the efficacy of a Government energy efficiency retrofit using a similar standard insulation package to the *Warm Up New Zealand: Heat Smart* insulation package in 100 state owned houses in Dunedin, a city in the South Island with an average annual temperature of 11°C (177). The study found that even after the retrofit slightly increased indoor temperatures in living rooms and bedrooms by  $0.6^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$ , occupants were exposed to indoor temperatures less than 12°C for almost half (48%) of any 24 hour day over the three month winter period (177). Further, to reduce fuel poverty to only 10% of the population using similar calculations to estimate potential fuel poverty as that described above, will require additional insulation measures and many more efficient heating appliances than are currently funded by the *Warm Up New Zealand: Heat Smart* programme (37). Another problem of the present programme is the limited targeting to low-income households, and poor uptake of subsidies to landlords of low-income tenants (10, 184). The introduction of a mandatory housing rating scheme in New Zealand has been suggested as a means to improve housing quality, particularly that of the significant private rental housing stock, and through this, health outcomes (185-187).

### 2.7.2 Heating practices/appliances

Many New Zealand households fail to achieve thermal comfort and low indoor temperatures are a common phenomenon with national average winter living room temperatures under 18°C, and bedroom temperatures under 14°C (9, 188). The *Household Energy End-use Project* found mean daily living room temperatures in

August-September 2001-2006 of around 16°C and in the southern South Island the average was just 14.7°C; bedrooms were, on average, slightly cooler than living rooms (189). Most households only heat the living room, or occupied rooms; bathrooms, hallways, and laundry rooms are only heated by up to a third of households; and bedrooms are heated overnight by only 16% of households (189). Although it has been suggested that New Zealander's have a culture of stoicism that encourages resistance to using heating (166), other data suggest that warmer indoor temperatures are desired, but are often unachievable due to poor energy efficiency of both buildings and heating appliances, and the cost of energy (2, 9, 10, 167, 189).

Space heating is usually electric, with 74.8% of households using electric space heating according to the most recent New Zealand Census, although many of these homes will also use some heating fuelled by wood, gas, or coal (175). There are no requirements for landlords to provide any heating appliances (10), contributing to the unaffordability of warmth for many private tenants. Limited government subsidies are available to homeowners, including landlords, for replacing non-compliant (polluting) fires with a new, efficient, clean heating appliance.<sup>14</sup> As Sharam argues, citing evidence from cross-sectional surveys in Australia showing that when other alternatives are limited rental arrears is used as a form of overdraft facility by low-income and private rental tenants, *"Landlords need to recognise that minimising capital expenditure on appliances results in cost shifting onto the tenant that only serves to undermine their capacity to pay their rent, and increases the likelihood that energy retailers will become the priority creditor"* (170, p3). Although there has been significant market penetration of air-source heat pumps, most households, particularly in the private rental sector, commonly rely on electric resistance space heating which is costly and often ineffective (9). Around 25-30% of households continue to use unflued gas heaters, despite health concerns and the relative expense

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<sup>14</sup> <http://www.energywise.govt.nz/funding-available/insulation-and-clean-heating/clean-air-funding> – accessed 30 November 2012

of this form of heating (9). *Household Energy End-use Project* data indicates that households heated by open solid fuel burners have the coolest average winter living room temperatures, followed by those using portable electric resistance heaters, and portable unflued gas heaters (189).

The inefficiency of heating appliances is not limited to space heating. Hot water heating accounts for 29% of household energy use and around 80% of households use electric cylinder hot water heating, with most of these being low pressure systems, although there is a trend to new systems being installed with greater pressure, which increases energy use (190). In addition, thermostats are often set at high temperatures or are faulty, increasing energy use and posing safety risks (190). A recent qualitative study of householders and tradespeople replacing or installing new hot water systems found that uptake of efficient hot water heating appliances in the current situation requires the householder to be aware of other options and drive the decision to install an efficient system, otherwise a conventional electric resistance hot water cylinder will be installed as the default option (191).

### **2.7.3 Income poverty and inequalities**

Although there is no official poverty measure in New Zealand the thresholds for low income or poverty commonly used is 60% of the median household income after housing costs, as is used widely among countries of the European Union and the Organisation for Economic Co-operation and Development (192). By this measure, analysis of cross-sectional data from the routinely undertaken Household Economic Survey found that the rate of poverty in the New Zealand population was 18%, remaining static over the period 2007-2010 (192). There are marked ethnic inequalities, with around half of Māori and Pacific households in the lower two income quintiles, compared to around a third of New Zealand European households in the lower two income quintiles (192). As has been recently highlighted by the Office of the Children's Commissioner's Expert Advisory Group on Solutions to

Child Poverty, inequalities are particularly striking among children (for further discussion see Chapter Seven), with around 25% of children in poverty nationally, and especially high rates for children of state-welfare beneficiaries, and Māori and Pasifika children (185).

Longitudinal survey data from the Survey of Families, Income and Employment study, with a baseline of over 18000 participants in the first of seven years, found higher rates of low income defined as <60% of the median household income equivalised for household size, and concluded that cross-sectional measurements of low-income and deprivation underestimate rates over time (193). In each of the seven study years between 23-25% of the survey population were in 'low income', with about 50% of the study population experiencing low income in at least one of the survey years (193). Low income was also found to be persistent over time with a quarter of those in low income in the first year remaining in low income over the seven years (193). The New Zealand Individual Deprivation Index, an eight question survey tool that measures individual-level deprivation, (153) and has become increasingly commonly used as a non-monetary measure of low income or poverty and deprivation, was included in the study at years 3, 5 and 7 (193). The study found that 6-7% of the study population, and that around three times more Māori than New Zealand European, were experiencing deprivation (defined as three or more New Zealand Individual Deprivation Index measures) in each of the three waves, but over the study period about 12% were experiencing deprivation at one of the timepoints measured (193). The duration and extent of deprivation increased with low income, especially among Māori, younger people, and sole-parent families (193). Of particular relevance here, the New Zealand Individual Deprivation Index includes a question that indicates poor thermal comfort and fuel poverty: "*In the last 12 months have you **personally** put up with feeling cold to save on heating costs? (yes/no)*" (153, p1484, original emphasis).

Both of these reports highlight that because over 40% of retired New Zealanders are solely reliant on the New Zealand Superannuation for their household income, using an income poverty measure comparing income to the national median finds a high proportion of people over 65 in poverty (192, 193). For this reason, Perry makes the case that non-monetary indicators, such as the New Zealand Individual Deprivation Index should be used to compare the material well-being of households (192). When the New Zealand Individual Deprivation Index is used to measure deprivation, middle-aged (45-64) are less deprived, and older (65+) New Zealanders even more so than younger age groups (193). This reflects the comparative wealth of older New Zealanders, most of whom own their own homes, although there are large racial differences, with many more Pākehā homeowners than Māori, Pacific, Asian and Other ethnic groups (42, 180).

#### **2.7.4 Electricity market influences**

In New Zealand household energy is predominantly electricity, therefore electricity access and pricing is an important driver of fuel poverty (2, 9). Following an extensive programme of deregulation, New Zealand's electricity market is one of the least regulated electricity markets among the countries of the Organisation for Economic Co-operation and Development (174). The market, although small, is disaggregated into different sectors including generation, transmission, and retail, with some state-owned enterprises, which must act under a business model to return profits to the government shareholder, also participating in the market. In practice, vertical reintegration of the market through large companies operating in more than one sector has occurred in New Zealand, as in other parts of the world such as the United Kingdom, and deregulation has not delivered either the increased market competition or efficiency that was promised to drive down prices (32, 194, 195). There are five major companies including the state-owned enterprises engaging in electricity generation and retail (known as "gentailers"), as well as lines companies providing electricity transmission. Several smaller companies also provide

electricity retail for residential consumers, some in specific local regions. Oversight of the electricity market is the under the jurisdiction of the Electricity Authority.

Between 1981 and 2012, overall electricity prices have increased 6.8 times, compared to the 4.1 increase in the Consumer Price Index (196). Since the 1990s deregulation, the real price of residential electricity has risen steeply, increasing 77.7% between 1990 and 2010, while industrial prices increased only 3.1% and commercial prices actually decreased 19.4%% (197). This price escalation of residential electricity intensified after 2000 (195, 198), and has been the subject of recent inquiry, including a Ministerial Review of Electricity Market Performance (199-202). These price rises have a particularly severe impact on the lowest income deciles, with household energy expenditure in the lowest income decile rising from 7.6% to 13.1% between 1989 and 2010, compared to expenditure in the highest income decile which remained fairly stable (1.1–1.6%) (10, 196). This has translated to inequalities in the increase of the amount of electricity purchased over time; after accounting for price rises, between 1989 and 2010 electricity consumption increased by around 5% for households in the lowest income decile, compared with an increase of around 11% in the highest income decile (196).

Despite this, even after the Ministerial Review (201), regulation of the domestic market continues to be light-handed and favours voluntary guidelines rather than state intervention. The only way in which the government has directly intervened to achieve lower electricity prices is by requiring a low user tariff for those using under 8000kWh per annum or 9000kWh per annum in the south of the South Island: this must be offered at around one third of the price of regular fixed daily charges.<sup>15</sup>

Disconnections for non-payment, another indicator of the unaffordable residential electricity prices, are continuing to increase (47, 160) despite the government's focus

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<sup>15</sup> <http://www.legislation.govt.nz/regulation/public/2004/0272/latest/viewpdf.aspx> - last accessed 25 November 2012

on consumer 'switching' between retailers to increase competition.<sup>16</sup> The government-supported "What's my number?" campaign, instigated as a response to improve market competition after the Ministerial Review, which encourages consumers' use of a website to calculate the number of dollars they could save by switching, is credited with the decrease in electricity prices seen in the last half of 2011 (203). However, we questioned how much more successful consumer switching can be in reducing prices when New Zealand's rate of consumer switching was already high by comparison with other countries (204, 205), prior to the increased focus on consumer switching resulting from the Ministerial Review (172). A recent international report ranks New Zealand's consumer switching rate for 2011 as second of 38 "fully liberalised" or deregulated electricity markets, up from fifth in 2009 and behind only Victoria, Australia (206). Further, while the campaign may have reduced the relative costs of the 388,000 consumers who changed companies in 2011 (203), it has not constrained the rise in overall residential electricity prices. Prices increased in early 2012 by 5-10%<sup>17</sup> across the country and continue to trend upwards (196).

Any benefits to households from switching are likely to have been skewed toward upper rather than lower income households, because of the constraints on switching faced by those on low incomes. Electricity companies require a cash 'bond', usually of NZD\$150-\$200, before they will connect households. Switching also creates additional difficulties for those consumers who have outstanding electricity debts, or a bad credit history, more often those at the severe end of the fuel poverty spectrum, who have already experienced the costs of disconnection for non-payment and subsequent reconnection fees. Moreover, for those using prepayment metering an up-front payment is usually required to remove the meter and transfer to another payment method. Despite criticism from the independent Parliamentary

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<sup>16</sup> <http://www.ea.govt.nz/consumer/csf/> - accessed 4 May 2012

<sup>17</sup> <http://www.consumer.org.nz/news/view/nationwide-power-price-hikes> - accessed 10 May 2012

Commissioner for the Environment (207) and the International Energy Agency (208), prepayment meters in New Zealand have usually not been smart meters and smart meters being installed are not required to be capable of remotely switching from prepayment to post-payment and vice versa (209).

## **2.8 Summation and direction**

This chapter has outlined alternative approaches to defining, measuring, and naming fuel poverty, coping strategies and health risks for householders experiencing this multi-sectoral problem, and described the policy issues involved in addressing fuel poverty. The present evidence indicates that fuel poverty is widespread in New Zealand and demonstrates that definitional debates do not reduce the urgency for either, investigation of, or policies to mitigate, the extent and effects of fuel poverty. However, finding the fuel poor is difficult in the local setting due to inadequate data. Therefore, this thesis continues with an investigation of the experience of fuel poverty, particularly among prepayment metering customers, before returning to suggested policy approaches for New Zealand in Chapter Nine, drawing on empirical results from the studies outlined in the following chapters.



## Chapter Three:

### Prepayment Metering – Making the (dis)connections

#### 3.1 Overview

There are a range of account payment options for electricity consumers in New Zealand, including direct debit billing, which often has prompt payment or other discounts; or alternatively, prepayment metering. Prepayment metering is a payment method where the consumer credits a meter installed at the house, in advance of the electricity being consumed. Prepayment metering is used by utility companies to provide service in instances where the consumer is considered a credit risk, has electricity debt or difficulty budgeting, or the consumer requests this method of payment (210-217). Prepayment meters can be used to collect payment of debt while continuing the supply of electricity (213), and are often portrayed by retailers and perceived by consumers as a useful budgetary tool (211, 212).

Overseas, prepayment metering is typically used by low-income households, as has been shown in Australia, England, Northern Ireland, North America, and South Africa (211, 212, 214-216, 218). Use of prepayment metering is becoming more widespread especially with the introduction of advanced metering technologies, and is also being introduced in developing and transitioning countries, for example in India, parts of South America including Argentina (219), and in Rwanda and other African nations (220). The international evidence cited above suggests consumers using prepayment metering are likely to experience high rates of fuel poverty. The little evidence available in New Zealand that relates to fuel poverty and prepayment metering indicates that this is also likely in the local setting.

There are several advantages to using prepayment metering, particularly with regards to increasing awareness and control of electricity consumption, which can reduce both household expenditure and emissions. However, disadvantages, particularly for low-income and fuel poor households, have also been highlighted. One of the most significant disadvantages to using prepayment metering is the risk of households “*self-disconnecting*” or running out of credit on their prepayment meters, resulting in no electricity, which may have serious health implications. The primary concern here is with deliberate self-disconnection due to financial constraint.

This chapter first outlines the technology involved, before examining the advantages and disadvantages of prepayment metering, and outlining the little information currently available on prepayment meter use in New Zealand. The second part of the chapter details a price comparison analysis undertaken in late 2009 and early 2010 in the beginning stages of this PhD investigation. This price comparison found that prepayment metering in New Zealand is a more expensive payment method for electricity than post-payment billing, and provided further rationale for continued investigation of the outcomes for prepayment meter consumers as a group likely to be experiencing fuel poverty in the subsequent studies.

### **3.2 Metering technologies**

Companies offering the use of prepayment meters have often justified increased pricing due to having to install special metering equipment at the household (211). Early prepayment technologies included mechanical coin or token meters, although this required cash or tokens to be collected, and therefore there was greater risk of tampering or theft associated with these. Magnetic strip card meters are credited by swiping a single use card through prepayment meter to transfer the credit and have

the advantage of requiring no special retail equipment to charge the preloaded cards (221). However, they cannot collect information on electricity consumption or disconnections, and have to have the tariff manually programmed (221). More modern prepayment meters are usually credited by entering a code into a keypad or with the use of a smart card. Use of keypad meters in particular, significantly reduces the costs for companies, as the code is usually purchased from stores that print the code onto a receipt from a payment system, which is usually capable of managing payments for other services, for example mobile phone prepayment vouchers. Keypad meters are usually described as “*semi-smart*” or “*advanced*”, in that only one-way communication from the electricity company to the meter is available, though this can allow tariff changes without manual programming (221). Newer smart card meters have cards that are assigned to the meter, and when loaded with credit this automatically displays on the meter (221). These systems can be programmed to record data from the meter to the card, for example crediting, consumption, and self-disconnection data, and tariffs changes can be recorded from the card to the meter (221). Smart card meters require special devices to read and upload information to and from the card at retail outlets, and a system for the electricity retailer to record the information (221).

Smart metering technologies that provide two-way communication between electricity companies and meters installed in dwellings and measure consumption regularly are becoming more widespread in industrialised countries (111). As smart meters can be remotely switched between prepayment and post-payment billing, these additional charges should no longer be necessary, although whether reduced costs are passed on to consumers depends on either corporate decisions or regulatory frameworks (111, 222). However, Darby notes that there is no universal agreement of what capabilities a smart meter has to have, though there is a European policy guideline on minimum services that includes: accurate monthly consumption information and data when switching; billing and consumer offers

based on actual consumption; remote connection and disconnection; and that meters must also be able to measure generation being fed back into the grid by consumer generators (111). The United Kingdom has added further requirements to current consultation documents of the provision of an in-home display, vital for consumer feedback, and a standardised home area network that can communicate real-time information to in-home displays (111, 223). The consultation also proposes the ability for remote switching between credit and prepayment, and load management capability for the supplier to control customer loads (111, 223), similar to the ripple control of hot water heating used in New Zealand.

In the local setting, there are no requirements for metering devices in New Zealand, causing the Parliamentary Commissioner for the Environment, an independent advisor to the Government, to voice concerns about the haphazard and purely market-led roll out of smart metering technologies being carried out (207). The regulatory body issued only voluntary guidelines, which, with regards to functions such as home area network capability and installation of in-home displays, were largely being ignored (207, 209). The International Energy Agency recommended to the Government that they review their decision and intervene by regulating the roll-out of smart metering in the 2010 review on energy policy (208). The regulator consulted and reviewed the guidelines, but has decided not to intervene further citing adequate competition in the metering services provision market (224). This lack of functional requirements of metering devices also holds for prepayment metering devices, and different devices are used by different companies, with no requirements for in-home displays or information provided by them where they are deployed.

### **3.3 Advantages**

Coutard and Guy (225) argue that the advantages of prepayment metering, and the appreciation that prepayment meter users have for them are often overlooked.

Using prepayment metering provides the potential for greater budgetary control, and avoids the accrual of large debts, in addition to disconnection and reconnection fees often applied to post-payment customer accounts where disconnection cannot be avoided, advantages that are also highlighted by consumers participating in qualitative research (88, 108, 168, 226). Prepayment metering may also empower low-income consumers to choose when unavoidable disconnection may occur, and remove the need for embarrassing or stressful interactions with their electricity company about debt and disconnection (212, 225, 227).

A cost-benefit analysis of the introduction of a prepayment metering system in Argentina, which has achieved uptake by 45% of consumers, found that prepayment metering overall had a positive effect on the social welfare of the company and consumers, but not the government, due to reduced taxes associated with reduced electricity (219). However, while the analysis included transactional costs associated with weekly credit purchases, as opposed to monthly purchases for consumers, any costs associated with self-disconnection were not included. A companion survey to the study found high satisfaction with prepayment metering and that 45.2% of respondents had self-disconnected in the past year. Of these self-disconnections, 62.0% were less than seven hours long, and for short self-disconnections, 83.3% were due to neglect rather than financial reasons (219). The authors noted that the opposite was true for self-disconnections longer than seven hours.

Most electricity prepayment meters have the ability to be programmed to continue service until normal working hours if credit runs out overnight or on weekends or public holidays (this is referred to in the United Kingdom as supplying “friendly credit”, which is later paid for by the consumer) (228). It is also possible for most systems to make set amounts of emergency credit available, either automatically, or when activated. However, the use of emergency credit does not always have positive

outcomes for consumers if the resulting debt is unaffordable, and some consumers may choose not to use emergency credit even if self-disconnected (228).

### 3.3.1 Feedback

Prepayment metering increases awareness of energy use, by improving consumer feedback and allowing consumers to engage in decision-making around purchasing energy services or end-uses which are materialised, as opposed to purchasing energy itself, which has been described as invisible, intangible, or abstract to consumers (229-231). To illustrate this, the delayed feedback typically provided by energy billing statements sent in arrears has been classically contrasted with a hypothetical situation of being billed for groceries, which were not individually marked with prices, at the end of the month (112, 113).

A review of 12 pilot studies undertaken by electricity retailers that investigated the effect of in-home displays showing electricity use on consumer behaviour found that the direct feedback provided by in-home displays encourages energy conservation (232). Consumers who actively used in-home displays reduced electricity consumption by an average of 7%, and when a prepayment meter was used in addition to an in-home display consumption was reduced by about 14% (232). However, as other reviews of studies investigating the effect of feedback on electricity consumption have noted, the quality of these investigations has been variable, including that of the studies included by Faruqui and colleagues (232), and methodological shortcomings, including the sampling strategy and small samples used, and lack of control groups, may have overestimated the effectiveness of feedback in several of the available studies (111, 233, 234). Darby notes that the figures for reductions in energy consumption in earlier, less robust studies, were typically reported as around 5-15%, though larger trials compared with control groups have reported smaller savings of 2-6% (111). Recent evaluations in the United Kingdom have found that smart meters, when combined with in-home

displays, have given reductions of 3% (111). Nevertheless it is clear that providing regular feedback, such as that provided by in-home displays and prepayment meters, does reduce electricity consumption to some extent, and savings may be further improved when appliance-specific information is given (111, 233, 234). However, the disadvantages of prepayment metering (discussed below), raise the question of whether an alternative strategy for improving feedback without the risk of self-disconnection could be more appropriate. Other means of providing feedback that have been investigated include the use of more regular or informative billing; in-depth energy advice; and in-home displays (233-237).

In contrast to the research presented above, a recent quantitative modelling study using data from Northern Ireland, where prepayment metering is used by around 30% of the national population, found that using prepayment metering tended to increase electricity consumption (214). The study used a matched analysis approach with data from the Northern Ireland Continuous Household Survey to estimate the counter-factual expenditure on electricity for households using prepayment metering if they were to pay using post-payment billing. While this study used a modelling approach rather than collecting before and after data from the same households, it is consistent with the idea presented by Colton (2001) that low-income households that typically use prepayment metering often cannot reduce consumption as it is essential, not discretionary (110). It is also consistent with the evidence that electricity is relatively price inelastic in terms of demand (238), indicating that at least up to a certain level of energy consumption, electricity is a necessary good in economic terms, as opposed to a luxury good. These findings suggest that the relationship between feedback and consumption is complex among households using prepayment metering and further, robustly planned investigations are required to untangle the effects.

### 3.3.2 Corporate advantages

The advantages of prepayment metering from the perspective of electricity companies are largely that they reduce the costs associated with post-payment billing, even for consumers who do not have outstanding debt (219, 239). Similarly, the advent of smart metering technologies arguably enables companies to further disengage from low-income consumers, while focussing higher value products and services, such as security and home energy management services that can be controlled by smart meters, to more lucrative classes of consumers (240-242). For more problematic consumers who do incur debt, prepayment metering is useful for reducing costs as it provides a means for debt collection, limits exposure to future bad debt, and reduces the social responsibility of companies who would previously had to disconnect services from consumers with debt (216, 217, 227, 239, 241). It further prioritises electricity above other household expenses, with some indications that without the flexibility previously offered by energy credit accounts, households will further restrict grocery spending or enter rental or other billing arrears to purchase electricity when other options are unavailable (227). However, prepayment metering also provides a means for companies to offer services to consumers with minimal or irregular incomes, while limiting risk (219).

Another advantage is that if peak demand can be reduced by better feedback, there may be reduced need to provide peaking electricity generation which is expensive to produce, but required in the local setting where renewable generation can cause large fluctuations in supply that often do not match peak demand (239). Smart prepayment metering may be particularly successful at reducing peak demand if used in conjunction with time-of-use tariffs, where scheduled prices vary at different times of the day; real-time tariffs, where dynamic prices reflect the available generation of renewables and current consumer demand; or critical peak pricing, where high prices are scheduled for critical events (111).



### 3.3.3 Harnessing the advantages – the Northern Ireland model

With stronger controls in place to restrict electricity companies from charging more for electricity purchased through prepayment, prepayment metering could be useful to low-income households living in fuel poverty. Northern Ireland provides a good example of how implementation of suitable policies and regulatory oversight can make prepayment part of the solution to the fuel poverty problem (7, 81).

The main electricity retailer in Northern Ireland, Northern Ireland Energy, switched to a semi-smart key-pad prepayment metering system in 2002, resulting in increased uptake of prepayment metering, and in mid-2009 230,000 of electricity consumers (30%) were using the key-pad meter (140, 214). Although over half of these are low-income households (58%), use has spread to other groups and 32% are middle-to-high income earners (140). Owen and Ward (2010) attribute the diffusion through the market to three key drivers: Northern Ireland Energy offers a 2% discount to prepayment metering consumers, which is considered by the retailer to reflect reduced costs of debt management (compared to standard credit accounts, although consumers paying by direct debit receive a 4% discount); credit payment options now include phone and internet, which is considered to have reduced stigma and attracted higher value consumers as payment via these methods have a minimum payment limit of £15 and are typically of above average denominations; the regulator, the Office for the Regulation of Electricity and Gas (known as Ofreg), required “friendly credit” hours, and self-disconnection can only occur between 8am and 4pm Monday-Friday, with an extension to 11am available on request (140).

### 3.4 Disadvantages

Several articles have discussed the effect of prepayment metering on low-income domestic consumers in the United Kingdom (210, 216, 240, 242-246). A growing body of grey literature also discusses fuel poverty and the use of prepayment meters (168, 211, 212, 215, 217, 227, 228, 247-249). These authors highlight the essential

nature of electricity services, the sacrifices made by households in order to afford even inadequate levels of energy services, and the higher prices generally paid by consumers using prepayment meters, among other problems as growing concerns which can lead to social exclusion of low-income consumers using prepayment metering.

While not advocating their use, Sharam points out that low-income people prefer the discretion and privacy that prepayment meters offer, rather than face negotiating with electricity companies, reconnection fees, and uncertainty about when they will be disconnected (212). However, prepayment metering may contribute to poor health, by increasing cold and damp through lack of heating (246). The shifting of low-income consumers to prepayment metering has been described as “*social dumping*”; enabling companies to reduce the costs and negative publicity of household disconnection (216, 244). In this context, prepayment meters act to “*shift the burden of disconnection from the public to the private sphere*” (245, p120).

### **3.4.1 Self-disconnection**

The misleading term “*self-disconnection*” refers to the service being shut off when a prepayment meter runs out of credit. The electricity company is not disabling the connection to the electricity grid: rather, the consumer is ‘choosing’ not to re-credit their prepayment meter, and is thereby ‘self-disconnecting’ their household from electricity services (or other services that may be supplied through prepayment metering). While the term problematically implies the consumer has agency to make a choice to disconnect, it is widely used and understood so I will continue to use it throughout this thesis.

During the early years of prepayment meter use, official statistics on self-disconnection events have not been collected and reported in the manner that disconnections for late or non-payment of bills for standard post-payment billing

accounts have been (243). Part of this is due to the limited capabilities of older technologies; however, the framing of self-disconnection as an autonomous decision by householders contributes continued justification for companies to refrain from reporting statistics on this critically important disadvantage of using prepayment metering. Self-disconnection is of policy relevance however, as it has *“clear negative impacts”* with a recent extensive study from the United Kingdom reporting that *“almost half of households using prepayment metering and that had self-disconnected said that the disconnections had had a negative impact on their wellbeing”* (168, p11). These negative impacts included those with practical implications and which may have poor physical health outcomes, such as, reduced indoor temperatures, reduced quality and nutritional value of food, and restrictions on leisure and lifestyle. There were also negative impacts for psychological wellbeing including stress and worry about both the financial concerns and practical concerns of having to credit meters, and boredom (caused by restricted entertainment).

British information suggests a clear correlation between reduced official electricity disconnection figures, and increased prepayment meter use (243, 245). Graham cites figures from the Office of the Gas and Electricity Markets (known as Ofgem), the regulatory body for the electricity and gas markets in Great Britain, suggesting around one quarter of consumers using prepayment meters experienced self-disconnection in the third quarter of 2005, a period of relative prosperity (243). The Electricity Commission compared New Zealand’s much higher rate of disconnection with that of Victoria, Australia and the United Kingdom, and commented that while *“prepayment meters have been used extensively in the United Kingdom, and this may be reducing the apparent rate of disconnection for non-payment”*, prepayment meters are not used in Victoria (250, p86). The meaning of this point is unclear, as Victoria has had an electricity market with stronger regulations and stricter consumer protections than New Zealand, after New Zealand embarked on an even more extensive programme of deregulation than the United Kingdom example (32). Therefore, it is

expected that rate of disconnection in Victoria would be less than in New Zealand, even without the use of prepayment metering in both settings, and that the United Kingdom would have low rates of disconnection compared to both Victoria and New Zealand, due to the high use of prepayment metering.

### *Quantitative research examining self-disconnection*

As it is a significant disadvantage of prepayment metering, several studies have been undertaken to investigate self-disconnection rates, frequency, duration, and reasons for self-disconnection, particularly in the United Kingdom where they have been long-used, with a large number of these by or commissioned for advocacy agencies. Many studies that were identified through web searches were unable to be fully examined, as key results may be mentioned in a shorter article or other papers, but detailed reports were unavailable, especially for some of the earlier studies and for those undertaken by or for utilities companies. Doble argued that in order to give a useful picture of the pattern of self-disconnection among prepayment meter users, a representative sample of *all* those who use prepayment meters should ideally be studied (169). He highlighted that earlier studies by advocacy and community organisations may have reported biased results when samples of their populations have been used, as these people are usually already seeking help or known to the agencies as having experienced or being at risk of self-disconnection (for extensive descriptions and critiques of earlier studies in the United Kingdom see (169)).

Four robust, cross-sectional surveys (168, 169, 251, 252), and a recent modelling study (253) reporting self-disconnection rates and outcomes in the United Kingdom all found that although there are a number of self-disconnections which, although potentially inconvenient or associated with additional transaction costs such as an extra trip to purchase credit, are largely unproblematic. Overall, these studies report that the majority of self-disconnections are less than a few hours long, and are due to

forgetfulness. However, they also highlight that for a small number of particularly vulnerable consumers, prepayment metering results in self-disconnection events that cause significant further hardship as they may be: problematically frequent; of unreasonably long duration; and due to financial constraints. Overall, the studies indicate that self-disconnection in the United Kingdom population of prepayment meters occurs in 16-30% of households using this payment method. I will now discuss these studies and their findings in detail.

Doble used a cross-sectional survey design and face-to-face interviews with 200 gas prepayment meter users in Coventry, randomly sampled through British Gas to investigate the extent and outcomes of gas self-disconnections (169). This study showed that while the number of households experiencing gas self-disconnection (33% in the past 12 months) was higher than in other previous surveys sampling community and budgeting agencies, 64% of these self-disconnections were less than seven hours long and were largely unproblematic (169). The most common reason for short self-disconnections (n=39) was that households were unaware the meter credit was low. For longer self-disconnections (n=36), reasons were that households had to wait for wages or benefits to be paid; that credit outlets were closed; or that the gas ran out overnight.

Two larger studies, undertaken at around the same time as the above study, reported slightly lower self-disconnection rates (251, 252). Henderson and colleagues reported on a cross-sectional survey conducted by face-to-face interviews, with an earlier qualitative scoping study using focus groups, which was commissioned by the then regulatory body (now the Office of Gas and Electricity Markets) (251). Their study of 295 electricity prepayment meter users, from areas of the United Kingdom where electricity had been deregulated in 1998, found a self-disconnection rate of 27% in the past 12 months; of these 59% were less than two hours long and 9% lasted between two to five hours. Among their respondents, the

main reason for self-disconnection was financial constraints, which were further described with: 21% reporting that they had no money at the time; 6% that they were waiting for wages or benefits to be paid; and 1% reporting that they were saving money by not crediting their electricity meter.

A large cross-sectional survey conducted using face-to-face interviews, and designed for a representative sample of prepayment meter users, was commissioned by the Electricity Association and undertaken by Cooke and colleagues in Great Britain (252). The sample of 3417 households included: 941 households using prepayment meters for both electricity and gas; 1150 using prepayment for electricity only; 41 using prepayment for gas only; and 1285 post-payment consumers. They reported a self-disconnection rate for electricity of 24% during the previous year; of these 42% had self-disconnected once; 24% on three or more occasions; and 4% had experienced 20 or more self-disconnections in the past 12 months. The predominant reason for self-disconnection was forgetfulness, except for the unemployed for whom financial constraints were the most common driver of self-disconnection.

Most recently, *Consumer Focus*, an advocacy organisation in the United Kingdom, commissioned an extensive mixed methods research study undertaken by the research agency *RS Consulting*, to investigate the experiences and outcomes of using prepayment metering for consumers. The full study is reported by Boelman and colleagues (168), with summaries reported by Mummery and Reilly (228), and Consumer Focus Wales (247). This study, which demonstrates high levels of methodological rigour, was conducted across England, Wales, and Scotland with prepayment metering consumers and included 5726 face-to-face quantitative surveys, supplemented by 761 extended quantitative interviews; and 31 in-depth qualitative interviews. The study, which was weighted to provide representativeness across Great Britain, found a lower self-disconnection rate of 16% in the past 12 months. Of those who self-disconnected, 5% did so 'regularly' or three

or more times per month; while 3% did so 'occasionally' or between six and 12 times, and 8% 'rarely' or one or two times in the past 12 months. The duration of the self-disconnection was usually short – less than one hour for 37%, and between one and three hours for 27%. However, 9% of self-disconnections lasted 24 or more hours, while 1% were at least 48 hours long. As with the earlier studies, the main reasons identified for self-disconnection were: not realising the meter credit was so low; financial constraints; or forgetting to top-up. The main reason for regular weekly and monthly self-disconnections was waiting to be paid, but for more frequent self-disconnections at set times of the day the main reason was running out of credit overnight.

Cooke and colleagues commented that as their interviews were undertaken in the spring/summer of 2000, following a mild winter, and their self-disconnection rate was based on whether households had self-disconnected in the past 12 months, the rate of self-disconnection found is likely to be lower than that occurring in an average winter (252). Timing of the other studies may have similarly affected the reported rates of self-disconnection.

A recent modelling study that used data from British Gas Electricity's consumer database comprising 2.3 million households, reported self-disconnection among 22% of households in the past 12 months, although the study is likely to have underestimated self-disconnection (253). For the model, 'self-disconnection' was defined as when emergency credit had been accessed and predicted to have run out, in contrast to the usual definition of when credit runs out. The time self-disconnection occurred was estimated using the time between crediting, and the ratio of median expenditure to the estimated use by the self-disconnecting household in the month of disconnection. The ratio was calculated by comparing the median expenditure to the self-disconnecting household in the month prior to the disconnection, and it was assumed that the same expenditure would be observed

in the following month when self-disconnection occurred. A self-disconnection of less than one day (62% of self-disconnections) was counted when the meter was credited on the same day the household was predicted to have run out of accessed emergency credit. Brutscher acknowledged that this is probably a conservative measure of duration of self-disconnection as does not account for self-rationing prior to self-disconnection (253).

The study reported that the main reason for self-disconnection was financial constraints, although the methods used to estimate this also raise some questions (253). A quantitative telephone survey, from the same sample, was matched to the model to estimate the reasons for self-disconnection and crediting habits of prepayment meter users; however, proxy questions were used, instead of direct questions to participants which may have been more informative. For example, participants were asked whether they considered themselves forgetful, rather than whether they self-disconnected because they forgot to check or credit the meter.

Brutscher suggests that from a policy perspective the key issue is *“when households are without the possibility of electricity”* (253, p11). The cross-sectional survey by Cooke and colleagues reported much higher rates of emergency credit use (73%) among electricity prepayment meter consumers than self-disconnection overall (24%), although rates varied by household demographics, composition, and rurality (252). Similarly, Boelman and colleagues reported emergency credit use by 54% of 718 prepayment meter users in their cross-sectional survey, compared with 16% who self-disconnected (168). However, the assumption that emergency credit will be used is problematic as this and other research indicates that at least some prepayment meter users do not use available emergency credit when self-disconnected. This assumption also ignores that self-rationing can be extensive, and should also be considered important from a policy perspective as the negative wellbeing outcomes are likely to require public spending to address including



spending on healthcare and, or, social welfare. Also, for some households that use the emergency credit, the duration of self-disconnection or extensive self-rationing following emergency credit use may be significant, because they cannot afford to clear the debt.

### 3.4.2 Self-rationing

Coping strategies for managing financial constraints and using prepayment metering typically reflect those previously outlined as fuel poverty coping strategies, captured well by the title of a Consumer Focus United Kingdom report *“Cutting back, cutting down, cutting off”* (228). As a reflection of the terminology around self-disconnection, several reports include descriptions of *“self-rationing”*, a term which is equally problematic, as again it implies that there is scope for choice for these households about whether or not they ‘ration’ their energy services where none may exist.

In the full report of the recent research undertaken for Consumer Focus United Kingdom, Boelman and colleagues define self-rationing as follows (168, p68):

*“‘Self-rationing’ is behaviour intended specifically to preserve the credit on a prepayment meter. This can be by reducing energy consumption (energy rationing), or by saving money in other areas that is then used to top up the meter (spend rationing).”*

Mummery and Reilly provide the following description of the consequences of self-rationing (228, p18):

*“This behaviour often goes well beyond basic energy efficiency measures and often involves cutting back on everyday essentials and/or energy use in a way that impacts negatively on the consumers’ daily life. This can range from not socialising, having to go to bed early just to keep warm or skipping meals.”*

This description makes clear that the additional concern around rationing for fuel poor households using prepayment metering is that the increased feedback provided tends to encourage reductions in essential energy consumption. While reduced consumption may be beneficial from an environmental perspective, or in a purely economic sense, low-income households tend to have less discretionary energy consumption and therefore less opportunities for reducing consumption (110). This may be of particular concern among electricity prepayment metering consumers in New Zealand where electric space heating is commonly used, indoor temperatures are typically low, and use of central heating is rare, as cutting back on electric heating to reduce electricity consumption will often mean that the house is even more under-heated. Several studies have highlighted that despite self-rationing energy consumption, sometimes taking extreme lengths, some households continue to experience periods of self-disconnection (2, 226-228, 245, 247, 248, 252). As with self-disconnection, the negative effects for households that engage in self-rationing also include the physical and psychological impacts of cold housing, restricted diets, and social exclusion (168).

### *Quantitative research examining self-rationing*

Measuring self-rationing is more problematic than measuring self-disconnection which is more easily defined; however, some information quantifying the extent of self-rationing is available. For example, Doble commented that 33.5% of the participants in his survey reported not being able to afford enough heating (169). Cooke and colleagues (252, p39), reported figures for the following measures of energy self-rationing used to conserve electricity (n=2091) and gas (n=982) by prepayment meter consumers (Electricity, Gas):

- Turned off unnecessary lights (70%, not applicable);
- Used energy saving bulbs (26%, not applicable);
- Turned heating off when the house was unoccupied (38%, 58%);

- Had some rooms unheated (22%, 26%);
- Had the heating off when the house was occupied (18%, 31%);
- Had thermostats set to a lower temperature than occupants would have liked (10%, 16%);
- Reduced use of hot water (16%, 15%);
- Reduced use of cooker (9%, 8%);
- Reduced use of other appliances (13%, 6%).

They also reported that 16% of electricity prepayment meter consumers reported not trying to economise on electricity consumption; similarly, 22% of gas prepayment meter consumers reported not trying to economise on gas consumption (252).

Boelman and colleagues extensively investigated self-rationing, using a mixed methods research approach including both a quantitative survey, and an in-depth interview study, and found that 50% of households reported some self-rationing to preserve or purchase credit for their prepayment meter (168). They reported that 45% of all prepayment metering consumers (n718) self-ration energy, and specifically:

- 33% turned down heating;
- 16% reduced kitchen/laundry appliance use;
- 15% reduced lighting use;
- 11% reduced TV/computer/games console use.

They also reported that energy self-rationing was more prevalent among rental tenants than those occupying their own homes and among those with a long-term health condition or disability than those without a health condition (168).

In order to afford credit for their prepayment meters, 22% of all prepayment metering consumers (n=718) reported self-rationing other spending, specifically:

- 10% reduced spending on/missed payments on other bills;
- 5% reduced or cancelled phone/TV/internet accounts;
- 2% missed a rent/mortgage payment;
- 13% reduced leisure spending (e.g. going out or on holidays, buying books or music);
- 10% reduced spending on food and other essentials;
- 8% reduced spending on celebrations and gifts for others.

In their cross-sectional survey investigating the coping strategies of low-income households, Anderson and colleagues found that 62% of electricity prepayment metering consumers (n=216) reported that their home was colder than they wanted last winter (88). Electricity prepayment metering consumers had 2.6 times higher odds of energy self-rationing than direct debit or standing order payment customers (total survey n=699) (88).

The findings from the research presented above suggest that, approximately, between one third and two thirds of prepayment metering consumers report indicators of poor thermal comfort, including insufficient heating; and that energy self-rationing contributes to this. Interestingly, Cooke and colleagues also reported that of electricity prepayment meter users, 12% reported not being able to afford enough fuel, and 9% not being able to heat their homes properly; figures which are lower, although gas rather than electric space heating is more typical the United Kingdom (252). Waddams Price and colleagues (80), who analysed some of the same data collected in the 2001 study reported by Cooke and colleagues (252) to compare objective and subjective measures of fuel poverty, found that only 16%

reported “*feeling fuel poor*”, compared to 28% who were expenditure fuel poor (spending over 10% of income on fuel). Taken together, this suggests that asking specific questions that indicate energy self-rationing, rather than asking whether households feel able to afford sufficient energy, may be important when determining the extent to which self-rationing occurs.

The findings from several studies highlighted above, agree that the majority of households using prepayment meters are satisfied with the payment method, even when self-rationing or self-disconnection occurs as a result of using them. A cross-sectional survey of 180 households conducted by Energy Action Scotland specifically focussed on consumers who reported dissatisfaction with prepayment metering to explore the reasons for this (249). Only 14% of the respondents reported ever experiencing self-disconnection, showing that this is often not the reason for dissatisfaction with prepayment metering. Dissatisfaction was mostly related to practical or system issues with prepayment metering and crediting meters and the effects of self-rationing (249), further described by qualitative studies outlined in Section 3.6 below.

### **3.6 Qualitative research investigating the experience of using prepayment metering**

There is little available qualitative research that explores the experience of and implications for households of the disadvantages of using prepayment metering, and it is often difficult to access. Extensive web searches yielded only two high quality studies directly investigating prepayment metering. The first, a study commissioned by the Office of Gas and Electricity Markets, was undertaken in 2007 in Greenwich, London, with 33 participants using prepayment metering for electricity, gas, or both, and included six former prepayment metering consumers

(226). The data were collected during a “*qualitative deliberative workshop*” consisting of informative plenary sessions followed by break-out focus groups with facilitated discussions. Participants also filled in a pre-event diary in the week prior to the workshop and a quantitative survey. The second qualitative study was part of the mixed methods research project commissioned by Consumer Focus United Kingdom, and included 31 survey participants purposively sampled for extensive/regular self-disconnection, and a spread of household and demographic characteristics, from England (n15), Scotland (n5), and Wales (n11) (168, 228, 247). Data collection included semi-structured interviews, and participants also completed diaries for the week following interviews. Interviewers took photos although these were not intended for publication, and completed observation diaries. Neither of these two studies described the qualitative analytic methods in detail however, making it difficult to assess the rigour of the analysis.

Limited information is available from other studies that may not have directly focussed on prepayment metering consumers, or presented certain qualitative results with little discussion of methods (88, 98, 108, 169, 248, 254). This is particularly true of qualitative studies that have been added as an addition to a quantitative study, but do not appear to have been designed with a strong qualitative methodology underpinning them.

The advantages of prepayment metering identified by participants of qualitative research are consistent with those highlighted in Section 3.2, and reflects the findings of quantitative research reporting that the majority of prepayment meter users prefer their method of payment despite any disadvantages. However, the reports of disadvantages found by qualitative research extend those typically identified in quantitative research findings, and are outlined in detail below.

### 3.6.1 Self-disconnection and self-rationing

The consequences of even short duration self-disconnection events are presented as more problematic in qualitative research reports, compared to the figures from the quantitative evidence discussed above. When having to go out to obtain credit, participants often describe this as an inconvenience, particularly those who have children at home, or if self-disconnection occurs when children are asleep (168, 226). This research also illustrates that maintaining credit can be a significant stressor for some, although some households that report this also report that they still prefer prepayment metering as a payment method (108, 168, 226).

Compared to households using other payment methods, prepayment meter consumers have described increased use of self-rationing behaviours, due to the cost of energy being more visible via increased feedback and therefore more easily reduced (98). Self-rationing is driven by economic concerns, but even with the feedback provided by prepayment metering, qualitative research reports gaps in consumers' knowledge of energy efficiency and energy consumption of different appliances (168, 226). Prepayment metering consumers report physical and mental health impacts of restricting heating, and also social costs including not inviting family or friends to visit because their homes are insufficiently warm (168). As has been found by research investigating the coping strategies of the fuel poor generally, many households using prepayment metering report restricting their diet, or even going without meals to credit their meters, although Boelman and colleagues comment that this is a "*false economy*" as it has other negative flow-on effects (168). For households with children, maintaining prepayment meter credit is presented as a priority, and some consumers report extra self-rationing occurring when children are away from home to avoid self-disconnection (2, 169, 248). One report included a participant who was unable to have his children to stay despite a shared custody arrangement as he felt his home was too cold when he could not afford heating (168).

### 3.6.2 System Issues

Several system issues with prepayment metering are highlighted as problematic, though these are likely to be amenable to change, which could reduce most of the disadvantages for some consumers. The research commissioned and reported by Consumer Focus (168, 228, 247) and their subsequent successful engagement with retailers has demonstrated this (255).

One problem noted by qualitative research that causes inconvenience for prepayment consumers is that sometimes the meter is poorly located – for some this has resulted in self-disconnection if they have not remembered or gone out of their way to check meters that are for example, in a storage cupboard, outside, too low, or too high (168, 226, 254). As a result of highlighting this, Consumer Focus United Kingdom report that there has been effort made by retailers to correct this, often with fees for moving or replacing meters being waived (255).

Location and availability of outlets for purchasing credit has been highlighted as a disadvantage by consumers, with many indicating they would appreciate other crediting options for example web or phone based crediting, although technological advances since some of these reports were made may have reduced these problems to some extent. A related issue to this is the timing of self-disconnection, particularly when “friendly credit” is not offered and emergency credit may have already been used. System faults can also be problematic and sometimes create hardship, particularly if they result in self-disconnection, with some consumers describing extended periods of over a day without the service being restored (168, 226). These faults may either be with the payment/purchasing system, or with the metering system itself.

The amount of debt that is repaid when consumers who are in arrears credit their prepayment meters varies by jurisdiction where there are regulations or by



company. For some households, the proportion of debt being paid per credit prolongs hardship for extended periods while debts are paid off (168, 248). The availability and use of emergency credit is also variable, fees may be charged for using it, and some studies report some households are unaware of the availability of emergency credit, or sometimes how to use it when it is required to be manually triggered (168, 248). Similarly to those with previous arrears being paid through the meter, some studies report that the resultant debt creates further hardship and households may be reluctant to access the credit due to this (248).

### **3.7 New Zealand scenario**

Although prepayment meters have been in use in New Zealand for over twenty years, there is very little information available about the outcomes of using prepayment metering for consumers. What little evidence is available is outlined below.

#### **3.7.1 Community Energy Action Prepayment Metering Survey**

A cross-sectional survey that sampled 29 vulnerable households using prepayment metering who were engaged with social agencies in Christchurch was undertaken by Community Energy Action in the mid-1990s (11). The study found that 59% had experienced a period of self-disconnection over the previous fortnight, with the duration most commonly reported as two days, ranging from 1-6 (11). The average frequency of crediting the meter was almost weekly, with an average amount of just over \$25 (personal communication, Ian McChesney, Community Energy Action, August 2012). Over a quarter (28%) of the participants were repaying electricity debt through the meter, and half used electric space heating. Despite the disadvantages highlighted, over half of the participants gave positive evaluations of prepayment metering. A report of this research was never made public, although it was used by

Community Energy Action in their advocacy role to engage with the local retailer offering prepayment metering.

### 3.7.2 Warm Homes Pilot Study: Qualitative Component

One household that used a prepayment meter was interviewed as part of the *Warm Homes Pilot Study: Qualitative Component* in 2007 (2, 172). Kahu and Howard<sup>18</sup> described an extreme method of self-rationing, which could be described as a form of self-disconnecting, turning off the mains power supply at the fuse box during the day, to ration the electricity remaining before they would be able to afford more. Howard described this in detail, saying:

*"I've done it three times now... turning it off on a Tuesday morning... because I've only had say four or five dollars in there, and I turn it on at four o'clock... do a barbeque for the kids when I come home, so they got dinner, and then turn it on at night... we had a dollar fifty left in the morning, it would last until nine o'clock and I'd go down and buy some."*

He explained that if the credit runs out, the electricity is not disconnected between 4pm and 8am, and that switching off the mains electricity during the day and then turning it on again later ensured that their meter would not disconnect the electricity. Evaluating their situation, Howard said, *"But ah no one likes to live like that! Every week. Yeah."* Later in the interview, Howard described how Kahu, who also has COPD, had once been admitted to hospital because they had run out of electricity on a Monday and were not going to be paid until the Wednesday, which meant she would be without her nebuliser (critical electronic medical device) for that time. The family were informed that an emergency loan was available from social welfare; however Howard commented *"I'll stick to turning it off. Because you've gotta still pay that back... you don't have to if I turn it off."* Using prepayment metering

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<sup>18</sup> pseudonyms

provided Howard a method of controlling their electricity usage, and ensuring that they remain out of debt, and in this sense he has agency to control their situation. However, this method also means that on the days where he has 'self-disconnected', he and Kahu will be at home on a winter's day with no electricity, leaving the only available source of heating an unflued gas heater which negatively affects Kahu's respiratory disease.

### **3.7.3 Government study: Household Energy Affordability Project**

The qualitative study recently undertaken by government departments, (as described in Chapter Two), noted that prepayment metering was used by "*several*" households interviewed, and use of them among low-income households was reported as "*widespread*" by stakeholders interviewed in some regions, although no figures were supplied (94). The report comments that all households using prepayment metering preferred it to post-payment billing, and notes that the awareness of the cost of using different appliances, or energy services, encouraged conservation (94). The report also indicated that self-rationing, particularly of space heating, and self-disconnection may be problematic for low-income households using prepayment metering (94).

### **3.7.4 Survey of retailers offering prepayment metering by the regulatory body**

In 2008, the Electricity Commission's survey of retailers offering prepayment metering reported that there were 52,664 prepayment meters in use nationwide (256). No updated figures have been made public, and the regulator (now the Electricity Authority) is not undertaking further surveys of retailers with regards to prepayment metering. Based on the official estimate of the number of households in New Zealand for the year ended 2011, this is around 3% of households. The report noted that costs for prepayment meters vary considerably, with retailers reporting in July 2008 that fixed daily charges for prepayment meters ranged between NZ\$0.21 and NZ\$0.68 (256). Previous similar surveys had been carried out in 2007, 2006, and

2003, and the report noted that the number of prepayment meters in use had not increased over the period 2003-2008 (256). One retailer reported using meters with two-way communication, and a second that encrypted codes were entered by consumers which provided consumption data (256).

### **3.7.5 Media commentary**

Some anecdotal evidence that households using prepayment metering locally experience problems, including self-disconnection, is available from media stories. For example, one story from Invercargill in 2007 detailed a house fire caused by a candle being used after the household had self-disconnected (257). On another occasion, a computer fault made one company's crediting facility unavailable for more than 24 hours, and stories of households unable to credit their prepayment meter, and the Government's response were published (258, 259). A similar incident in 2010 was publicised when households, including one where a baby used critical electronic medical equipment, were again unable to credit their prepayment meters due to a fault (260). Concerns have been raised that low-income consumers may be forced onto prepayment metering plans when they run into financial difficulty (261-263). Retailers reject this accusation, but state that in some cases, where they cannot extend credit, *"we may limit our offer to pre-payment only"* (263, 264).

### **3.7.6 Alternative prepayment accounts**

As an alternative to prepayment metering, electricity companies are now considering prepayment accounts that revert to supply in arrears on the account when pre-purchased credits are used (i.e. the account would otherwise be self-disconnected if a prepayment meter was in use). This form of advanced payment account is pitched at higher income consumers than those who typically use or are targeted for prepayment metering system as they involve the use of web-based interfaces to monitor the accounts and purchase credits. One example of this is Powershop, the subsidiary company of Meridian Energy (a currently state-owned

gentailer), which offers consumers the chance to purchase electricity credits from a range of different packages, and monitor their energy consumption by manually reading and entering meter data into the web interface, or where a smart meter has been installed at the house metering data is automatically updated.<sup>19</sup>

A recent Master's thesis investigated aspects of a similar prepayment account system, *Advance*<sup>20</sup>, being trialled by Mercury Energy, the retailing company of state-owned Mighty River Power (239). The thesis used a mixed methods design, with a quantitative survey, and followed by a qualitative interview study. The quantitative survey was emailed to 2500 Mercury Energy customers, with one follow-up email, and achieved a response rate of just over 10% (n265). The qualitative study included a total of nineteen participants from two groups, six who had opted to participate in the Advance trial for at least two months when the interviews took place and thirteen who opted to continue with post-payment billing. The study highlighted that participants viewed electricity as an essential service, and they were reluctant to risk any supply interruptions, which they viewed as problematic as compared to other services they would use a prepaid account for, for example mobile phones. Participants also commented that they had little control over their electricity usage, although they did express a desire for better information of electricity consumption, and of better controlling their electricity bill payments. The study also found that there is a social stigma attached to prepayment electricity services, as prepayment metering has traditionally been targeted toward low-income consumers who have electricity debt in the local setting (239).

### 3.8 New Zealand price comparison analysis

Although better consumer protections are now recognised as important for prepayment metering and are particularly strong in the United Kingdom and

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<sup>19</sup> <http://www.powershop.co.nz/> - accessed 20 October 2012

<sup>20</sup> <https://www.mercuryadvance.co.nz/how-does-it-work/> - accessed 20 October 2012

especially Northern Ireland, concerns had previously been raised about disparities caused by retailers charging more for electricity purchased using prepayment metering than other payment plans (211, 245). This problem has also been recently highlighted as a concern in parts of the United States of America where prepayment is being increasingly introduced in several states; with Howat and McLaughlin labelling the additional fees that may be incurred for purchasing credit or checking balances “*junk fees*”(215). As described above, increased tariffs for prepayment metering was historically justified due to the requirement for specific metering technologies, however the presently available technologies and reduced costs for companies limits the credibility of these arguments today. To investigate whether prepayment pricing plans were more expensive than other payment plans in New Zealand, which would provide further evidence that a detailed examination of the use of prepayment metering would be beneficial when considering fuel poverty, I undertook a price comparison analysis.

Price comparison is complicated by several factors at play. New Zealand has a segmented market with little competition, as previously described (see Chapter Two). There are also significant regional price variations in electricity overall, in part due to the differences in generation, transmission, and retail in the different areas. These factors particularly affect prepayment metering consumers as there is usually only one retailer offering prepayment metering in each geographic region. In addition, the costs between each region cannot be directly compared, as the estimated annual usage of electricity increases with each southern geographical shift due to the changes in climate which lead to increased need for heating.

The majority of electricity plans available in New Zealand when the analysis was undertaken included a fixed daily tariff charge, and a per kWh charge for the actual amount of electricity used. One retailer was offering only single rate tariffs, where consumers are only charged a per kWh charge and any other costs are bundled into

that single charge. These single rate plans are shown in the graphs below in yellow, and were in most situations slightly cheaper than direct debit. Additional fees (junk fees) and other transactional costs incurred, for example time and travel to purchase credit, were not included in the analysis below.

As noted, as part of their initiatives to encourage competition in the electricity retail market, the government sponsors a website run by Consumer New Zealand, which displays price comparisons: [www.powerswitch.org.nz](http://www.powerswitch.org.nz). Price comparisons were obtained for four city areas of New Zealand; Auckland Central and Manukau City, and Wellington in the North Island, Christchurch City, and Dunedin City in the South Island. Price comparisons were run in September 2009, and again in February 2010 with similar results, and only the latest results are presented below. Comparisons were run using the following variables that can be entered into the site: one- to two-person, three- to four-person, and five- or more-person households; someone at home during the day; water heating provided by an electric hot water cylinder; plug-in electric space heating with additional space heating provided by a portable unflued LPG heater as is more typical in low-income homes who were also hypothesised to be using prepayment metering; and an electric oven and stove. Estimated annual electricity usage was generated by the website calculator, and prices over two plan types were compared: controlled hot water, which allows the electricity retailer to restrict hot water heating at times of peak demand; and uncontrolled hot water. Direct debit payment prices were compared with prepayment metering prices for both plan types. The cheapest possible prices across all retailers as at February 2010 are shown in the results below.

Comparing the estimated costs for a three- to four-person household, Figure 3.1 shows that prepayment metering is more expensive than direct debit payment in every case. Dunedin, the most southern and coldest city examined, had the most disparity between the direct debit and prepayment plans, with the cheapest

prepayment metering price for a controlled hot water plan being \$2,523 compared to \$2,056 for a direct debit plan, a 22.7% increased cost. The difference in the prices of uncontrolled hot water plans was even more marked, with a 38.9% higher price for prepayment metering (\$2,918 compared with \$2,100 for direct debit payment). Prepayment was also more expensive than the single tariff post-payment rate offered by one retailer.

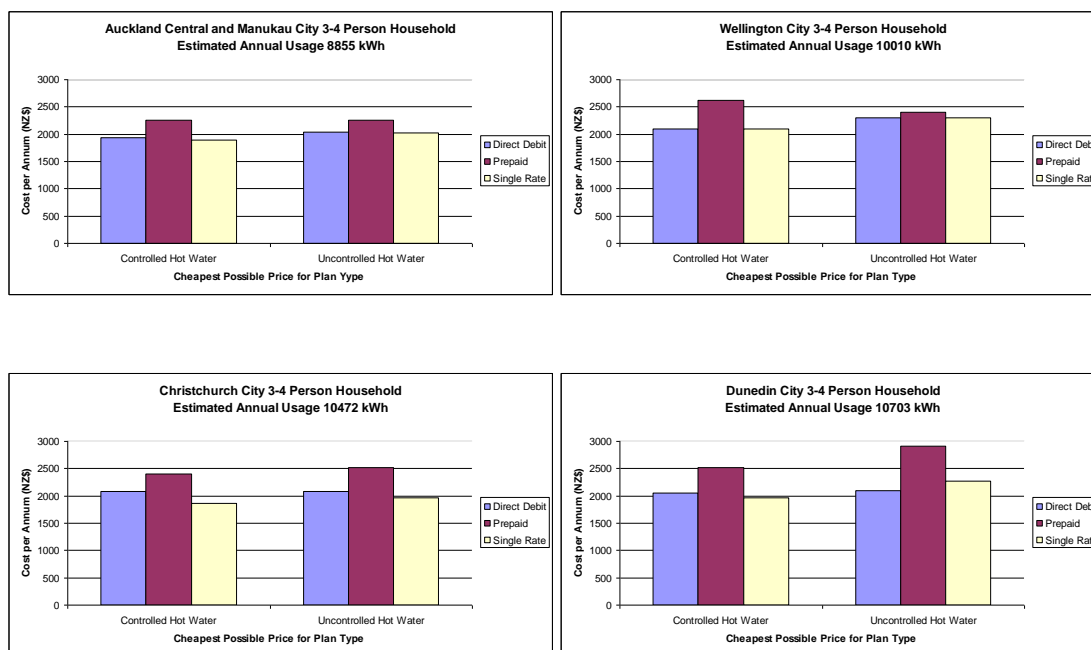


Figure 3.1 Electricity price comparisons for 3-4 person households for Auckland, Wellington, Christchurch, and Dunedin cities. Sources of prices: [www.powerswitch.org.nz](http://www.powerswitch.org.nz) accessed 10 February 2010

In the Wellington region in February 2010, two retailers offered prepayment metering according to [www.powerswitch.org.nz](http://www.powerswitch.org.nz), and the retailer offering the cheapest plan was not offering a controlled hot water plan, where the company has no ability to restrict electricity use in times of peak demand. This inability further limits the choice of those using prepayment metering, and increases their costs, as uncontrolled hot water plans are usually more expensive than controlled hot water plans. The uncontrolled plan in this case was more expensive than the controlled



plan, but this is probably because the comparison was between two retailers; if the cheaper company offered a controlled plan it would probably have been cheaper.

Comparing prices for households of five or more people (Figure 3.2) showed the same patterns. Prepayment metering was the most expensive plan type and greatest disparity was again in Dunedin.

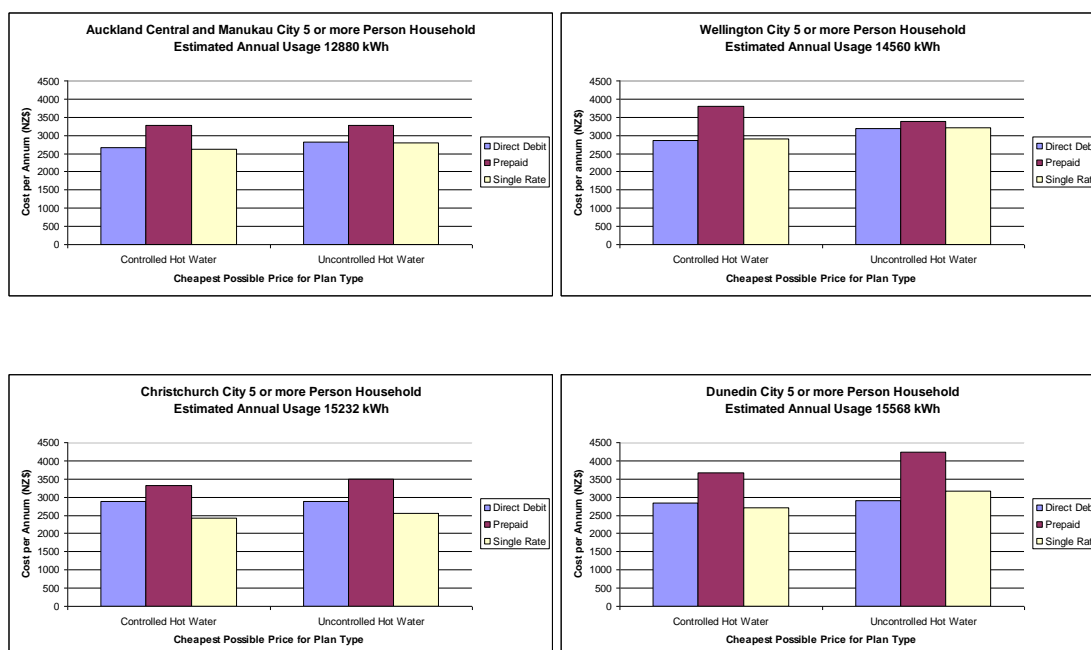


Figure 3.2: Electricity price comparisons for 5 or more person households for Auckland, Wellington, Christchurch and Dunedin cities. Source of prices: [www.powerswitch.org.nz](http://www.powerswitch.org.nz) accessed 10 February 2010

Turning now to price comparisons for one- to two-person households, the pattern was similar, although more complex, as these households are all eligible for a low daily fixed charge tariff option (Figure 3.3). Legislation stipulates that households using under 8000kWh annually for Auckland and Wellington, or 9000kWh in Christchurch and Dunedin in this study must be offered a low daily fixed charge that is around one third of the usual daily fixed charge. Retailers are free to set the

per kWh charge, however, and therefore the price difference between a low user tariff plan and a regular plan is small, as the per kWh charge is higher.

The graphs below show that in the case of one- to two-person households, prepayment metering was again more expensive than direct debit payment plans, in the four regions studied.

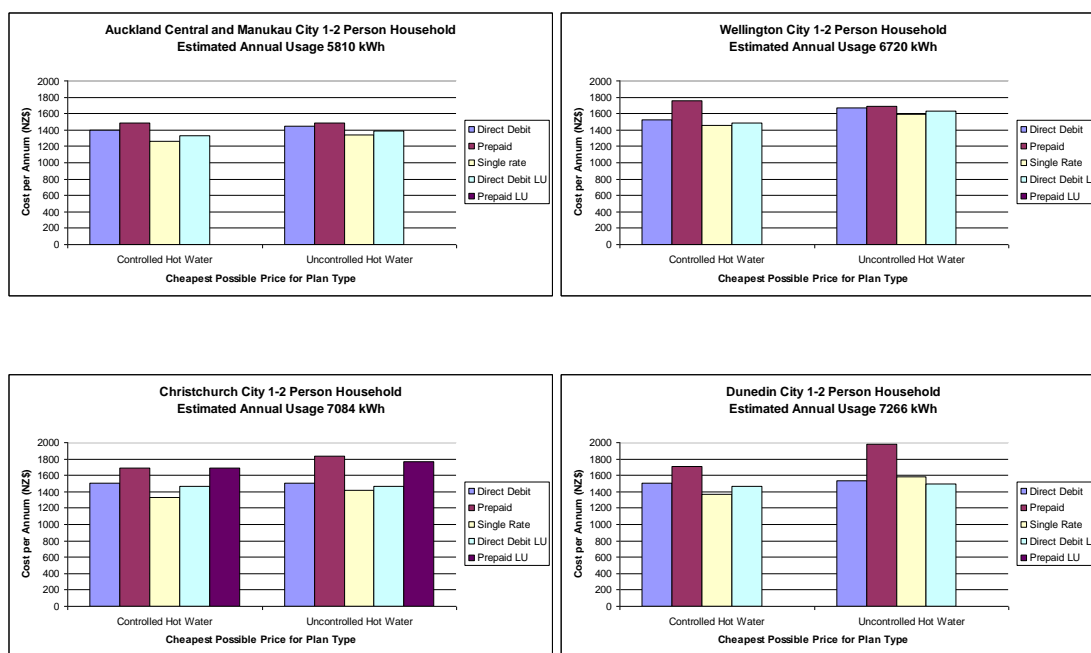


Figure 3.3: Electricity price comparisons for 1-2 person households for Auckland, Wellington, Christchurch, and Dunedin cities. Source of prices: [www.powerswitch.org.nz](http://www.powerswitch.org.nz) accessed 10 February 2010

Only one company, (Meridian Energy) which was retailing prepayment metering in the Christchurch region in February 2010, offered low fixed user tariffs to customers using prepayment metering according to [www.powerswitch.org.nz](http://www.powerswitch.org.nz). This indicates that the other companies may be operating outside the legal regulations, unless they have since made a low fixed user tariff available or gained an exemption from the Minister of Energy.<sup>5</sup>

Since 2010, Meridian Energy has moved out of prepayment metering in the Christchurch region, and has recently transferred those customers to Mercury Energy's prepayment metering programme where possible,<sup>21</sup> while they are still providing prepayment metering in some areas they have commented that they are looking to end their prepayment service nationwide (265). The only retailer currently offering prepayment metering in the Wellington region according to [www.powerswitch.org.nz](http://www.powerswitch.org.nz) is Genesis Energy, although at the time of the price comparison, Contact Energy also offered prepayment metering in the Wellington region.

This price comparison analysis highlighted that the use of prepayment metering alone is not an adequate policy to address fuel poverty in New Zealand, and in fact that continued use of prepayment metering in this form by fuel poor households is likely to cause greater hardship, as the electricity purchased is more expensive per kWh than other payment methods, even apart from additional transaction costs. The only saving likely to be beneficial to fuel poor households using prepayment metering, was if they could not afford to pay, and would otherwise face disconnection on a post-payment plan, they could avoid the disconnection and reconnection fees, which are often substantial and can lead to greater hardship to those struggling with electricity bills. This work was published and disseminated at conferences, and provided grounding for the continued investigation of the use of prepayment metering as one concrete way, in the absence of other national data, of targeting fuel poor households outlined in the following chapters.

Similar results were published in May 2012 by Consumer New Zealand, an independent not-for-profit organisation, which manages the price comparison website "Powerswitch" with government support (47). The price comparison

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<sup>21</sup> <http://www.meridianenergy.co.nz/for-home/your-account/powermanager/important-changes-to-powermanager/#www.glo-bug.co.nz> – accessed 13 October 2012

analysis reported by Consumer New Zealand differed from the one presented above in that the same company's prepayment and cheapest standard post-payment plans were compared in each regional area. Other conditions were similarly kept constant as outlined above to enable comparison. This comparison found that prepayment remains more expensive across 10 regional areas, with prices ranging from 3% - 38% higher than standard post-payment, with a median increased price of around 12% (47). As the company offering prepayment metering in each region is not necessarily also offering the cheapest available post-payment billing plan in the same region, it is likely that the *Consumer* price comparison underestimates the disparities between the two payment methods.

An initial policy recommendation arising from the price comparison analysis here is that prepayment pricing be required to be at least as cheap (if not a set percentage rate cheaper) as the cheapest possible post-payment plan offered by the same company in the same geographical area.

### **3.9 Summation and direction**

This chapter has outlined the issues of prepayment metering for energy, a technology that has most commonly been deployed among low-income households, many of whom are likely to be fuel poor, or tending towards fuel poverty. While prepayment metering has several advantages, the evidence presented suggests that without careful oversight, the disadvantages, particularly for some especially vulnerable households, cause considerable further hardship. It is not the prepayment meter device itself that causes most of the problems identified, but the way in which prepayment meters are regulated, priced, and marketed that contributes to the less extreme disadvantages experienced by many households. The overseas evidence, combined with the results of the price comparison analysis undertaken as a scoping

study at the beginning of this PhD project, confirmed that further investigation of the situation of households using prepayment metering was warranted, particularly in the absence of other data to identify fuel poor households in New Zealand.



## Chapter Four:

### Influences and Methods

#### 4.1 Outline

This thesis uses a multiphase mixed methods investigation of fuel poverty in New Zealand. It focusses on prepayment metering consumers as a group at high risk of fuel poverty (in the absence of other data for targeting fuel poor households). This chapter discusses the approaches applied to the investigation of prepayment metering from a consumer perspective.

This chapter provides an overview of the influences of this thesis, first setting aside the vexed issue of contested paradigms; then relating pragmatism, translational research, and sociotechnical systems theory to the thesis. It then outlines mixed methods research, and the multiphase mixed methods design used here. Lastly follows a general description of the methods used in the studies that come together in the complete multiphase mixed methods research programme undertaken: survey, interviews, and qualitative description. For ease of reference when reading each of the individual studies undertaken, practical methods are explained in Chapters Five through Eight.

I have specifically avoided the use of the terms ontology, epistemology, and methodology in my labelling of this chapter, as the literature often mixes the meaning of these terms, creating confusion. I have hopefully, however, made clear my influences and positions on these important concepts.

## 4.2 Influences

### 4.2.1 Paradigms

There is a vast body of social sciences literature debating methodological paradigms, which stems from the work of Thomas Kuhn, and is complicated by the multiple interpretations of the term, including by Kuhn himself (266). Mixed Methods Research has been described by Tashakkori and Teddlie as *“a third methodological movement”* (267, p272), reflecting earlier methodological theorising on the so-called *“paradigm wars”* between the competing philosophies of Quantitative Research, largely held as ‘positivist’ by those seeking a paradigm shift in the 1980s, and Qualitative Research, usually described as deriving from constructivist and interpretivist philosophical standpoints (266-269). It is not my intention to explore differing paradigms in depth here, particularly as the field of mixed methods research has developed especially over the past 10 years, and as Creswell noted has largely *“moved beyond”* the *“incompatibility thesis”*, that paradigms cannot be mixed, thereby ruling out the possibility of mixed methods research (270). However, a brief discussion explains my influences and position, giving some orientation to the mixed methods approach used in this research.

Morgan summarised four different concepts of paradigms (266, p50-53):

1. paradigms are *“worldviews or all-encompassing ways of experiencing and thinking about the world, including beliefs about morals, values, and aesthetics”* (p50);
2. paradigms treat *“epistemological stances (e.g. realism and constructivism) as distinctive belief systems that influence how research questions are asked and answered and takes a narrower approach by concentrating on one’s worldviews about issues within the philosophy of knowledge”* (p52);
3. paradigms are *“model examples that serve as “exemplars” for how research is done in a given field”* (p53);



4. paradigms are *“shared beliefs within a community of researchers who share a consensus about which questions are most meaningful and which procedures are most appropriate for answering those questions”* (p53).

It is the latter model that is advocated by Morgan, along with the *“pragmatic approach”* of Mixed Methods Research as an alternative to the previous dominant paradigms of Quantitative Research and Qualitative Research (266). As Morgan explained, although Kuhn acknowledged that this version of ‘paradigm’ could be applied to whole disciplines, his emphasis was on *“research communities”* or smaller groups focusing on the same technical area. Creswell also advocated this version of paradigms, which make it possible for researchers to move between them, as opposed to the more restrictive *“paradigms as epistemologies”* definitions (270, 271). Consistent with this description, Johnson and Onwuegbuzie suggested that a research paradigm is best viewed as a *“research culture”* (268). However, they also characterised mixed methods research itself as a paradigm.

Denzin argued that while researchers must be aware of different theoretical paradigms, they may not agree with mixing them if paradigms are defined as: *“overarching philosophical systems denoting particular ontologies, epistemologies, and methodologies”* which *“represent belief systems that attach the user to a particular worldview”* (269, p85). He describes *“perspectives”* as a kind of lower tier to paradigms: *“Perspectives, in contrast, are less well-developed systems and can be more easily moved between”* (269, p85).

In my thinking behind my research, I use a version of paradigms that is more consistent with the *“research communities”* idea or fourth model described above. In this thesis I have largely drawn on the ideas of pragmatism as described by mixed methods theorists; however I also acknowledge the influence of the ideas of

translational research and sociotechnical systems theory on this work. I will now briefly outline these concepts as they relate to mixed methods research – again, it is not my intention to explore these schools of thought in depth, rather to provide a backdrop that offers insight into the influences on my research approach.

#### 4.2.2 Pragmatism

Mixed methods research literature discussing pragmatism particularly highlights the contributions of three classical American pragmatists (Charles Sanders Peirce, William James, and John Dewey) to the development of pragmatism as a philosophy, with others including contemporary pragmatists (such as Richard Rorty) as influential in their interpretations of pragmatism (268, 269, 271). Barnes provides a useful introduction to common themes of the philosophies of the classical American pragmatists (he also includes Oliver Wendell Holmes as one of the “*original practitioners*”) as follows (272, p1544-7):

- **Anti-foundationalism** – Ideas were not considered firm, timeless, pre-existing, or perfect;
- **Social character of knowledge** – Knowledge and beliefs were collective, social products. For knowledge to be true, it was useful;
- **Darwin and radical contingency** – radical contingency was important, requiring recognition of the need to adapt ideas in the face of chance and unpredictability;
- **Experimentation, democracy and hope** – Dealing with radical contingency required continual experimentation, democratically allowing everyone to participate, and aspiration for a better world;
- **Pluralism** – ideas were not expected to cohere, and no pure, simple or single truth exists.

Most mixed methods researchers acknowledge being influenced by the philosophy of pragmatism to some extent (273, 274). Pragmatism offers a way for mixed methods research to avoid the “forced dichotomy” of following post-positivism or constructivism (275), for example, pragmatism avoids the issue of the nature of truth and reality, instead allowing for the existence and exploration of both single and multiple realities (268, 273, 274).

Pragmatism has been described in the mixed methods literature as (276, p713):

*“a deconstructive paradigm that debunks concepts such as “truth” and “reality” and focuses instead on “what works” as the truth regarding the research questions under investigation. Pragmatism rejects the either/or choices associated with the paradigm wars, advocates for the use of mixed methods in research, and acknowledges that the values of the researcher play a large role in interpretation of results.”*

Feilzer argued that pragmatism is useful in that (273, p13):

*“Pragmatism does not require a particular method or methods mix and does not exclude others. It does not expect to find unvarying causal links or truths but aims to interrogate a particular question, theory, or phenomenon with the most appropriate research method.”*

Morgan’s outline of a pragmatic approach places methodology at the centre of research, while still acknowledging epistemological and axiological influences that shape the values, goals, and political agendas of researchers and therefore, their research (266). Although Morgan’s pragmatic approach operates as a paradigm, he specifically avoided the use of the “P-word” in an attempt to curtail the historical constraints of defining approaches to methodology implicit in the use of the term (266). Johnson and Onwuegbuzie instead proposed that pragmatism be viewed “as

*the philosophical partner for mixed methods research*", and translated the basic pragmatic maxim as it applies to mixed methods research as *"choose the combination or mixture of methods and procedures that works best for answering your research questions"* (268, p16-17). They further emphasised the research question as *"fundamental"*, with selection of research methods following to provide *"the best chance to obtain useful answers"* to the research questions (268, p17-18). Feilzer similarly commented that *"Pragmatists do not "care" which methods they use as long as the methods chosen have the potential of answering what it is one wants to know."*; while cautioning that this does not excuse *"sloppy research"* (273, p14). She therefore argued that as the research question is central pragmatism can guide either deductive research methods or alternatively, inductive or abductive research designs. As the pragmatic paradigm avoids the notion of a top-down movement from epistemology, to methodology, to method, it does not preclude the idea of moving between paradigms when using different methods as suggested by Creswell (270, 271) and Creswell & Plano Clark (275). These authors proposed that pragmatism may provide an overall paradigm for a mixed methods programme, or sequential design, where quantitative and qualitative phases may be influenced by post-positivism or constructivist paradigms.

The ideas of pragmatism as presented above appealed to me in that it offered a practical framework that focussed on addressing research questions by whatever means could produce relevant and useful information. It was broadly consistent with the developing project ideas and objectives in the planning stages of this thesis, and could be used to guide a mixed methods research programme, while still allowing for other influences to contribute helpfully, further described below.

#### **4.2.3 Translation of research to policy**

As I have previously acknowledged, this thesis was driven by a desire to create useful research that could influence policy and promote health. Translation of research to health policy has been widely written about in both medical science, with

models of “bench to bedside” in evidence-based medicine described (for example (277)), and in public health research (278-283).

Smith and Katikireddi described several theories of policymaking developed in the political sciences and based on empirical evidence, which emphasise the complexity of the policymaking processes (278). They have suggested that public health advocates may require persistence over time to influence policy, and that as multiple actors, and interactions are involved in policymaking researchers “*may therefore need to move beyond making singular lists of policy recommendations for generic ‘policymakers’ and instead consider how to effectively target key messages to multiple different audiences*” (278, p4). Several authors have also described the importance of face-to-face relationships between researchers and policymakers (280, 281, 283), especially in both the planning and dissemination stages of research, facilitating what has been termed a “*knowledge brokering*” role (282). These ideas are consistent with the ideas of the modern roles of public health and public health researchers, and the need for increased dissemination of research, particularly in politically and publicly accessible formats, presented in Chapter One (25, 30, 31).

Qualitative studies investigating the influence of research evidence on policy on health inequalities from the perspectives of both senior policymakers and health researchers provided some suggestions for increasing the influence of research on policy (279, 283). Policymakers emphasised the need for research to provide simple and clear messages, with less priority given to methodological details and limitations, and to be timely and relevant, aligning with policy debates (279). Researchers identified five types of evidence as particularly persuasive: “*observational evidence showing the existing of a problem; narrative accounts of the impacts of policies from the household perspective; controlled evaluations; natural policy experiments; and historical evidence*” (283, p817). Both policymakers and researchers agreed with the concept of a “*jigsaw of evidence*” by which was meant that “*the most valuable policy*

*relevant information was not one single piece of evidence, but rather many different bits, of varying quality, creatively pieced together” (283, p819).* They felt that using a range of quantitative and qualitative evidence, for example the combination of observational studies that identified policy problems, descriptive studies that provided examples of human impact, and experimental and quasi-experimental studies for guiding interventions, was seen as providing information more useful in policy shaping (283).

The ideas of translational research contributed to the rationale for the use of mixed methods research in this thesis as an approach to assemble evidence to use in an attempt to influence policy to reduce fuel poverty in New Zealand. Despite the current political inertia in the area as described, I decided to focus on prepayment metering as an area in which fuel poverty is operationalised and could potentially benefit from smaller policy changes. I considered this a more achievable target for influencing positive policy action in the present climate, rather than attempting to precipitate a larger policy shift focussing on the broad issue of fuel poverty.

#### **4.2.4 Sociotechnical systems theory**

As indicated in by the research outlined in Chapter Three, complex practices are involved in household decisions around energy consumption. These household decisions may be influenced by the use of technological tools such as prepayment meters. Prepayment meters also function as mediating tools within the wider energy system. Therefore, a multi-disciplinary perspective of prepayment meters may be useful in analysing their effects and actions.

Guy outlines a sociotechnical approach to viewing energy use in which (284, p652):

*“technical choices are viewed as expressive of the prevailing social, political, and commercial pressures operating within spatially and temporally contingent contexts... consumers may be unable or prefer not to use particular technologies, or*

*may even use technologies in unpredictable ways not envisaged in the original design."*

This approach acknowledges the active role that metering technology has in mediating the relationship between energy suppliers and households, as illustrated by Akrich, who described the first installations of electricity metering in areas including parts of the Ivory Coast and French Polynesia, noting that *"the electricity company could call upon the meters to act as unequivocal spokespeople at will"* (285, p220). This idea ties to those put forward in the introductory chapters that metering technologies, including prepayment meters, act to redistribute agency; altering the moral landscape of payment and disconnection from an essential service (216). In many western settings this agency has first been moved from public ownership and stringent regulatory governance of utilities, to corporate structures through privatisation and deregulation of electricity (among other utilities) markets (32). Increasingly, technology has been called upon to shift the unwanted burdens of corporate social responsibility for the adverse effects of high energy prices from companies, to the household setting. Within some households, the dilemma is a 'choice' between two undesirable options of disconnecting immediately when using prepayment metering, or in many other cases, delayed disconnection after post-payment debt accrual, following which, prepayment metering may be the only option offered by companies.

Reviewing different approaches to investigating household energy consumption, Hinton explains the agency a sociotechnical approach ascribes to different actors, and comments on the route for interventions using this approach (286, p40):

*"Both individuals and technologies are active, and arranged in socio-technical assemblages; agency is distributed across different levels, from the socio-technical regime to the household, including practices themselves. Interventions focus at*

*multiple levels in order to attempt to drive change within the socio-technical regime; interventions in homes work with domestic socio-technical assemblages."*

Viewing prepayment meters through a sociotechnical lens acknowledges the complex social constructs which influence modern household energy use (109, 114-116, 287-289), and provides an approach to investigating social interactions with prepayment meters which can be viewed as a "gatekeeper" to utilities (242). Guy argues that using a sociotechnical approach requires use of qualitative techniques, although his discussion does not preclude the utility of combining quantitative and qualitative methods in mixed methods research (284, p651):

*"Rather than relying solely on positivist research tools, such as surveys, opinion polls, and statistical analysis, undertaking sociotechnical research means attempting to peer over the shoulder of the actors making energy-related decisions by following actors through their professional and personal routines."*

The framework offered by sociotechnical systems theory usefully contributed to the investigation of prepayment metering, particularly as a means for understanding household management of electricity use through their interactions with their prepayment meters described by the qualitative description study in Chapter Eight.

### **4.3 Mixed methods research**

As with the topics of paradigms and pragmatism in mixed methods literature, several other controversies are notable, partly due to the rapid expansion of the field and the uptake of the approach. Creswell comments on the current controversies in mixed methods research which include the definition and terms used, and the design structures, along with continued questioning of the value of mixed methods



research (271). In the context of this, the following provides an overview from current mixed methods literature, and indicates the approach taken in this thesis.

#### 4.3.1 Definition of mixed methods research

Johnson and Onwuegbuzie asked many of the current leaders in the research field to provide a definition of mixed methods research, presenting 19 of these definitions from 21 highly published mixed methods researchers and creating the following composite general definition (290, p123):

*“Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration.”*

They also noted that the mixing may occur within a single mixed methods study; or where a mixed method programme is used, the mixing might occur within or across the set of studies (290). This definition has been widely cited in the mixed methods literature, and the paper is currently the most cited article from the Journal of Mixed Methods Research, indicating its influence on the discussion of defining mixed methods research.

In acknowledgement that the discussion of the definition of mixed methods research continues, Creswell and Plano Clark in the most recent edition of their textbook *Designing and conducting mixed methods research* also provide a definition of core characteristics (291, p5):

*“In mixed methods, the researcher:*

- *collects and analyzes persuasively and rigorously both qualitative and quantitative data (based on research questions);*
- *mixes (or integrates or links) the two forms of data concurrently by combining them (or merging them), sequentially by having one build on the other, or embedding one within the other;*
- *gives priority to one or to both forms of data (in terms of what the research emphasizes);*
- *uses these procedures in a single study or in multiple phases of a program of study;*
- *frames these procedures within philosophical worldviews and theoretical lenses;*
- *and combines the procedures into specific research designs that direct the plan for conducting the study.”*

#### 4.3.2 Advantages and disadvantages of mixed methods research

Some advantages of mixed methods research are that complex and interdisciplinary research questions require pluralistic methods to answer them (271, 276), this allows for both exploration and explanation of research problems (268, 291). Triangulation<sup>22</sup> between methods offers better understanding of the phenomenon studied, adds rigour and depth, and strengthens the conclusions that can be drawn (268, 269, 274). When methods are carefully combined in a mixed methods study the strengths of the different methods can contribute, while weaknesses can be overcome (268). Mixed methods research also allows for a greater range of divergent viewpoints of a phenomenon to be explored, or divergent findings, which is useful because it can prompt transformation of data, investigation of the quality of the inference, or further research (274).

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<sup>22</sup> *Triangulation* is a term originating from qualitative methodology that has been widely used in the mixed methods literature, and is helpfully defined by Tashakkori and Teddlie (271, p32-33) as both a process and outcome where “the combinations and comparisons of multiple data sources, data collection and analysis procedures, research methods, and inferences that occur at the end of a study”.

Limitations of mixed methods research include that it requires a broad understanding of methods, is time-consuming, and can be expensive; and it is also questioned whether post-positivist quantitative aspects are privileged over qualitative aspects within mixed methods research (268, 269, 271). It can also require a research team rather than being able to be carried out individually, particularly when designs use concurrent study phases (268).

### 4.3.3 Mixed method research designs

Key considerations in mixed methods research designs are: how qualitative and quantitative mixing occurs, either within or across the research; whether quantitative and qualitative components of the study are considered equal or whether one is prioritised; and the time ordering of qualitative and quantitative phases (268, 291). Six major strategies for data collection used in mixed methods research have been identified as: questionnaires, interviews, focus groups, tests, observation, and secondary data (274). Basic data analysis methods in mixed methods include those of both qualitative and quantitative data analysis. For example, qualitative data analysis methods typically employed within mixed methods research include the use of thematic analysis in most methods, and the use of either categorical analysis strategies that focus on sections of data, or contextual analysis strategies of the entire narratives or texts (274). Basic quantitative data analytic methods including descriptive and inferential statistical methods, and more sophisticated methods such as multivariate analysis and parametric testing may be used (274).

There are several different kinds of mixed methods research designs that have been characterised and used within the broad field of mixed methods research. For example, Creswell and Plano Clark give examples of 15 different mixed methods design classifications across different disciplines (291). They describe six major mixed methods designs, four that use one of each quantitative and qualitative study that are differently ordered, prioritised, and integrated: the concurrent; the

explanatory; the exploratory; and the embedded mixed methods design (291). They also include two designs that include multiple design elements: the transformative design, that is guided by a transformative theoretical framework; and the multiphase design, that uses multiple methods over three or more phases of a study programme (291). It is outside the scope of this thesis to provide a full discussion of all of the different design possibilities that mixed methods research offers, so I will focus on describing only the multiphase design that I have used here.

### *Multiphase mixed methods design*

As described by Creswell and Plano Clark , the multiphase mixed methods design occurs when a topic is explored over a series of sequential study phases, with each approach building on the generated knowledge and contributing to the overall programme objective (291). It *“provides an overarching methodological framework to a multiyear project that calls for multiple phases to develop an overall program of research”* (291, p100). They suggest that the most appropriate philosophical foundation is often pragmatism, with quantitative strands influenced by post-positivism and qualitative strands influenced by constructivism. They describe the following strengths and weaknesses of the multiphase mixed methods design type relevant to the present research (291, p101-103):

#### *Strengths*

- *“it incorporates the flexibility needed to utilize the mixed methods design elements required to address a set of interconnected research questions;*
- *researchers can publish the results from individual studies while at the same time still contributing to the overall evaluation or research program;*
- *and the researcher can use this design framework for conducting multiple iterative studies over multiple years.”*

### *Weaknesses*

- *“The researcher must anticipate the challenges generally associated with individual concurrent and sequential approaches within individual or subsequent phases;*
- *The researcher needs sufficient resources, time, and effort to successfully implement several phases over multiple years;*
- *The researcher needs to consider how to meaningfully connect the individual studies in addition to mixing quantitative and qualitative strands within phases.”*

## **4.4 Mixed methods approach of this thesis**

### **4.4.1 Research problem and justification for using a mixed methods approach**

The research problem identified at the outset of this thesis was:

Fuel poverty is estimated to affect one in four households in New Zealand, although an official definition and sufficient data are unavailable for assessing the extent and experience of fuel poverty. Prepayment metering has been found overseas to be more expensive than other payment methods for purchasing electricity, and it is expected that low-income households experiencing or at risk of fuel poverty are more likely to be using prepayment metering. Very little is known about the characteristics or experiences of consumers using prepayment metering in New Zealand. In the absence of other data to identify households experiencing fuel poverty, an investigation of the advantages and disadvantages of prepayment metering from a consumer experience is warranted.

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This problem statement justified the use of a multiphase mixed methods design as described above. The overall objective of exploring fuel poverty, through

investigating the use of prepayment metering in New Zealand from a consumer perspective, required several phases of investigation that could be developed over time and in response to the outcomes of previous phases. Similarly the project could emerge over the course of the thesis, with questions arising over the incremental study phases. It also provided the opportunity for the results of the individual phases to be disseminated and published over the course of the thesis.

Johnson and Onwuegbuzie describe the mixed methods research process as “*cyclical, recursive, and interactional*” (268, p21). This accurately describes my position and research approach, in that I have taken a bottom-up, or perhaps flat-structured, approach to the overall research design in practice, beginning with development of research questions. I am influenced in undertaking my research by my philosophical position, largely consistent with the notions of pragmatism, and with a strong emphasis on social justice, which inevitably contributes to the development of my research questions. This reflects the driving desire for this research to usefully contribute to policy and provide recommendations that would go some way to reducing fuel poverty in the local setting. It also implies recognition of the current lack of political will to acknowledge fuel poverty. The favoured political ideology is to use economic means, rather than social reforms, to improve outcomes for residential consumers. As noted, this is evidenced by the mandate of the regulatory body, the Electricity Authority, to favour competition over mandatory requirements of companies, to achieve redistributive outcomes. Therefore, I have chosen to examine the effects of one market-driven method used as a demand-side intervention, with the goal to provide policy suggestions that are more easily adopted within the corporate-focussed social policy environment. Figure 4.1 below, outlining the studies contributing to the mixed methods programme here using the starting point of research questions posed by the previous study to begin each next cycle of work hopefully illustrates this.

#### 4.4.2 Research design

As described, the initial starting point for the investigation of the outcomes of prepayment metering consumers as a group at risk of fuel poverty was the questions raised by my previous Master's research which provided some initial qualitative evidence that prepayment metering could be problematic for users. Informed by this, the scoping investigation using a price comparison analysis as described in Chapter Three was included as the first phase of the mixed methods research programme of this thesis. The rationale for that study was to assess whether some of the other problems identified overseas, in that instance investigating whether prepayment metering was more expensive than other payment methods, may also be present in the local setting. Also in the initial planning stages of this thesis, when considering undertaking a survey of prepayment meter users', I met with a senior policy advisor for the Electricity Commission (now the Electricity Authority), which had undertaken (at the time) recent surveys of retailers offering prepayment metering. This meeting confirmed that although no work was planned by the Electricity Commission to investigate the experiences of consumers using prepayment metering, the survey could usefully complement the work that had been undertaken, and could be of interest to policymakers in the area. Having described the starting point of this mixed methods research programme, the following diagram summarises the overall research design, indicating the flow of the research which allowed for each research phase to be informed by the previous research phases.

I have used a standardised method of drawing visual models for mixed method designs (292), and the conventional notation system from the mixed methods literature, first described by Morse (293). 'Quantitative' and 'Qualitative' indicate the phases of the design, while 'QUANTITATIVE' and 'QUALITATIVE' (capitalised) designate priority in data collection and analysis. Arrows show the sequential flow of the four discrete research phases, which are indicated by rectangular boxes, while

ovals show stages of integration of results from the research phases. Procedures and products of the research and integration phases are indicated alongside for each step of the process.



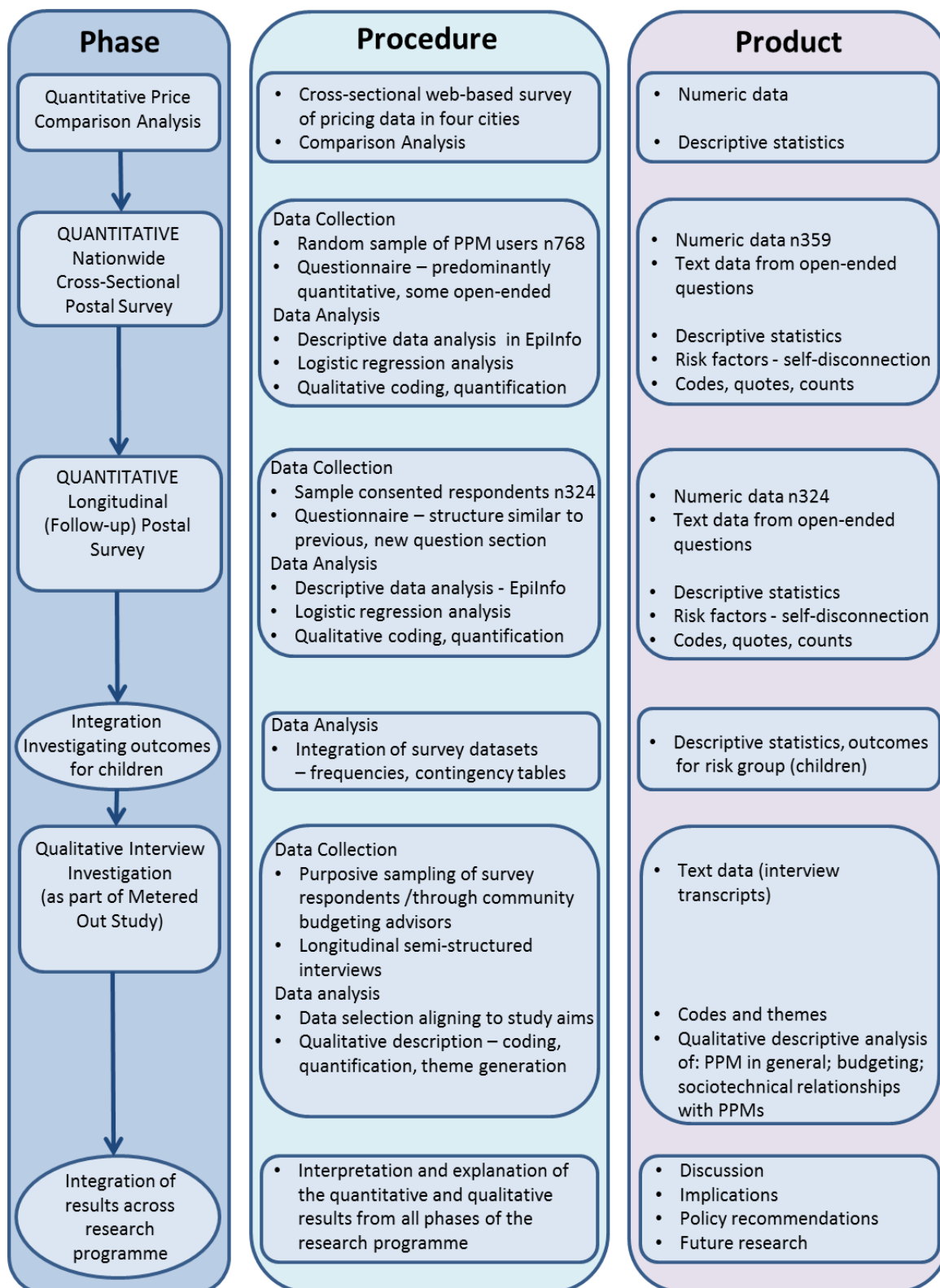


Figure 4.1: Visual model of multiphase mixed methods thesis research programme

## 4.5 Data collection and analysis methods

The methods used in the price comparison analysis have been fully described in Chapter Three. The final section of the present chapter describes general features of survey design (used in phases two and three of the thesis) qualitative description and interview techniques, (used in phase four of the thesis).

### 4.5.1 Postal Surveys

Postal surveys have been extensively used across several disciplines, and widely discussed in the academic literature. Mixed methods survey questionnaires often include the use of both quantitative, closed-response questions resulting in numerical data, for example using Likert scales, and qualitative open-ended questions, resulting in text data that are then analysed (274). Data from qualitative survey questions may also be '*quantitized*'<sup>23</sup>. Advantages of postal surveys are that they are relatively inexpensive, and when carefully designed can achieve response rates that offer robust results; the biggest disadvantage is that insufficient response rates can bias the results (274, 294, 295). Key design considerations in postal surveys are questionnaire design, accompanying letters and contact, the mailing protocol, and the use of incentives (294-296).

When investigating postal survey methods I focussed on those used in health research, and in local studies, and drew largely on the Tailored Survey Design Method described by Dillman and colleagues for conducting postal surveys (294); Dillman's earlier pioneering book describing the method for postal and telephone surveys has been cited in over 3600 scientific publications. Other useful evidence for developing the postal survey was provided by Edwards and colleagues, who conducted thorough systematic reviews evaluating randomised controlled trials designed to test strategies for influencing response rates to postal surveys; the

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<sup>23</sup> Quantitizing of qualitative data is described by Sandelowski (300, p253) as a process that reduces text data "*into items, constructs, or variables that are intended to mean only one thing and that can, therefore, be represented numerically*".

second review also including electronic surveys (295, 296). From their meta-analysis of 110 interventions for influencing the response rate of postal surveys from 481 trials, they concluded that the odds of response were at least doubled when monetary incentives, recorded delivery, a teaser on the envelope (for example, a comment suggesting to participants that they may benefit if they open it), or a more interesting questionnaire topic were used (295). The odds of response were substantially higher with: pre-notification; follow-up contact; unconditional incentives; shorter questionnaires; providing a second copy of the questionnaire with follow-up; mentioning an obligation to respond; or university sponsorship (295). The odds of response were increased to a lesser extent by using: non-monetary incentives; personalised questionnaires; hand-written addresses; stamped return envelopes (instead of franked return envelopes); an assurance of confidentiality; or first class outward mailing (295). Including sensitive questions in the questionnaire reduced the odds of response (295).

The Tailored Design survey method is based on social exchange theory and emphasises the use of repeated contact, with careful consideration of accompanying letters, and questionnaires deliberately designed to be respondent-friendly, and the use and type of incentives (294, 297). The Tailored Design method aims to reduce, as much as possible, the main sources of error in postal surveys: *coverage error*, occurring when the sampling frame does not adequately cover the population of interest; *sampling error*, occurring because not all members of the population are surveyed; *nonresponse error*, occurring when those who do not respond to the survey request are different from survey respondents in characteristics that may influence the results; and *measurement error*, occurring when the answers given by a respondent are incorrect (294, 297). The Tailored Design method employs several of the strategies investigated by Edwards and colleagues described above (295, 296), and attempts to specifically tailor the design to the study population in every step of the survey process (294).

### *Mailing protocols*

The basic mailing protocol of the Tailored Design Method for postal surveys includes (294, p243):

1. Pre-notification contact – a brief letter is sent to the sample a few days before the survey advising them to expect the questionnaire.
2. First survey mailing – includes a detailed cover letter with information about the study and why their response is important, the questionnaire, the prepaid return envelope, and any token incentives.
3. First follow-up – three to seven days after the first survey a postcard reminder is sent to all in the sample thanking early responders and politely inviting non-responders to reply.
4. Second follow-up – two to four weeks after first survey is mailed, a reminder letter is sent only to non-responders urging their reply, including a replacement questionnaire and return envelope.
5. Third follow-up – two to four weeks after the second survey is mailed, a final reminder letter is sent only to non-responders strongly requesting their reply and, if necessary, addressing concerns raised by responders, including a further replacement questionnaire and envelope.

Dillman's earlier work suggested this final letter be sent by certified mail or courier (297), however the New Zealand surveys mentioned below did not comment whether a courier or special delivery was used. Dillman and colleagues suggested that as typical modern households are often not at home during the day to accept signature required mail, this method may be outdated, and another method to differentiate the final mailing from earlier mailings and create a sense of importance, such as a different envelope or packaging, may be more appropriate (294).

The costs and benefits of repeat mailings are a necessary consideration when developing a survey protocol; therefore a literature search for evidence of the success of the Total Design method in the local setting was undertaken. Postal surveys undertaken within New Zealand have shown that response rates are indeed increased by the use of repeat mailings. A postal survey undertaken with a random sample of 2000 people drawn from the Tāmaki Makaurau Māori electoral roll, with only one follow-up mailing and an incentive of a prize draw yielded only a 23% response rate (298). A second postal survey sampled 980 from the New Zealand electoral roll, used a pre-notification letter, followed by the first questionnaire mailed one week later which included a means to indicate non-participation and request no further reminders, a reminder postcard a further one week later, and finally a second questionnaire was sent three weeks later (299). This study achieved a response from 592 participants, a response rate of 60%. A postal survey with a random sample of 350 drawn from the general electoral roll with up to three written reminders as per Dillman's Total Design Method had a 72% response rate (300). Mainvil and colleagues do not however, report the use of incentives or a pre-notification letter (300). Although these three studies were on different topics, and one used the Māori electoral roll, it was expected that an increased response rate would be achieved using repeat mailings, and therefore it was proposed to use five mailings, as per Dillman's Total Design Method. Other design strategies that increase the response rate of surveys as suggested by Dillman's Total Design Method (294), and demonstrated to be successful by Edwards and colleagues (295, 296), were considered in the planning of the surveys described in Chapters Five and Six, and incorporated where possible.

#### 4.5.2 Interviews

Interviews are widely used in qualitative research, and the semi-structured interview approach is the most used data collection approach in mixed methods research (301). Alternatives are the survey interview, which is rigidly structured and

generally used for eliciting quantitative data, and the in-depth or open interviewing techniques commonly used in qualitative methodologies such as narrative analysis, ethnography, and phenomenology (302, 303). The semi-structured interview uses a predetermined interview guide to gather data in an interview interaction, while allowing some flexibility of the ordering of questions, or to follow the participant's direction if other topics arise. The semi-structured interview approach was used in the series of longitudinal interviews for the Metered Out: Household Management of Electricity Use study, which was undertaken concurrently with this thesis project by me and my colleagues, and for which a section of data was used to contribute to this thesis. The Metered Out study was informed in a large part by the results of the first postal survey of the thesis, as were the interview guides. This interviewing method was consistent with the qualitative description method outlined below (107).

#### 4.5.3 Qualitative description

Qualitative description is described by Sandelowski (2000, 2010) as a naturalistic approach that typically uses maximum variation sampling to comprehensively summarise an event or phenomenon in its' *"everyday terms"* (105, 106). Researchers conducting qualitative descriptive studies usually take a *"factist perspective"* (304) of the data meaning that the interview data are accepted as truthful representations; and seek descriptive validity, where most people would agree on the accuracy of the description of events or phenomena, and interpretive validity, where participants would agree to the accuracy of meanings attributed to events or phenomena (106). Sandelowski specifically notes that qualitative description is especially useful for achieving *"answers to questions of special relevance to practitioners and policy makers"* (105, p337).

Data analysis in qualitative descriptive studies involves qualitative content analysis, where codes are iteratively generated from the data, often in cycles of data collection and analysis, and systematically applied to the data (105). Data may be summarised

using descriptive statistics to aid the comparison and contrasting of accounts and the presentation of patterns and irregularities (105, 107). While the data are qualitatively interpreted, and effort is made to understand the latent content of the data, the outcome is a data-near *“descriptive summary of the informational contents of the data, organized in a way that best fits the data”* (Sandelowski, 2000, p338-9).

#### 4.6 Summation and direction

In this chapter I have provided some discussion of the key influences of my research, features of mixed methods research, and general concepts of the design features used within the mixed methods research programme described in this thesis. Although the discussion of the topics is necessarily limited in scope due to the constraints of the thesis, it is intended to make explicit some of the positions driving my research, and the theory behind the research methods of the study phases outlined in the following chapters.

I conclude this chapter with an aspirational goal put forward by Denzin who, in his discussion conceptualising mixed methods research, challenges social science researchers to become bricoleurs on several levels, describing the: methodological bricoleur who is *“adept at performing a large number of diverse tasks”*; theoretical bricoleur who has knowledge of and works *“between and within competing and overlapping perspectives and interpretive paradigms”*; interpretive bricoleur who *“understands that research is an interactive process shaped by the personal history, biography, gender, social class, race, and ethnicity of the people in the setting”*; critical bricoleurs who *“stress the dialectical and hermeneutic nature of interdisciplinary inquiry, knowing that the boundaries between traditional disciplines no longer hold”*; and the political bricoleur who *“knows that science is power, for all research findings have political implications”* (269, p85). This is a weighty challenge; however it highlights the

complexity of the issues outlined above among others of contextual interaction, situation, and politics, which are at play in finding a way forward in undertaking mixed methods research. It is a path that I hope I have begun tentatively treading the very first steps of in completing this mixed methods research programme.



## Chapter Five:

### **Empowered? A nationwide postal survey of electricity prepayment meter consumers.**

#### **5.1 Chapter outline**

This chapter reports on a nationwide postal survey of electricity consumers using prepayment metering undertaken in 2010. It contributes to meeting the first, second, third, and fourth overall thesis objectives identified in Chapter One (see section 1.6.3). Methods for postal surveys in general were described in Chapter Four; the methods used for this survey are described in detail in Section 5.2 below. The remainder of this chapter reports the results, and discusses the findings. It contributes information on consumers' experience of prepayment metering, costs incurred, and outcomes of self-disconnection in households using electricity prepayment metering. It indicates the public health and policy implications of the findings, providing the rationale for later integration of the results from this study, and the studies outlined in the following three chapters, for the policy recommendations provided in Chapter Ten.

#### **5.1.1 Acknowledgements**

This chapter is an extended version of a paper that was published in *Energy Policy* in September 2012 (305) (for a full copy of the paper see Appendix Five), for which I undertook the majority of the work and was the lead author. I gratefully acknowledge the contributions of my co-authors to the manuscript, much of which appears verbatim below, and also the anonymous reviewers for thoughtful comments which strengthened my writing. I also would like to thank the three

electricity retailers who enabled this study to take place in this form, providing the means for nationally representative figures to be obtained: Mercury Energy; Contact Energy; and Genesis Energy. This study was funded by a FRST grant *Adaption to Climate Change of Vulnerable Populations* and the University of Otago.

## 5.2 Research methods

### 5.2.1 Background and rationale

As the introductory and literature review chapters have highlighted, a key limitation of researching fuel poverty in New Zealand is the lack of sufficient and available data, including individual dwelling condition and energy efficiency data, to identify fuel poor households. The evidence provided by overseas literature and experience, along with the limited evidence from qualitative research (2) and anecdotal evidence, including acknowledgement from retailers (256), supported the hypothesis that consumers using prepayment metering would be experiencing greater rates of fuel poverty than the general population. The price comparison analysis detailed in Chapter Three further supported that a detailed exploration of the population using prepayment metering, and their experiences was warranted, as it indicated that the pricing structures may contribute to further exacerbate fuel poverty rates among this group (172). There was (and still is to date) no collection of official statistics on the number of households self-disconnecting or the consumer experience of using prepayment metering in New Zealand.

As described in Chapter Three (see Section 3.4.1) Doble emphasised that a representative sample of *all* those who use prepayment meters should ideally be studied, and used random sampling from British Gas in his investigation of gas prepayment self-disconnections (169). While Doble's study was a useful precursor

to the present study, the New Zealand Privacy Act 1993<sup>24</sup> restricts the sharing of personal information for uses other than those it was originally collected for. The Privacy Act 1993 therefore ruled out the possibility of a face-to-face survey: without being told by electricity retailers which houses to survey, a face-to-face survey was unfeasible as only three percent of the total population uses prepayment metering, making random sampling even in areas demographically targeted unlikely to reach the sample population in a timely and cost-effective manner. Instead, the present study required an innovative participant recruitment and data collection technique of working with three electricity retailers and a third party mailing company, to send the surveys to a representative nationwide sample of prepayment meter users, without personal information being shared with me by the electricity retailers.

The aims and specific objectives of the survey are outlined below. It is important to note that the focus of this study was to obtain a picture of prepayment metering nationally. While I have indicated which retailers were involved (with so few retailers and in most areas only one it is difficult to avoid this, so providing this level of detail is warranted), the results of the study are not differentiated by retailer; the study was specifically not powered to achieve this, which helped to achieve corporate cooperation as it minimised risk of their involvement. Indeed, in response to recent media attention focussing on some concerns raised by the survey findings, Mercury Energy noted that the study presents nationwide results, and that the figures are not necessarily reflective of the experience of their consumers.<sup>25</sup>

### *Aims*

This study aimed to investigate the advantages and disadvantages of using prepayment metering from a consumer's perspective, explore the number of self-

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<sup>24</sup> <http://www.legislation.govt.nz/act/public/1993/0028/latest/DLM296639.html> - accessed 8 May 2012

<sup>25</sup> <http://www.radionz.co.nz/national/programmes/checkpoint/audio/2534915/families-struggling-to-pay-pre-paid-power-bills> - accessed 10 October 2012

disconnections from electricity among these consumers and whether these disconnections were problematic.

### *Specific objectives*

- To investigate the advantages and disadvantages of prepayment metering;
- To determine the number of prepayment meter users who self-disconnect;
- To investigate the causes of self-disconnection and the length of time households who disconnect are without electricity.

### **5.2.2 Corporate engagement**

The five electricity retailers offering prepayment meters in 2009 were approached to gain access to a representative sample of the total population of prepayment meter users. Of these, one (King Country Energy) had very few consumers using prepayment in a localised area and declined to be involved. A second retailer (Meridian Energy) had the majority of its prepayment consumers residing in the Canterbury region, and following the September 2010 Christchurch earthquake declined to be involved.<sup>26</sup> As noted, this retailer has now shifted its prepayment consumers to another retailer (Mercury Energy) and is currently looking to withdraw from the prepayment market entirely. The three remaining major electricity retailers (Mercury Energy, Contact Energy, and Genesis Energy) assisted with the study.

### **5.2.3 Questionnaire and cover letter development**

Questionnaire development drew largely on the techniques for survey design described by Dillman and colleagues (294), including the guidelines they put forward around ordering, question types, question stems, question wording, response scales, and layout among other issues. As described in Chapter Four, where possible questionnaire design strategies proven to increase the response rate

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<sup>26</sup> This retailer is withdrawing prepayment metering services from this area from September 2012, and is moving towards ending the service nationwide (262).

were incorporated (295, 296). Several locally used questionnaires were examined to determine the extent to which inclusion of questions would be useful in order to allow for comparison with other datasets. In order to facilitate comparisons with the national population some demographic questions were taken from the Census 2006, for example the ethnicity question. Consideration was also given to whether questions that had been used in other studies undertaken by *He Kainga Oranga*/Housing and Health Research Programme as these questions had in effect already been piloted and could also be used in order to allow for comparison of outcomes for different groups at a later date. Some questions used as part of a broader series of questions about non-monetary indicators of material wellbeing, making up the Economic Living Standards Index were included in the survey (306), although due to space constraints the full 25 questions from the Economic Living Standards Index short-form survey were unable to be used. The eight questions selected have also been used in other research undertaken by *He Kainga Oranga*. Some questions investigating the energy use characteristics of the households were aligned to the price comparison website [www.powerswitch.org.nz](http://www.powerswitch.org.nz).

The questionnaire was limited to 10 pages, which would allow double-sided printing on five pages with booklet stapling to reduce respondents missing pages, and was considered the maximum useful length without deterring response. Care was also taken to frame questions neutrally, so that responses would not be biased towards viewing prepayment in a positive or negative light, and also in part due to needing to achieve cooperation from the electricity retailers. Once drafted, the questionnaire was discussed with several members of *He Kainga Oranga* who had experience with survey research, with useful feedback provided to refine the questions selected for the survey.

Envelopes and letters were addressed only to “*The householder*” at the address. Electricity companies reported a suspected high level of transience within this

population; it is possible for named account holders to move out of an address without notifying them, and other household members, or new occupants to subsequently continue using the account by crediting the meter. Addressing letters to *"The householder"* was thought appropriate to reduce undeliverable mail. The instructions to participants in the letters and on the front of the questionnaire included the following: *"Any household member who can tell us about using the prepayment meter at this address and who is over 18 may fill in the survey."*

The surveys were sent with accompanying cover letters explaining that the electricity company was mailing the survey, but that the research was being independently carried out by university researchers. I had provided drafts of each of the cover letters to the companies, and while small changes were made, these were stylistic in nature, and the content of each mailing was the same. Cover letters stressed the reason for the research, the importance placed on respondents' views and getting responses from as many people as possible, assurances of confidentiality, the incentive vouchers, and my contact details at the University of Otago should they have any questions or concerns. In drafting the cover letters I followed the guidelines of the Total Design Method (see Chapter Four), using a polite, though personal tone, that increasingly urged response over the course of the study (294).

Due to logistical considerations the questionnaire was not piloted with consumers; however, during the corporate engagement process copies of the draft questionnaire were provided. Although the three companies that took part did not request changes, significant feedback on the questionnaire was received from Meridian Energy during the period before the Christchurch September 2010 earthquake when that company was considering involvement with the study. This useful feedback resulted in some of the questions being reordered and slight wording changes to some of the questions.

#### 5.2.4 Ethical considerations

Ethics approval (Category B) was obtained for the study, and all results are reported anonymously. Mailing packs included a detailed information sheet about the study, and also an informed consent form, although where consent forms were not returned with completed surveys (in around a third of cases), consent was assumed.

As noted, the Privacy Act 1993 dictated that the electricity retailers could not provide any personal details of any of the electricity customers to me to undertake this research. To get around this, and remove the need for the electricity companies to undertake the mailing, I contracted a mailing company (*Orangebox*) to undertake the mail merging, printing, and mailing. Confidentiality agreements between the mailing company and electricity companies were used as requested by electricity companies. A unique identification code was assigned to each household in the random sample, to enable the three parties: me, the mailing company, and electricity companies, to discuss the households without revealing personal details to the researchers.

A free-phone study number was listed on letters for mailings 2, 3, 4, and 5 for households to call if they preferred to opt out of the study. The opt-out approach was considered justified by the need to obtain accurate, policy-relevant data, as it was thought that for this population similar results were unlikely to be achieved with an opt-in approach. Participants were informed of their right to refrain from answering any questions, or to withdraw from the study at any time, without any disadvantage to themselves in the information and consent forms included in mailings 2, 4, and 5. Confidentiality was assured.

As an incentive consistent with survey design (294-297), and as is increasingly customary for participation in social research in New Zealand, participants were offered a NZD\$20 supermarket voucher to compensate them for their time and

thank them for completing the survey. Participants were informed of this in mailings 2, 3, 4, and 5, on the grounds that in order to decide whether it was worth their time some participants would take the compensation payment into account, and that this could contribute significantly to their budget. I considered that some people may opt out of participating in the survey, and then find out from someone who took part that they got the voucher, and feel that if they had known about the voucher they would have liked to do the survey. Vouchers were sent with a thank you letter from me on receipt of the survey form, where participants provided their personal details and indicated whether they consented to postal and/or face-to-face follow-up.

Survey forms were kept in locked storage, and will be held by the University of Otago for five years in secure storage, as is standard practice. When data were entered into a computer database, personal information was not included, and a separate spreadsheet recorded personal details matched to identification codes for future contact, in order to increase confidentiality security. Electricity companies were never shown any of the survey forms or given data which identified consumers.

### **5.2.5 Sampling**

A total number of 768 customers were included in the postal survey sample; based on a response rate of 50% (384), chosen so that confidence intervals for proportions would have an accuracy of plus or minus 5% (i.e. the total width of the confidence interval would be 10 percentage points at maximum).

The retailers were provided with a spreadsheet template (prepared by James Stanley) to select the random sample from their total prepayment customer base. The sample from each retailer was proportional to their share of the total population of prepayment meter users.



### 5.2.6 Mailing protocol

The mailing protocol used was adapted from the Tailored Design Method, (294, 297) as described in Chapter Four. There were slight variations in the time between each mailing, and one company chose not to send the second to last to reminder mailing (Mail 4).

As responses were received, I reported identification codes to the mailing company, who then removed those households from the next reminder mail-out. For two of the companies the return address was the mailing company, one company reported the identification codes to me when items were undeliverable.

A copy of the questionnaire, each of the cover letters, and postcards are provided in Appendix One. Table 5.1 below describes the contents of each mailing, and the mailing dates.

**Table 5.1: Mailing Protocol - Electricity Prepayment Meter Users Survey 2010**

| <b>Mail-out</b> | <b>Company 1, 2, and 3 mail-out dates</b>       | <b>Contents</b>                                                                                                                                                                                                                                                                                        | <b>Sent to</b> |
|-----------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Mail 1          | 1. 14/09/2010<br>2. 22/09/2010<br>3. 28/09/2010 | Pre-notification letter from Electricity Company<br>Standard sized Electricity Company envelope                                                                                                                                                                                                        | All 768 sample |
| Mail 2          | 1. 21/09/2010<br>2. 01/10/2010<br>3. 05/10/2010 | Cover letter from Electricity Company<br>A4 sized Electricity Company envelope<br>Letter from University of Otago<br>Information sheet from University of Otago<br>Consent form from University of Otago<br>Questionnaire from University of Otago<br>Return prepaid envelope from University of Otago | All 768 sample |
| Mail 3          | 1. 06/10/2010<br>2. 20/10/2010<br>3. 15/10/2010 | Reminder postcard (co-branded with Electricity Company and University of Otago)                                                                                                                                                                                                                        | Non-responders |
| Mail 4          | 1. Not sent<br>2. 04/11/2010<br>3. 03/11/2010   | Cover letter from Electricity Company<br>A4 sized Electricity Company envelope<br>Letter from University of Otago<br>Information sheet from University of Otago<br>Consent form from University of Otago<br>Questionnaire from University of Otago<br>Return prepaid envelope from University of Otago | Non-responders |
| Mail 5          | 1. 10/11/2010<br>2. 23/11/2010<br>3. 24/11/2010 | Cover letter from Electricity Company<br>A4 sized Electricity Company envelope<br>Letter from University of Otago<br>Information sheet from University of Otago<br>Consent form from University of Otago<br>Questionnaire from University of Otago<br>Return prepaid envelope from University of Otago | Non-responders |

### 5.2.7 Data handling and analysis

The survey data were entered into a Microsoft Access database (prepared by James Stanley) and analysed using Epi Info version 3.4 (Center for Disease Control, Atlanta, GA). Figures in tables may not always sum to 100% as although counted, non-responses or invalid responses (when more than one response was provided to a question with an instruction to provide one response) are generally not reported below, unless there was an unusually large proportion. In several questions, answers were not mutually exclusive and more than one response category was accepted, as per the instruction provided.

While I conducted the descriptive statistics, the logistic regression was performed by a Departmental biostatistician, James Stanley, and conducted using Epi Info. Based on the descriptive analysis I had undertaken, I suggested risk factors for inclusion in the model (ethnicity<sup>27</sup>, age group, children in household, previous disconnection for late or non-payment, previous electricity debt, and household income) which were discussed and chosen prior to modelling. Age group and household income were modelled as ordinal predictors such that the odds ratios reported indicate the change in the odds of the event per additional level of that factor.

Qualitative data from the open questions and partially closed questions (with “*other, please specify:\_\_\_\_\_*” optional responses) were analysed using an iterative process to develop codes, followed by a final round of coding to give frequencies. Selected quotes are presented anonymously.

## 5.3 Results

### 5.3.1 Demographics and characteristics of households and dwellings

A response rate of 47.9% (359/750) was achieved for the survey, excluding 11 of the 768 mailed which were returned to sender, and 7 respondents who returned the survey stating they were no longer using prepayment and were therefore ineligible for the study. It is probable that more of the non-respondent surveys should have been marked as ‘undeliverable’, however the return address was to the electricity companies and few notifications of returned mail were sent to the researchers.

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<sup>27</sup> As New Zealand allows for the multiple reporting of ethnicities by respondents, and the standard ethnicity question from the Census 2006 was used in the survey, we have reported total responses to ethnicity. For the logistic regression analysis ethnicity was prioritised due to the relatively small sample size, as is common practice when analysing health data, using the following order of priority: Māori, Pacific peoples, Asian, other ethnic groups besides European – commonly termed Middle Eastern, Latin American, and African or MELAA – then lastly European, other European, New Zealand European, and New Zealander which were grouped together due to the sample size (304). Prioritised ethnicity was further condensed into the reference group “non-Māori, non-Pacific” due to the very small sample size in the non-European/New Zealand European group.

Compared with the general population in the 2006 Census data (308), there were fewer male, retirement age, and employed respondents (Table 5.2). Home ownership rates were very low (26.8%), as compared with the 2006 Census, which reported 66.9% home ownership across the population and that 81.8% of those making rental payments paid a private landlord (175).

**Table 5.2: Summary of respondent demographics**

| <b>Demographic variable</b>             | <b>%</b> | <b>95% CI</b> |
|-----------------------------------------|----------|---------------|
| Female                                  | 67.9     | 62.8 - 72.7   |
| Average Age                             | 43.9     | 42.4 - 45.4   |
| Employment                              |          |               |
| Full-time                               | 30.2     | 25.5 - 35.3   |
| Part-time                               | 17.9     | 14.1 - 22.3   |
| Unemployed                              | 48.9     | 43.6 - 54.2   |
| Household income ≤\$40,000              | 50.6     | 45.3 - 55.9   |
| Total ethnicity*                        |          |               |
| Māori                                   | 35.4     | 30.5 - 40.6   |
| Pacific                                 | 23.1     | 18.9 - 27.9   |
| Non-Māori, non-Pacific                  | 56.8     | 51.5 - 62.0   |
| Children under 18                       |          |               |
| At least one in household               | 54.3     | 48.8 - 59.6   |
| None in household                       | 45.7     | 40.4 - 51.2   |
| Home ownership/Tenancy                  |          |               |
| Owner occupier/family trust ownership   | 26.8     | 22.4 - 31.8   |
| Private rental                          | 39.9     | 34.9 - 45.2   |
| Government rental                       | 30.2     | 25.5 - 35.3   |
| Other rental (church, charitable group) | 2.0      | 0.9 - 4.2     |

\*As with the national census, the total responses to ethnic groups include all of the people who self-reported that ethnic group, whether as their only ethnic group or one of several ethnic groups, further detail of ethnicity responses are provided below in Table 5.4.

Table 5.3 compares the age of survey respondents with the New Zealand adult (over 20) population from Census 2006 data (308). The age of respondents ranged from 18 to 89 years, and the mean age was 44 years.

**Table 5.3: Age of Respondents compared to the New Zealand adult (over 20) population**

| Age range | %    | 95% CI      | NZ Adult Population                    |
|-----------|------|-------------|----------------------------------------|
| 80+       | 0.3  | 0.0 - 1.8   | 4.5%                                   |
| 65-79     | 8.4  | 6.0 - 12.2  | 12.8%                                  |
| 55-64     | 15.6 | 12.4 - 20.4 | 14.4%                                  |
| 45-54     | 19.2 | 15.8 - 24.4 | 19.1%                                  |
| 35-44     | 25.9 | 22.1 - 31.7 | 21.5%                                  |
| 25-34     | 18.1 | 14.8 - 23.2 | 18.1%                                  |
| 20-24     | 9.2  | 6.7 - 13.1  | 9.5%                                   |
| 18-19     | 0.6  | 0.1 - 2.3   | (Public Census statistic not provided) |

There were high rates of Māori and Pacific participants, but fewer Asian and European participants as compared to the general population according to Census 2006 data (Table 5.4) (308). As with the Census, the total responses to ethnic groups include all the people who reported an ethnic group, whether that was their only ethnic group, or one of several ethnic groups.

**Table 5.4: Self-reported (total responses) ethnicities of respondents compared with NZ population**

| Ethnicity                              | %    | 95% CI      | NZ Population |
|----------------------------------------|------|-------------|---------------|
| Māori                                  | 35.4 | 30.5 - 40.6 | 14.6          |
| Pacific Peoples                        | 23.1 | 18.9 - 27.9 | 6.9           |
| Asian                                  | 2.5  | 1.2 - 4.9   | 9.2           |
| European / NZ European / New Zealander | 52.1 | 46.8 - 57.3 | 78.7          |
| MELAA                                  | 0.3  | 0.0 - 1.8   | 0.9           |
| Other Ethnicity                        | 0.3  | 0.0 - 1.8   | 0.04          |

Gross household incomes were low, with just over half below \$40,000 (Table 5.5), compared to the national median household income from regular sources of \$63,237 in 2010 (309). Over a fifth of respondents report household incomes of less than \$20,000, which if considered as less than 50% of the median income within the study population, a statistic used as a measure of deep poverty, provides an indication of extreme financial hardship among households using prepayment metering. One fifth (20.1%) of respondents said they did not know their household's gross income in the last year. When the 20.1% of respondents who did not know their household income are removed, and the spread of valid responses across the six income

brackets are examined, those using prepayment metering are shown as an even more disadvantaged group. Under this analysis over a quarter of households within the group experience deep poverty, and over 65% have a household income less than \$40,000, while over 86% have a household income less than \$60,000.

**Table 5.5: Household Income of Respondents**

| <b>Household Income</b> | <b>%</b> | <b>95% CI</b> | <b>% Spread of Valid Responses Only</b> |
|-------------------------|----------|---------------|-----------------------------------------|
| \$0-\$20,000            | 22.9     | 18.7 - 27.7   | 29.8                                    |
| \$20,001-\$40,000       | 27.7     | 23.1 - 32.7   | 36.0                                    |
| \$40,001-\$60,000       | 15.6     | 12.1 - 19.9   | 20.3                                    |
| \$60,001-\$80,000       | 5.6      | 3.5 - 8.6     | 7.3                                     |
| \$80,001-\$100,000      | 3.4      | 1.8 - 5.9     | 4.4                                     |
| \$100,001 or more       | 1.7      | 0.7 - 3.8     | 2.2                                     |
| Don't know              | 20.1     | 16.2 - 24.7   |                                         |

As shown in Table 5.6, other indicators of financial hardship similarly illustrated marked socioeconomic deprivation.

**Table 5.6: Indicators of financial hardship**

| <b>Indicator</b>                                                           | <b>%</b> | <b>95% CI</b> |
|----------------------------------------------------------------------------|----------|---------------|
| Unable to pay telephone, gas, or water bills by due date in past 12 months | 46.5     | 35.3 - 45.7   |
| Received outside help to pay for electricity in past 12 months             |          |               |
| Grant or loan from family/friends                                          | 13.9     | 10.6 - 18.0   |
| Government grant                                                           | 7.0      | 4.6 - 10.2    |
| Government loan                                                            | 1.9      | 0.9 - 4.2     |
| Access to NZ\$500.00 for a family emergency in the next week*              |          |               |
| Self-fund                                                                  | 30.9     | 26.2 - 36.0   |
| Access from family/friends                                                 | 29.0     | 24.4 - 34.0   |
| Not available                                                              | 27.3     | 22.8 - 32.3   |
| Access from Work and Income <sup>vi</sup>                                  | 15.6     | 12.1 - 19.9   |
| Bank loan                                                                  | 13.4     | 10.1 - 17.4   |
| Access elsewhere                                                           | 10.6     | 7.7 - 14.4    |
| Money-lender                                                               | 10.0     | 7.2 - 13.7    |

\*Multiple responses accepted

In comparison, the New Zealand Living Standards Survey 2008 reported only 11% of respondents reporting being behind on their utilities in the past 12 months, and that

81% could pay for a \$500 unexpected, unavoidable expense on an essential within a month without borrowing.

The eight questions selected for use from the Economic Living Standards Index , were taken from the section that asks to what extent households economise (*not at all, a little, a lot*) to keep down costs to help in paying for (other) basic items. Table 5.7 compares the results reporting “*enforced lacks*” or economising “*a lot*” with those who report economising “*not at all*”, with figures from the New Zealand Living Standards Survey 2008 (306), and shows that across the indicators those using prepayment metering report greater hardship. Enforced lacks were at least double those reported in the New Zealand Living Standards Survey for the following indicators: staying in bed to keep warm; postponing a visit to the doctor; not picking up a prescription; and doing without or cutting back on trips to the shops or other local places.

**Table 5.7: Non-monetary indicators of material wellbeing describing extent of economising compared to the New Zealand Living Standards Survey 2008**

| Item description                                                   | Enforced lacks |             |          | Not economising |             |          |
|--------------------------------------------------------------------|----------------|-------------|----------|-----------------|-------------|----------|
|                                                                    | %              | 95%CI       | %<br>LSS | %               | 95%CI       | %<br>LSS |
| Gone without fresh fruit and vegetables                            | 19.3           | 15.4 - 23.8 | 10       | 40.5            | 35.4 - 45.8 | 66       |
| Continued wearing worn out clothes                                 | 31.6           | 26.8 - 36.7 | 18       | 31.8            | 27.1 - 37.0 | 49       |
| Put off buying new clothes as long as possible                     | 47.9           | 42.7 - 53.2 | 30       | 17.5            | 13.8 - 22.0 | 33       |
| Stayed in bed to keep warm                                         | 19.5           | 15.6 - 24.1 | 7        | 49.3            | 44.0 - 54.6 | 81       |
| Postponed a visit to the doctor                                    | 32.9           | 28.1 - 38.0 | 11       | 34.0            | 29.1 - 39.2 | 72       |
| Not picked up a prescription                                       | 17.0           | 13.1 - 21.4 | 4        | 54.0            | 48.7 - 59.3 | 88       |
| Spent less on hobbies than you would like                          | 40.4           | 35.3 - 45.7 | 21       | 26.5            | 22.0 - 31.4 | 49       |
| Do without or cut back on trips to the shops or other local places | 45.4           | 40.2 - 50.7 | 15       | 16.2            | 12.6 - 20.5 | 46       |

As shown in Table 5.8, self-rated housing conditions were mainly positive, however, previous research has found that New Zealanders living in typical, low socio-economic dwellings tend to overestimate their housing conditions (122). In the

Housing, Insulation, and Health study, 18% of participants self-rated their dwelling in poor or very poor condition, however when a subsample were assessed by a qualified building inspector 53% of dwellings were in *poor*, or *very poor* condition (122).

**Table 5.8: Self-rated housing conditions**

| <b>Self-rated housing conditions</b>                         | <b>%</b> | <b>95% CI</b> |
|--------------------------------------------------------------|----------|---------------|
| Excellent (no immediate repair and maintenance needed)       | 19.8     | 15.9 - 24.4   |
| Good (minor maintenance needed)                              | 35.2     | 30.3 - 40.4   |
| Average (with some repair and maintenance needed)            | 35.8     | 30.8 - 41.0   |
| Poor (immediate repairs and maintenance needed)              | 4.7      | 2.9 - 7.6     |
| Very Poor (needs immediate extensive repair and maintenance) | 2.0      | 0.9 - 4.2     |

Electricity was the main form of hot water heating used and was also the main method of cooking for respondents. Electric hot water heating was used by 89.7% of respondents, while only 10.6% reported using gas water heating. Electric cooking facilities were used by 95.5% of respondents, and 12.8% used gas cooking. Answers for both hot water and cooking are not mutually exclusive, with some households having access to both electricity and gas.

### 5.3.2 Prepayment metering in general

Table 5.9 shows that the duration of reported prepayment meter use varied from less than a year to twenty years. Cumulatively, 63.0% of households had used prepayment for less than five years. It is difficult to assess whether there was an initial choice to use prepayment metering for many respondents as the most commonly reported reason for starting to use prepayment metering for electricity was that the meter was already in the house when they moved in. For many people, the fee required to get the meter changed would be a financial consideration; the majority of respondents were in rental accommodation. Few respondents reported that their landlord wanted them to use a prepayment meter, although this might be



implicit where a prepayment meter was already installed. Similarly, the decision may have been instigated by others when respondents stated that their electricity company had first informed them about prepayment metering.

It is clearer when households took an active decision to use prepayment, when they stated that they requested a prepayment meter be installed when they shifted in. Similarly, most of the 'other' reasons indicated active agency by the households in the decision to commence prepayment. These included, for example, that respondents wanted better control over their electricity consumption or spending than a monthly bill offered, that friends or family suggested they spent less when using prepayment, or that they did not like having a meter reader coming to check their conventional post-payment meter.

**Table 5.9: Duration and details of prepayment meter use**

| <b>Details of prepayment use</b>                          | <b>%</b> | <b>95% CI</b> |
|-----------------------------------------------------------|----------|---------------|
| <b>Previous payment method*</b>                           |          |               |
| Posting a cheque or paying in person (at the post office) | 54.0     | 48.7 - 59.3   |
| Automatic payment of a set amount (smooth or easy pay)    | 16.4     | 12.8 - 20.8   |
| Direct debit (of the total bill amount per month)         | 10.9     | 7.9 - 14.7    |
| Internet banking or telephone banking                     | 8.1      | 5.6 - 11.5    |
| Always used prepayment metering                           | 8.1      | 5.6 - 11.5    |
| Never paid for electricity before                         | 5.3      | 3.3 - 8.3     |
| <b>Source of initial information about prepayment*</b>    |          |               |
| Friends or family used prepayment metering                | 52.1     | 46.8 - 57.3   |
| Informed by electricity company                           | 21.4     | 17.4 - 26.1   |
| Work and Income, budgeting service, or community group    | 5.3      | 3.3 - 8.3     |
| Advertising                                               | 3.9      | 2.2 - 6.6     |
| Other source                                              | 21.4     | 17.4 - 26.1   |
| <b>Reason for commencement of prepayment meter use*</b>   |          |               |
| Meter in house when moved in                              | 48.2     | 42.9 - 53.5   |
| Debt built up on electricity account                      | 23.4     | 19.2 - 28.2   |
| Had ppm in previous house and requested when moved in     | 10.3     | 7.5 - 14.0    |
| Electricity company wanted you to use prepayment metering | 5.6      | 3.5 - 8.6     |
| Landlord wanted you to use prepayment metering            | 1.7      | 0.7 - 3.8     |
| Transferred from old coin meter                           | 1.4      | 0.5 - 3.4     |
| Other reasons                                             | 18.1     | 14.3 - 22.6   |
| <b>Duration of prepayment meter use</b>                   |          |               |
| ≤ 1 year                                                  | 16.2     | 12.5 - 20.5   |
| 1 – 2 years                                               | 14.2     | 10.8 - 18.4   |
| 2 – 3 years                                               | 16.5     | 12.8 - 20.8   |
| 3 - 5 years                                               | 16.0     | 12.3 - 20.2   |
| 5 - 10 years                                              | 19.9     | 15.9 - 24.5   |
| ≥ 10 years                                                | 17.1     | 13.3 - 21.5   |

\*Multiple responses accepted

Respondents were asked whether they had electricity debt on the account prior to commencing using prepayment metering; two thirds of respondents (66.9%) reported that they did not have electricity debt. Of those that did have electricity debt, 112 provided responses to an open question asking why the debt had accumulated. Responses most commonly (59%) described precarious financial circumstances, not having enough income to keep up with payments or afford a monthly bill, and indicated that once households had become behind on payments it was too difficult to make up the debt. For example, one respondent explained: “I

*was unable to pay the full amount before the next bill came and I continued to make part payments but couldn't get on top of my debt. By then I had received 3 months' worth of my bill and ended up being disconnected".* Another respondent described the situation that *"It was not a priority unless you're issued with a disconnection notice".* For 18% of respondents a change of circumstances, such as recent unemployment or other loss of income, moving house, a new baby, or a relationship separation, were cited as reasons for precipitating debt accrual on the account. Not being aware or able to control their electricity usage was named as the reason for debt accrual by 9% of respondents. Some respondents (7%) described their own forgetfulness, carelessness, or lack of budgeting as the reason for debt accrual.

In the year before starting to use prepayment metering, 17.8% of respondents reported being disconnected for late, or non-payment, of electricity bills. Of these respondents 71.9% indicated how many times they had been disconnected; 34.8% had been cut off once, the same proportion had been cut off twice; a further 30.4% reported being disconnected three or more times for non-payment in the previous year.

Table 5.10 shows that respondents commonly credited their prepayment meter frequently. The reported amount spent on electricity per month varied widely, from as little as \$10.00 through to \$800.00, with a mean amount of \$141.66 per month (s.d. \$83.51). The median spend was \$120.00. This is less than the national average household expenditure on electricity of \$148 reported in the Household Economic Survey for the year ended June 2010 (309).

**Table 5.10: Frequency of meter crediting**

| <b>Frequency</b>       | <b>%</b> | <b>95% CI</b> |
|------------------------|----------|---------------|
| Every few days         | 17.5     | 13.8 - 22.0   |
| Weekly                 | 52.4     | 47.1 - 57.6   |
| Fortnightly            | 22.0     | 17.9 - 26.7   |
| Monthly                | 5.6      | 3.5 - 8.6     |
| Less than once monthly | 2.2      | 1.0 - 4.5     |

General satisfaction with both prepayment metering and their electricity company was high (see Table 5.11). The majority of respondents agreed or strongly agreed with the statement, *“Some people like the ability to budget with prepayment meters and say the benefits outweigh the risk of running out of credit”*.

**Table 5.11: Satisfaction with using prepayment metering**

| <b>Reason</b>                                | <b>%</b> | <b>95% CI</b> |
|----------------------------------------------|----------|---------------|
| Satisfaction with using prepayment metering  |          |               |
| Very satisfied                               | 48.5     | 43.2 - 53.8   |
| Satisfied                                    | 27.6     | 23.1 - 32.6   |
| Neutral                                      | 15.3     | 11.8 - 19.6   |
| Dissatisfied                                 | 4.5      | 2.7 - 7.3     |
| Very dissatisfied                            | 3.3      | 1.8 - 5.9     |
| Satisfaction with electricity company        |          |               |
| Very satisfied                               | 37.0     | 32.1 - 42.3   |
| Satisfied                                    | 32.6     | 27.8 - 37.7   |
| Neutral                                      | 21.2     | 17.1 - 25.8   |
| Dissatisfied                                 | 5.3      | 3.3 - 8.3     |
| Very dissatisfied                            | 2.8      | 1.4 - 5.2     |
| Benefits outweigh risk of self-disconnection |          |               |
| Strongly agree                               | 40.4     | 35.3 - 45.7   |
| Agree                                        | 46.8     | 41.6 - 52.1   |
| Disagree                                     | 9.5      | 6.7 - 13.1    |
| Strongly disagree                            | 1.9      | 0.9 - 4.2     |

Given that price comparison analysis found that prepayment metering was more expensive than standard payment methods, four questions were asked to discover how the respondents compared using prepayment metering to their previous

method of payment (Table 5.12). Less than a third of respondents were aware of increased prices through using prepayment metering, which was surprising. Perceived reductions in consumption and expenditure, and increased awareness of consumption were closer to expected responses.

**Table 5.12: Comparing Prepayment Metering to Previous Payment Method**

| <b>Comparison statement</b>                                                         | <b>%</b> | <b>95% CI</b> |
|-------------------------------------------------------------------------------------|----------|---------------|
| Electricity costs ---- when paying with the prepayment meter                        |          |               |
| More                                                                                | 29.5     | 24.9 - 34.6   |
| The same                                                                            | 32.9     | 28.1 - 38.0   |
| Less                                                                                | 31.2     | 26.5 - 36.3   |
| I use ---- electricity when paying with the prepayment meter                        |          |               |
| More                                                                                | 10.9     | 8.0 - 14.7    |
| The same                                                                            | 39.1     | 34.1 - 44.4   |
| Less                                                                                | 44.1     | 38.9 - 49.5   |
| I spend ---- on electricity when paying with the prepayment meter                   |          |               |
| More                                                                                | 24.0     | 19.8 - 28.9   |
| The same                                                                            | 30.2     | 25.5 - 35.3   |
| Less                                                                                | 39.9     | 34.9 - 45.2   |
| I think about how much electricity I use ---- when paying with the prepayment meter |          |               |
| More                                                                                | 45.1     | 39.9 - 50.4   |
| The same                                                                            | 27.9     | 23.3 - 32.9   |
| Less                                                                                | 22.3     | 18.2 - 27.0   |

### **5.3.3 Advantages and disadvantages of prepayment metering**

Participants were asked to name the two best things (answered by 96.7% of respondents), and two worst things (answered by 80.2% of respondents) about using prepayment metering in an open question format. The qualitative answers were thematically coded using an iterative process to develop codes, followed by a final round of coding to give the frequencies provided below. Where several answers were given by a respondent, all were included in the analysis rather than only the first two. Frequencies are given as a percentage of those who responded to the questions, i.e. those who did not answer the question have been excluded from this analysis.

## Advantages

Not having a monthly bill was the most commonly cited advantage of prepayment metering (see Table 5.13), with several comments around “no big bills”, “nasty surprises”, or “no scary bills” indicating that the unknown amount (and particularly the usually bi-monthly estimated usage) billed on a monthly post-payment plan was a stressor. Similarly, improved ability to budget, including saving money or spending less was mentioned by over a third of respondents. Comments about prepayment being cheaper were probably related to spending less, although it was not made explicit and could indicate lack of knowledge around pricing. Others commented directly that prepayment was “not stressful” or that they appreciated “being in control”. Being able to see or monitor their electricity use was beneficial, with several explaining that they better understood which appliances used more electricity, and were able to control usage or conserve their electricity when using prepayment metering. Other advantages included that there was no risk of building up debt, or that electricity services could be maintained while a previous debt was being paid. Some noted that prepayment metering is convenient in a shared living/flatting situation, or that all family members were able to contribute to payments or to conserving electricity.

**Table 5.13: Advantages of prepayment metering**

| <b>Advantages of Prepayment Metering</b>           | <b>% of respondents reporting</b> |
|----------------------------------------------------|-----------------------------------|
| No bills                                           | 45.8%                             |
| Monitor usage of electricity                       | 44.1%                             |
| Budgeting easier                                   | 34.9%                             |
| Control/conserve electricity                       | 18.2%                             |
| Prepaying/pay as use                               | 10.7%                             |
| Easy to top up/credit                              | 8.9%                              |
| Payment frequency                                  | 8.1%                              |
| Store to purchase is convenient/close/more options | 4.6%                              |
| Cheaper than on a bill/lower rate                  | 4.3%                              |
| Availability of emergency credit                   | 2.6%                              |
| No disconnection/reconnection fees                 | 2.0%                              |
| No meter readers                                   | 0.9%                              |

### *Disadvantages*

Disadvantages were more varied, with the most frequently cited disadvantage being running out or 'self-disconnecting' (see Table 5.14). Finding NZD\$20 for the minimum purchase of credit could be difficult, and smaller denominations of NZD\$10 or NZD\$5 were suggested as being manageable, with some indicating this had previously been allowed until the company had changed their policy. Having to pay in advance and not having the flexibility to juggle bills was also mentioned as a disadvantage. Respondents commonly remarked on crediting facilities, that there were not enough outlets, open hours were inconvenient, or that they were too far away or required travel (for some rural customers the nearest outlet was 20km away). There were also some reports that when they wanted to buy credit "*the system was down*" – the electronic transaction facilities or crediting computers were down and they may have had to wait several hours or even days to purchase credit.

Keying in the 20-digit top-up code was a hassle with respondents commenting that when they were required to have a prepayment card that they take to the store when they purchase credit, and are still given a receipt with a top-up code to enter it seemed like "*double-handling*". Others had difficulty with losing or forgetting to take the prepayment card to the retail outlet when trying to purchase credit, or losing the receipt with the top-up code. Having to ring customer services to reconnect after a self-disconnection or to top-up created further hardship for those who either used a cordless phone requiring electricity, or who were without a home phone as both of these meant using a cellphone (usually on relatively high prepaid rates) or finding a public pay phone. For one company's customers who are disconnected when the credit drops below \$10 the general feeling was that being disconnected when any credit remains is unfair, one described this as "*...so wrong!*".

Other disadvantages to using prepayment metering included that it was stressful having to "*constantly monitor*" electricity usage and respondents worried about not

having enough money and or running out of credit ('self-disconnecting'), for example *"Stress level up every few days when light turning to red."* Another said simply *"It's in your face"*. For some it created tension within the household, for instance *"The kids get sick of me telling them to conserve power."* Another problem related to conserving electricity was that some respondents said they had to cut back on heating. For others the time that disconnections came into effect was problematic, especially early in the morning, during nights, and weekends when retail outlets to purchase credit were not open. Although it could be questioned whether it matters if the household members are away during a self-disconnection event, as one person pointed out, *"If it gets low and runs out when for example you are at work, it uses a big chunk to reheat water etc. once you top it back up."* This also indicates that self-disconnecting for a short period may actually increase consumption slightly. In addition other complaints of self-disconnection occurring while the house was unattended included refrigerator/freezer thawing, not having hot water on their return, and the inconvenience of resetting clocks and appliances.

Some noted that there was no choice between companies (and also no opportunities for market competition to reduce prices), and not being able to move off prepayment to another payment method due to the high cost to change the meter. The availability of emergency credit (usually NZD\$20) caused problems if the debt could not be paid, with one respondent providing the following vivid descriptions: *"If it runs out and you're on your emergency power, you're out of luck!"* and *"All the food in the freezer going off because you can't afford to clear your emergency power."* One electricity company has changed its policy and no longer offers emergency credit which would come off the next top-up as they did previously, unless the householder reports a life-threatening medical condition, as per the disconnection guidelines, and some respondents complained about this.



Some respondents noted that the meter, and sometimes the in home display, was in an inconvenient location, for example outside where it was dark, or they would get wet when loading credit or checking the balance, or that it was too high to reach or see easily and they had to stand on a chair. Some had problems with the meter beeping, either with the noise or the disruption caused by *“the warning beeper going off during sleeping hours”*. Similarly the flashing of meter lights might also cause stress for example one respondent described the *“frantic flashing of red light when low on power”*. One of the more unexpected complaints was that meter readers still came to the property to read the meter. The corporate rationale for this is that the meter needs to be checked to ensure it has not been tampered with – perhaps due to the very low use of some of these customers as indicated by the monthly spend on electricity.

**Table 5.14: Disadvantages of prepayment metering**

| <b>Disadvantages of Prepayment Metering</b>                                                               | <b>% of respondents reporting</b> |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------|
| Self-disconnection (running out of credit)                                                                | 28.1                              |
| Outlets too far away/too few outlets to purchase credit                                                   | 18.1                              |
| Having to go to an outlet to purchase credit                                                              | 12.8                              |
| More expensive/extra charges                                                                              | 12.5                              |
| Forgetting to top-up/purchase credit                                                                      | 11.1                              |
| Hours of outlets inconvenient                                                                             | 11.1                              |
| Having no money for credit                                                                                | 8.0                               |
| \$20 minimum top-up too expensive                                                                         | 5.9                               |
| High cost of electricity generally/price increases                                                        | 5.9                               |
| Ringing to reconnect/top-up credit                                                                        | 5.6                               |
| Having to monitor meter                                                                                   | 5.2                               |
| Difficulty estimating credit required                                                                     | 4.5                               |
| Crediting system “down”                                                                                   | 4.2                               |
| Payment method limited (no online/phone/credit card payments)                                             | 4.2                               |
| Unexpected high consumption of electricity (eg having visitors, cold snaps, meter jumps to lower balance) | 2.4                               |
| Having to use emergency/used up emergency credit                                                          | 2.1                               |
| Keying in code                                                                                            | 2.1                               |
| Meter in an inconvenient location in the house                                                            | 2.1                               |
| Meter reader continues to visit                                                                           | 2.1                               |
| Having to limit consumption (heating, cooking, entertainment)                                             | 1.0                               |
| No emergency credit/not enough emergency credit available                                                 | 0.7                               |

### 5.3.4 Self-disconnection

The frequency of self-disconnection was high, with over half reporting having self-disconnected in the past year (see Table 5.15). Most respondents who had self-disconnected in the past year had only done so once or twice, with the mean number of self-disconnections in the past year being four times (mean 4.4, s.d. 6.9), and median two times. However, one in six households of those who had self-disconnected in the past year reported six or more self-disconnections; almost one in ten households reporting ten or more self-disconnections. The length of time the last self-disconnection lasted also varied widely, ranging from, most commonly, an hour or less, up to more than a week. The median length of time of the last self-disconnection was three hours. However, more than a third (37.9%) of respondents reporting self-disconnection in the past year had spent 12 or more hours, and more than a quarter (28.7%) 24 or more hours, without electricity when they last self-disconnected. To indicate the broader implications of this, the observed outcomes have been extrapolated to the 52,664 households using prepayment metering in 2008 (256). The reason for the last self-disconnection event (answered by 53% of respondents) was most commonly forgetfulness or lack of organisation in monitoring or purchasing credit. System problems included either outlet payment system outages or problems with the new system being used by one company. Another driver of self-disconnection was unexpectedly high electricity consumption, for example, using heating in cold weather, using the oven more often than usual, having visitors to stay, or after electricity price increases.

**Table 5.15: Frequency and duration of, and reasons for self-disconnection**

| <b>Frequency and duration</b>                             | <b>%</b> | <b>95% CI</b> | <b>Extrapolated to NZ Households</b> |
|-----------------------------------------------------------|----------|---------------|--------------------------------------|
| <b>Self-disconnected</b>                                  |          |               |                                      |
| Never                                                     | 38.7     | 33.7 - 44.0   | 10,720                               |
| More than 12 months ago                                   | 9.7      | 7.0 - 13.4    | 2,687                                |
| In the past 12 months                                     | 52.6     | 47.3 - 57.9   | 27,701                               |
| <b>Frequency of self-disconnections in past 12 months</b> |          |               |                                      |
| 1                                                         | 20.8     | 14.7 - 27.9   | 5,762                                |
| 2                                                         | 32.7     | 25.5 - 40.6   | 9,058                                |
| 3 - 5                                                     | 29.6     | 22.6 - 37.3   | 8,199                                |
| ≥6                                                        | 17.0     | 11.5 - 23.7   | 4,709                                |
| ≥10                                                       | 9.4      | 5.4 - 15.1    | 2,604                                |
| ≥15                                                       | 5.0      | 2.2 - 9.7     | 1,385                                |
| <b>Duration of last self-disconnection event</b>          |          |               |                                      |
| ≤1 hr                                                     | 33.3     | 26.8 - 40.4   | 9,224                                |
| 2 hrs                                                     | 11.8     | 7.6 - 17.2    | 3,269                                |
| 3 - 5 hrs                                                 | 13.3     | 8.9 - 18.9    | 3,684                                |
| 6 - 11 hrs                                                | 3.6      | 1.5 - 7.3     | 997                                  |
| 12 - 23 hrs                                               | 9.3      | 5.6 - 14.2    | 2,576                                |
| 24 - 47 hrs                                               | 17.4     | 12.4 - 23.5   | 4,820                                |
| 48 - 71 hrs                                               | 6.2      | 3.2 - 10.5    | 1,717                                |
| ≥72 hrs                                                   | 5.1      | 2.5 - 9.3     | 1,413                                |
| ≥1 week                                                   | 3.6      | 1.5 - 7.3     | 997                                  |
| <b>Reason for last self-disconnection event</b>           |          |               |                                      |
| Forgetfulness/organization                                | 38.7     | 31.8 - 46.1   | 10,720                               |
| Financial constraints                                     | 29.8     | 23.5 - 36.9   | 8,255                                |
| Outlet hours/disconnection hours                          | 9.4      | 5.7 - 14.5    | 2,604                                |
| System problems                                           | 8.9      | 5.3 - 13.9    | 2,465                                |
| Unexpected high use                                       | 8.4      | 4.9 - 13.3    | 2,327                                |
| Other                                                     | 4.7      | 2.2 - 8.8     | 1,302                                |

Of those that had self-disconnected in the past 12 months, all but two provided responses to the open-ended question asking what the worst thing about the last self-disconnection event was. Several provided more than one answer, and all were included in the following frequency counts. While a few people indicated that they were not bothered, 4% specifically noted that feeling “stress”, “panic” or “worry”, other responses highlighted that even short duration self-disconnections may be fairly inconvenient. For example, 4% pointed out that they could not use their phone as it required electricity to operate and in some cases reconnection involves calling

the retailer. Coming home from work to find they had self-disconnect could also be very inconvenient, especially for shift-workers, as one respondent described *“During winter, coming back home after work at 1am and the power is off – which really makes me angry.”* Others found the timing of the self-disconnection inconvenient, particularly when they were not expecting it, for example if they were in the middle of an activity requiring electricity such as cooking, using computers, or getting ready for work and school. The heavy reliance of modern households on electricity for seemingly inconsequential tasks was described, with one explaining: *“My garage wouldn’t open to get the car out as it’s got an electronic door.”* Obtaining credit could also be inconvenient, with 5% describing having to go out to purchase credit, and 4% that they disconnected outside the retail hours of their outlet. For 18% not being able to cook, 7% not being able to have hot drinks, and 12% having their fridge and/or freezer thaw was named as the worst thing, with other basics for living such as hot water (14%) and lights (16%) also identified. The effects on their children were explicitly mentioned by 15%, ranging from inconveniencing or distressing children and interrupting entertainment, through to being unable to prepare baby’s bottles or children’s food, and in alarmingly in one case: *“My child on his life support system”*. Others (9%) reported having to use emergency credit, borrow money, or having no money to purchase credit until they were next paid.

Risk factors for having a self-disconnection event in the past year were identified through logistic regression (Table 5.16). These include having been disconnected from electricity services for late or non-payment of bills in the year prior to starting prepayment metering (2.3 increased odds of self-disconnection), and previous electricity debt (1.8 increased odds of self-disconnection). Increasing age of the respondent was also associated with a reduction in risk of self-disconnection (OR = 0.72 for each age group compared with the previous age group, e.g. the 35 – 44 age group had only 72% of the odds of self-disconnection compared to the 25 – 34 age group). Presence of children under 18 in the household and household income were

not significantly associated with self-disconnection. Although there were a high proportion of both Māori and Pacific respondents, there were no significant ethnic differences.

**Table 5.16: Logistic Regression of Risk Factors for a Self-Disconnection Event in the Past Year**

| <b>Exposure variable</b>                    | <b>Odds ratio</b> | <b>95% CI</b> | <b>p-value</b> |
|---------------------------------------------|-------------------|---------------|----------------|
| Prioritised ethnicity                       |                   |               |                |
| Māori                                       | 1.33              | 0.77 - 2.31   | 0.308          |
| Pacific                                     | 1.6               | 0.8 - 3.2     | 0.187          |
| Non-Māori, non-Pacific                      | 1                 | Reference     |                |
| Age group*†                                 | 0.72              | 0.6 - 0.86    | < 0.001        |
| Children under 18                           |                   |               |                |
| At least one in household                   | 0.94              | 0.55 - 1.61   | 0.835          |
| None in household                           | 1                 | Reference     |                |
| Previous disconnection for late/non-payment |                   |               |                |
| Yes                                         | 2.29              | 1.1 - 4.74    | 0.026          |
| None prior to switch to prepay              | 1                 | Reference     |                |
| Previous electricity debt                   |                   |               |                |
| Yes                                         | 1.75              | 1.04 - 2.94   | 0.048          |
| None prior to switch to prepay              | 1                 | Reference     |                |
| Household income*‡                          | 0.97              | 0.87 - 1.08   | 0.607          |

\* Factor modelled as an ordinal predictor variable: odds ratio indicates change in odds of self-disconnection per level of factor compared. †Age group categories: 18-24, 25-34, 35-44, 45-54, 55-64, 65+. ‡ Household income categories: \$0-20,000; \$20,001-40,000; \$40,001-60,000; \$60,001-80,000; \$80,001-100,000; \$100,000+.

Another form of self-disconnection, turning off all the electricity to the house at the mains' switch to save the credit on the prepayment meter, was used by one in seven (15%) respondents in the past year. However, respondents were not asked for the reason that this action was used and although some indicated, through comments written alongside, that they did it frequently to save credit, others indicated they had done this when they had been away from home for a time.

## 5.4 Discussion

### 5.4.1 Review and synthesis

This survey shows that in New Zealand prepayment metering is typically used by low-income households, as is the case in Australia, England, Northern Ireland, North America, and South Africa (211, 212, 214-216, 218). Use of prepayment metering is becoming more widespread internationally, especially with the introduction of advanced metering.

Half of the respondents reported household incomes of less than \$40,000 per year. The national median household income from regular sources was \$63,237 in 2010 (309). Compared to the 2006 Census, home ownership is low, and social housing use is high (175). Non-monetary indicators of material wellbeing show that prepayment meter consumers report markedly greater levels of hardship compared with the New Zealand Living Standards Survey 2008 (306). Almost 70% of respondents credit their meter every few days or once weekly, indicating how this group often live week-to-week and tightly manage their budget. Ezipay, the company operating the top-up facilities at retail outlets advertises that one electricity company's customers credit on average eight times per month "*bringing considerable foot traffic to your stores*".<sup>28</sup> Bill stress, or inability to pay other utility bills by the due date was reported by 47% of the respondents. There were 37,443 hardship grants paid by the Government to beneficiaries to help with electricity costs last year, with most grants issued in winter, according to figures recently released to Consumer NZ magazine (47). Our survey respondents more commonly reported receiving help from friends and family, although 7% received a Government grant, and a further 2% a Government loan towards electricity costs. These results indicate that this is a highly, socioeconomically deprived population.

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<sup>28</sup> <http://www.ezipay.co.nz/glo-bug.asp>, accessed 4 May 2012

The former Government regulatory body reported that there had not been an increase in the number of prepayment meters among New Zealand households between 2003 and 2008 (256), during which time there were changes made to disconnection guidelines by the regulator following a highly publicised death caused by a household disconnection (3). No further surveys of retailers offering prepayment have been reported since then. While some households have been using prepayment metering for a significant amount of time, there may have been an increase in use in the past few years, as 63% of respondents in this study have been using prepayment metering for less than five years.

Media attention has highlighted that the suggestion that low-income consumers are “forced” onto prepayment metering plans when they run into financial difficulty is contested by retailers (261-264). While this study was independent of the retail companies involved, some sensitivity was required when developing the questionnaire due to the level of cooperation required. However, several questions can be combined to indicate that some consumers are effectively forced onto prepayment metering. After moving into a house where a meter was already installed, having a debt built up on the electricity account was the second most common reason for starting on prepayment metering. Only 6% of respondents said their electricity company wanted them to use a prepayment meter, although a fifth had first found out about prepayment metering by their electricity company. When these responses are considered, together with a third of respondents having debt *before* they started on prepayment and almost a fifth having been disconnected in the previous year, it appears that, conservatively, for about a third of people using prepayment metering, it was strongly recommended by the retailer and for some customers it might be the only option offered.

Nonetheless, there was a high level of satisfaction among respondents using prepayment meters, which is consistent with the overseas experience (225).

Although just over a third of these participants reported spending less on electricity, almost all of the participants agreed that prepayment metering provides the ability to budget, with these benefits outweighing the risk of running out of credit. This is perhaps surprising when over half of the respondents had run out of credit or self-disconnected in the past year. While half of those experiencing self-disconnection in the past year had done so only once or twice, the high frequency of self-disconnection experienced by one in six respondents is of concern.

In comparison with the figure of 30,000 disconnections for non-payment on standard post-payment billing in 2011 (160), there have been an estimated 27,700 prepayment meter self-disconnections. While it may be easier to reconnect from a self-disconnection and therefore this might occur more frequently than disconnection for non-payment of bills, national figures count every disconnection, rather than the number of households disconnecting. If each household that self-disconnects six or more times (17% of those self-disconnecting in the past year) is counted only once, the national rate of disconnection would be increased by 16%. This estimate closely aligns with the 18% of prepayment meter users who were disconnected for non-payment of electricity bills in the year prior to commencing prepayment, indicating that for those consumers who experience financial difficulties when using post-payment, prepayment metering hides the difficulties they continue to face, further evidenced by 30% of those self-disconnecting in the past year citing financial constraints as the reason for the last event.

Unlike the prepayment surveys undertaken in the United Kingdom (see Chapter 3, Section 3.4.1), where self-disconnections were largely unproblematic (168, 169, 251, 252), this is less likely in New Zealand where electricity is more commonly used for both space and hot water heating than in other countries (9). More than a third (38%) of New Zealand respondents reporting self-disconnection in the past year spent 12 or more hours without electricity. While it is possible that these self-



disconnections occurred while the house is unoccupied and could be unproblematic, more than a quarter (29%) of respondents who self-disconnected were without electricity for at least 24 hours. A disconnection of this length commonly resulted in respondents describing the implications of not being able to cook or make hot drinks, use heating, take showers, or being in the dark. While these effects may be considered transitory, they can place these consumers in unsafe situations which are potentially life-threatening. Of immediate concern during a self-disconnection event, newspaper articles have reported prepayment meters being used by households that have occupants medically dependent on electricity (49, 260, 310). One newspaper article from Invercargill in 2007 detailed a house fire caused by a candle being used after the household, that used prepayment metering for electricity, had self-disconnected (257). Unintentional house fires have resulted in fatalities when candles have been used in dwellings disconnected from electricity services due to non-payment at the time of the fire (152).

Problematically, the survey results showed that the self-disconnection was a chronic strategy. Those who had been disconnected from electricity services for late or non-payment in the year prior to going onto prepayment metering were 2.3 times more likely to have experienced a self-disconnection event in the past year. Previous electricity debt before going onto prepayment metering, which may or may not be paid off before going onto prepayment (some respondents commented that they were still paying off a previous debt), was also a risk factor for experiencing a self-disconnection event, with 1.8 times increased odds. In other words, for those on low incomes, who have already experienced significant problems managing electricity costs, it is not clear that prepayment metering will provide enough budgetary control to avoid further hardship.

There are clearly issues of rights and injustice at play when considering electricity disconnection due to financial hardship (7, 32, 43), whatever the payment method.

In a survey of retailers offering prepayment metering undertaken by the Electricity Commission in 2008, four retailers reported that they routinely checked up on their prepayment consumers who had run out of credit “where possible” (256). This implies that it is possible for electricity retailers to identify when a prepayment consumer has \$0 credit, or has “self-disconnected”, and especially with recent advancement in metering technologies, this capability should be readily available. Retailers are currently required to report disconnections for non-payment, but not self-disconnection of their prepayment consumers. Mandatory reporting of self-disconnection would enable monitoring to identify whether self-disconnection rates change over time, including monitoring of seasonal variations.

Prepayment meters are perceived as a useful budgetary tool by the majority of respondents, who agreed that the ability to budget with them outweighed the risk of self-disconnection. However, only one third of respondents were aware that the electricity purchased through prepayment is more expensive than on a comparable billing plan, with price differences in some areas up to 38% higher (47, 172). Indeed, for pre-payment account holders, there are additional transactional costs involved, such as travel to retail outlets providing top-up facilities and crediting charges. One of the companies involved in this study charges \$0.65 every time a credit is made to the meter.<sup>29</sup> Furthermore, those using pre-payment meters are not usually offered the prompt-payment discounts received by customers on a post-payment billing who pay by the due date (despite paying in advance of actual usage), neither are they offered low user tariffs for the fixed daily charges required by government legislation. Electricity companies also do not have to incur any transaction costs from debt-collection from customers using prepayment metering.

Although this study was designed to report national statistics as opposed to comparing the results between the three companies who assisted us, some

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<sup>29</sup> <http://www.globug.co.nz/about-globug/> - accessed 4 May 2012

comparison is warranted due to the large number of consumers expressing dissatisfaction with the metering display devices used by one company. There are no functional requirements of prepayment metering devices required by the Electricity Authority, and different devices are used by different companies. There are also no requirements for in home displays or information provided by them where they are deployed, including smart meters currently being installed (207, 208, 224).

One company changed their metering system from a previous system, which offered in home display information such as the amount of credit being used per hour, and the remaining credit available, to a “Glo-bug” in home display that operates as a traffic light system, approximately a month before the first surveys were sent out.<sup>30</sup> The Glo-bug device shows a green light when the balance is above \$10, an orange light indicates the electricity will be disconnected the following day at midday (the credit is below \$10), while a red light warns the electricity will be disconnected that day at midday.<sup>31</sup> To get a credit balance, which is not displayed on the device, customers must either check their balance online, sign up for a daily balance email, or opt to pay for a daily credit balance text message, or phone a customer service number which will cost \$0.50 per call.<sup>32</sup> Only 48% of respondents had a home internet account, so checking the credit balance online is not a viable option for many prepayment users. Similarly, once disconnected, customers must either reconnect with their customer number either online, by text, or phone,<sup>33</sup> which is made difficult without electricity and/or may incur additional charges.

Glo-bug customers made up 39% of the survey respondents, and 46% of Glo-bug customers who responded to the question asking for two worst things about using

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<sup>30</sup> <http://tvnz.co.nz/fair-go/power-struggle-3736876/video> - accessed 4 May 2012

<sup>31</sup> [http://www.globug.co.nz/resources/GLO-BUG\\_House\\_training\\_guide.pdf](http://www.globug.co.nz/resources/GLO-BUG_House_training_guide.pdf) - accessed 4 May 2012

<sup>32</sup> [http://www.globug.co.nz/resources/GLO-BUG\\_House\\_training\\_guide.pdf](http://www.globug.co.nz/resources/GLO-BUG_House_training_guide.pdf) - accessed 4 May 2012

<sup>33</sup> <http://www.globug.co.nz/how-to-reconnect/> - accessed 16 August 2012

prepayment named the new display unit. The Glo-bug system also reduces the benefits of the direct feedback that prepayment usually provides (111, 235) – apart from the reminder of having the display inside and needing to credit the meter, there is actually less information than would be provided on a monthly bill which states the number of units used, the fixed daily charges, and transmission charges for example. Other studies have similarly found that consumers prefer more information than that provided by the Glo-bug system, and the market can clearly not be relied upon to deliver these services (207, 311).

While some users may have a better sense of ostensible control with prepayment meters, which may help to reduce stresses associated with fuel poverty, others indicated that coping strategies used to reduce electricity consumption can be an additional stressor for households, who are already experiencing some of the negative psychosocial outcomes of fuel poverty (89). Whether or not electricity conservation, which can involve reducing indoor temperatures below comfortable levels contributes negatively to mental health is difficult to assess between households, as it appears to be determined in part by householders' attitudes (88, 166). However, there are clear negative outcomes for physical health caused by the physiological responses to exposure to adverse indoor temperatures (66, 73, 74, 121, 136, 312). The results provide some evidence that prepayment metering encourages households to reduce indoor temperatures below comfortable and safe levels, although further investigation is required.

The group of consumers in our study is clearly economically and socially vulnerable. While they spend less on electricity than their higher income counterparts in absolute terms, this represents proportionally more of their household incomes (9). As highlighted, climate change and associated policy responses have the potential to further increase hardship for those in fuel poverty (79, 145, 146). This study

indicates that those using prepayment metering in New Zealand are likely to suffer the same vulnerabilities and will be less financially capable of adaptation responses.

#### 5.4.2 Strengths and limitations

The rigorous follow-up methods employed in this study achieved a response rate that was adequate to power the study to identify a self-disconnection rate of 50%, plus or minus 5%. However, nothing is known about the make-up of the group that did not participate in the survey and it is possible that a greater response rate may have shifted the results in either direction. It is also possible that the slightly different wording and timing of letters sent out between companies may have affected the response rates; however this was unavoidable and is part of the nature of conducting studies in a community setting with corporate cooperation.

#### 5.4.3 Initial policy recommendations

As described in the introductory chapters, recent years have seen the outcomes of market failure in the domestic electricity market after rigorous deregulation in the early 1990s in the form of rapid and significant price increases over and above those seen in the commercial and industrial markets (9, 195). The real price of residential electricity in 2009 was 24.69c/kWh, compared with 14.81c/kwh in 1989 (197). Instead of engaging in market reform to address this problem, the current Government has continued its programme of encouraging market competition, and is currently in the process of partially privatising the largely state-owned generating and retailing companies, which is likely to further compound fuel poverty.<sup>34</sup>

Prepayment metering in itself is not a cause of fuel poverty, however the current lack of regulation around prepayment metering and pricing in New Zealand is such that it appears that prepayment metering is in fact contributing to the fuel poverty problem. Lessons could be taken from other jurisdictions such as in Ireland, where

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<sup>34</sup> <http://www.legislation.govt.nz/bill/government/2012/0007/latest/DLM4326312.html> - accessed 8 May 2012

prepayment metering is cheaper than other payment methods, and can therefore be argued to form part of the fuel poverty solution (7, 111). The results of this study have highlighted that regulatory reform of prepayment metering could reduce the burden of fuel poverty in New Zealand by protecting consumers against some of the pitfalls and harnessing the advantages of prepayment metering. In particular, recommendations for government policy arising from the survey are:

- That mandatory reporting of self-disconnection is introduced, and rates are monitored and published in the same way in which disconnection for late or non-payment of post-payment customers statistics are published;
- That hours of possible self-disconnection be set to business hours only, and that crediting facilities must be available at all times when self-disconnection can be allowed to occur;
- That minimum credit amounts be lowered;
- That additional fees for obtaining a credit balance be curtailed;
- That minimum informational standards for prepayment metering devices be set.

## **5.5 Summation and direction**

Little has previously been known about the advantages and disadvantages of using prepayment metering from a consumer perspective in New Zealand; this survey contributes usefully to fill this knowledge gap. This study identified some disadvantages to using prepayment metering that may not be experienced by fuel poor households on post-payment plans, in particular the informational asymmetry caused by some metering types offering less usage information than standard billing, and additional charges. While there are some advantages to using

prepayment metering as it is currently used in New Zealand, some government regulation could reduce the risks and disadvantages outlined above.

The study also raised further questions about whether self-disconnection remains problematic over time, and whether the increased control and reduced spending reported by many translates to reducing electric space heating use below comfortable and healthy levels. This provided the impetus to proceed with a follow-up postal survey of consenting participants in 2011 in order to explore these issues, as the following chapter describes.





## Chapter Six:

### Follow-up postal survey of prepayment meter consumers investigating self-disconnection and thermal comfort

#### 6.1 Overview

This chapter reports on a follow-up postal survey of consenting respondents to the nationwide survey of electricity prepayment meter consumers. Together with Chapters Five, Seven and Eight it contributes to meeting the first, second, third, and fourth overall thesis objectives identified in Chapter One (see section 1.6.3). It provides some longitudinal information on self-disconnection, and self-reported levels of thermal comfort experienced by, and heating practices of, prepayment meter consumers in New Zealand. Firstly, a brief background and rationale for the development of this phase and its place within the broader multiphase mixed methods research programme is given. Next follows a description of the research methods employed in the present study, before the results are provided. Lastly, a discussion synthesising these results, identifying strengths and limitations of this study, and outlining policy recommendations stemming from this survey concludes the chapter.

#### 6.1.2 Acknowledgements

This study was funded by a Foundation for Research Science and Technology grant *Adaption to Climate Change of Vulnerable Populations* and the University of Otago. James Stanley prepared the database used for data entry and analysis, performed paired data analysis, and provided useful critique of a manuscript in preparation which draws in a large part from this chapter.

## 6.2 Background and rationale

Although disconnection rates are regularly monitored and reported on for post-payment electricity customers, no longitudinal information on “self-disconnection” is available in New Zealand. When the initial survey detailed in the previous chapter was developed, consideration was given to the possibility of further follow-up with consenting respondents, which could contribute another research phase to the overall mixed methods research programme. This proceeded, and the follow-up survey, which investigated whether the same cohort experienced persistent patterns of self-disconnection, enabled the collection of self-disconnection and other data in 2011, approximately one year after the initial survey.

Given the typically low electricity consumption of prepayment meter users, there is limited opportunity for electricity conservation and space heating is one area in which savings may be made. While this may be useful for managing finances, and for reducing emissions, reducing heating in the context of New Zealand’s already cold indoor temperatures may pose a significant health risk. Due to space constraints, the initial survey asked very few questions to examine whether households using prepayment metering experience adequate levels of thermal comfort. One fifth indicated that they had stayed in bed to save on heating costs “*a lot*”, which is described as an “*enforced lack*” in surveys measuring non-monetary indicators of material wellbeing (306). Responses to open-ended questions provided some qualitative indications that self-rationing and self-disconnection events meant that several households were restricting space heating and feeling cold as a result. Another advantage of using a follow-up postal survey was that subjective indicators of thermal comfort and heating practices among prepayment consumers could be explored in order to clarify whether this group is exposed to self-reported low indoor temperatures, and identify reasons for this. Although the sample included only those who had previously consented, asking these questions via a follow-up

postal survey enabled a greater number of respondents to be surveyed than if only an interview study was undertaken.

### 6.2.1 Aims

This study aimed to follow-up the 2010 postal survey, by investigating patterns of self-disconnection from electricity among the cohort of prepayment meter consumers. It also aimed to explore self-reported levels of thermal comfort and heating practices among the cohort, and to determine whether prepayment metering encourages the restriction of space heating.

### 6.2.2 Specific objectives

The specific objectives of this follow-up survey were to:

- investigate whether patterns of 'self-disconnection' change over time;
- explore the heating practices of households using prepayment metering.

## 6.3 Research Methods

### 6.3.1 Questionnaire and cover letter development

The starting point for the development of the follow-up survey questionnaire was the original survey questionnaire, as it was important to gather enough similar details to achieve the aim of exploring self-disconnection patterns. Consideration was also given to retaining collection of data that may be useful statistical analysis matching the two datasets; and use of the same identification codes helped to facilitate this. New questions were developed to gauge agreement with commonly highlighted advantages and disadvantages from the initial survey and literature that were unable to be included due to space restrictions in the initial survey. Questions to investigate thermal comfort used in other studies undertaken by *He Kainga*

*Oranga*<sup>35</sup> were included, although Question 22 (see questionnaire, Appendix Two) which is designed to elicit detailed data on the heating sources used by households was edited to shorten and clarify descriptions of different heating types for the postal survey format. These questions are broadly consistent with similar questions to investigate thermal comfort used in studies overseas (64, 66, 75), and other local surveys (158, 306, 313). Two questions about paying for water that were unable to be included in the previous survey were used. The questionnaire was eleven pages long, with the consent form printed on the twelfth or back page of the double-sided printed questionnaire. The Tailored Design Method (294, 297) was used as a guide to questionnaire and cover letter development (see Chapter Four). Cover letters again used a polite, personal tone, and highlighted the usefulness of the previous research and the importance of receiving responses from as many people as possible again in order to achieve the most accurate results.

### 6.3.2 Ethical considerations

The 2011 study obtained separate Ethics Approval (Category B), and used similar ethical considerations to those in the initial survey with regards to identity protection, data storage, the provision of information and my contact details, consent, and the \$20 supermarket voucher offered to respondents returning completed survey forms as an incentive. A confidentiality agreement between the University of Otago, and the third party mailing company (*Orangebox*), was also used to ensure the protection of personal data. All results are presented anonymously.

### 6.3.3 Sampling

As described in the previous chapter, the 2010 survey used a complex method of participant sampling; I worked with three major electricity retailers offering

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<sup>35</sup> For example, the Warm Homes for Elder New Zealanders study, <http://www.healthyhousing.org.nz/research/current-research/warm-homes-for-elder-new-zealanders/> among other current research.

prepayment metering to provide a representative nationwide sample to a third party mailing company, who then mailed all study information and questionnaires as directed. Respondents to the 2010 survey were asked to indicate if they consented to postal follow-up when they provided address details to me so that a \$20 supermarket voucher could be sent to thank them for their participation. The electricity companies were not involved in the follow-up research in any way. The 2010 survey sample included a total number of 768 customers, calculated for a response rate of 50% (384), providing adequate study power assuming 50% frequency of self-disconnection in the population. The final response rate for the 2010 survey was 47.9%. Of the 359 respondents to the 2010 survey, 324 (90.2%) agreed to postal follow-up and were included in the 2011 sample.

#### **6.3.4 Mailing protocol**

As with the 2010 survey, the mailing protocol (Table 6.1) was adapted from the Tailored Design Method, which uses repeat mailings to maximise the response rate (294, 297). The third party mailing company was again contracted to print and send the mail, however the return address was the University, and the researchers provided the mailing company with updated mailing databases for each reminder mailing. The fourth and fifth mailing rounds used in the 2010 survey were cancelled in the follow-up study due to a higher than expected response rate being achieved after the reminder postcard was sent out. This was despite a handling error made by the mailing company which resulted in incorrect names used in the greeting of the postcards, although the names on the address side of the postcards were correct. I was made aware this when a few of the postcards were returned by addressees, drawing attention to the mistake. The decision to cancel further follow-up was made when the response rate reached 61.0% after the reminder postcard was sent. This is a relatively high response rate to a postal survey, and it was predicted that further reminders would put the study over the allotted budget. As noted, participants were again offered a \$20 supermarket voucher as an incentive. I believe

that the response rate was enhanced by trust in the reward being sent, and also the interest in the topic expressed by respondents to the 2010 survey round. Copies of each of the items listed below (with the exception of envelopes) are provided in Appendix Two.

**Table 6.1: Mailing Protocol - Electricity Prepayment Meter Users Follow-up Survey 2011**

| Mailing | Date Sent  | Contents                                                                                                                                        | Sent to            |
|---------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Mail 1  | 29/8/2011  | Pre-notification letter                                                                                                                         | All 324 sample     |
| Mail 2  | 07/09/2011 | Cover-letter<br>Information sheet<br>Consent form<br>Questionnaire from University of Otago<br>Return prepaid envelope from University of Otago | All 324 sample     |
| Mail 3  | 14/09/2011 | Reminder postcard                                                                                                                               | 307 non-responders |

### 6.3.5 Data handling and analysis

Data handling and analysis was carried out in a similar manner to the original survey. The survey data were entered into a Microsoft Access database and analysed using Epi Info version 3.4 (Center for Disease Control, Atlanta, GA). The denominator for all tables was all responses, unless stated otherwise; as small invalid or no-answer categories are not presented, tables may not sum to 100%. These categories are generally not reported below, unless there was an unusually large proportion. In several questions, answers were not mutually exclusive and more than one response category was accepted, as per the instruction provided. Paired data analysis was performed by James Stanley, using the statistical programme R (15.2, R Institute, Vienna, Austria).

Qualitative data from the open questions and partially closed questions (with “*other, please specify:\_\_\_\_\_*” optional responses) were analysed using an iterative process to

develop codes, followed by a final round of coding to obtain frequencies. Selected quotes are presented anonymously.

## **6.4 Results**

In order to avoid repetition of the previous chapter, many of the results from data obtained in the follow-up survey and reporting similar findings to the 2010 survey, are included in Appendix Three. The results presented below briefly describe the demographic characteristics of the respondents to the follow-up survey, with a comparison of the differences between reply groups using data from the 2010 survey also provided. The subsequent results focus on the advantages and disadvantages of prepayment metering, report patterns of self-disconnection, and then turn to the new information concerning thermal comfort and heating practices. Where questions from initial survey were included in the follow-up, data from that survey are presented in the tables for ease of reference. It is important to comment that the descriptive statistical analysis used here cannot identify changes between the results of the two surveys; however, patterns can be observed which mostly indicate similar advantages and disadvantages are reported by the cohort at the one year follow-up interval.

### **6.4.1 Demographics and comparison of response groups**

A response rate of 61.0% (194/318) was achieved for the survey, excluding 6 of the 324 mailed questionnaires, which were returned to sender.

Both surveys had high rates of respondents self-reporting Māori and Pacific ethnicity, compared to the ethnicities of the New Zealand population reported in the 2006 Census (308). The age range of respondents (21-79 years) was smaller in 2011, with an average age of 47. The proportion of those in retirement was 8.8% (65 years and over). Unemployment remains high, and gross household incomes low, with

over half below \$40,000 in both years as shown below. This compares to the national median household income from regular sources of \$62,853 in 2011 (314). Although income data were collected in ranges, this threshold most closely approximates the typical threshold of less than 60% of the median national household income used to measure poverty (306). Reported home ownership was higher than in the 2010 survey, though less than half that of the national rate, with only 30.4% (24.0-37.4) reporting the house was owned by them or their family trust. In comparison, the 2006 Census reported 66.9% home ownership across the population, with 81.8% of those making rental payments paying a private landlord (175). The number reporting *poor* or *very poor* remained static at 6.7%, although it is likely that the self-rated housing conditions overestimated housing quality as was found in an earlier local study, which compared self-rated housing conditions of those living in typically low-socioeconomic housing with ratings given by a qualified building inspector (122).



**Table 6.2: Respondent demographics for the 2010 and 2011 survey waves.**

| Demographic variable                    | 2011 Results (n194) |             | 2010 Results (n359) |             |
|-----------------------------------------|---------------------|-------------|---------------------|-------------|
|                                         | %                   | 95% CI      | %                   | 95% CI      |
| Female Gender                           | 67.5                | 60.5 - 74.1 | 67.9                | 62.8 - 72.7 |
| Mean Age                                | 46.9                | 45.0 - 48.8 | 43.9                | 42.4 - 45.4 |
| Paid employment                         |                     |             |                     |             |
| Full-time                               | 32.0                | 25.5 - 39.0 | 30.2                | 25.5 - 35.3 |
| Part-time                               | 22.2                | 16.5 - 28.7 | 17.9                | 14.1-22.3   |
| Unemployed                              | 43.3                | 36.2 - 50.6 | 48.9                | 43.6 - 54.2 |
| Household income ≤\$40,000              | 55.2                | 47.9 - 62.3 | 50.6                | 45.3 - 55.9 |
| Total ethnicity*                        |                     |             |                     |             |
| Māori                                   | 32.5                | 25.9 - 35.6 | 35.4                | 30.5 - 40.6 |
| Pacific                                 | 15.5                | 10.7 - 21.3 | 23.1                | 18.9 - 27.9 |
| Non-Māori, non-Pacific                  | 63.9                | 56.7 - 70.7 | 56.8                | 51.5 - 62.0 |
| Children under 18                       |                     |             |                     |             |
| At least one in household               | 47.8                | 40.5 - 55.3 | 54.3                | 48.8 – 59.6 |
| None in household                       | 52.2                | 44.7 - 59.5 | 45.7                | 40.4 – 51.2 |
| Home ownership status                   |                     |             |                     |             |
| Owner occupier/family trust ownership   | 30.4                | 24.0 - 37.4 | 26.8                | 22.4 - 31.8 |
| Private rental                          | 36.6                | 29.8 - 43.8 | 39.9                | 34.9 - 45.2 |
| Government rental                       | 28.9                | 22.6 - 35.8 | 30.2                | 25.5 - 35.3 |
| Other rental (church, charitable group) | 1.5                 | 0.8 - 5.9   | 2.0                 | 0.9 - 4.2   |

\*As with the national Census, the total responses to ethnic groups include all of the people who self-reported that ethnic group, whether as their only ethnic group, or one of several ethnic groups. Hence people can report multiple ethnic groups, and proportions can add up to more than 100% across these three categories.

A limitation of this study is that because the respondents opted into the study, it is uncertain whether the follow-up survey respondents are representative of prepayment meter users in New Zealand. Anecdotal evidence from the electricity companies also suggests that prepayment meter customers are highly mobile; New Zealand has relatively high residential mobility rates with more than half of the population having shifted in the five years prior, and almost a quarter in the year prior to the most recent Census (315). Residential mobility is accentuated in the younger age brackets, and among those of Māori and Pacific ethnicities (315). For this reason the three response groups: those who did not consent to postal follow-up; those who consented but did not respond to the 2011 survey; and those who consented and responded to the 2011 survey, were compared using responses to the

2010 survey to examine demographic differences (Table 6.3). Where the median is reported, lower and upper quartiles are given, where means and frequencies are reported, 95% confidence intervals are given.

No significant differences were found between the 2010 and 2011 respondents for gender, Māori ethnicity, income, median monthly electricity expenditure, and median years of prepayment meter use. Statistically significant differences were found between the groups for households with children (chi square = 9.53, p value = 0.009) who were over-represented in the group that consented to but did not take part in the 2011 survey. This group also had a significantly younger median age (chi square = 10.43, p = 0.005) than those responding and not consenting to follow-up. The groups also differed by the number of households who had a self-disconnection event in the past year (chi square = 13.78, p value = 0.001), with the least number of self-disconnecting households in the group that did not consent to follow-up at 36.1%, followed by the group that took part in the 2011 survey with 46.9% households self-disconnecting, and the most households self-disconnecting at 64.4% in the group that consented, but did not respond to the 2011 survey.

**Table 6.3: Comparison of reply groups socio-demographic and heating factors (based on 2010 data from all respondents)**

| <b>Demographics</b>                                              | <b>Did not consent to follow-up (36)</b> | <b>Consented, non-responder (129)</b> | <b>Consented, responded (194)</b> | <b>Significance</b>             |
|------------------------------------------------------------------|------------------------------------------|---------------------------------------|-----------------------------------|---------------------------------|
| Median age*<br>(interquartile range)                             | 47<br>(32, 55)                           | 39.5<br>(29, 48.5)                    | 45<br>(37, 56)                    | $\chi^2 = 10.43$ ,<br>p = 0.005 |
| Children (under 18) in household*                                | 46.9%<br>(29.1 - 65.3)                   | 65.0%<br>(55.9 - 73.4)                | 47.9%<br>(40.5-55.3)              | $\chi^2 = 9.53$ ,<br>p = 0.009  |
| Female Gender                                                    | 80.0%<br>(63.1 - 91.6)                   | 63.6%<br>(54.8 - 71.8)                | 68.0%<br>(61.0-74.5)              | $\chi^2 = 3.09$ ,<br>p = 0.213  |
| Māori Ethnicity (total responses)                                | 38.9%<br>(23.1 - 56.5)                   | 37.1%<br>(28.9 - 46.0)                | 33.5%<br>(26.9-40.6)              | $\chi^2 = 0.67$ ,<br>p = 0.716  |
| Household income                                                 |                                          |                                       |                                   |                                 |
| \$0-20,000                                                       | 28.6%<br>(14.6 - 46.3)                   | 19.7%<br>(13.3 - 27.5)                | 23.7%<br>(17.9 - 30.3)            | $\chi^2 = 12.43$<br>p = 0.714   |
| \$20,001-\$40,000                                                | 34.3%<br>(19.1 - 52.2)                   | 33.3%<br>(25.4 - 42.1)                | 23.2%<br>(17.5 - 29.8)            |                                 |
| Median monthly spend on electricity<br>(interquartile range)     | \$120<br>(\$80, \$180)                   | \$132.50<br>(\$82.50, \$180)          | \$120<br>(\$88, \$180)            | $\chi^2 = 0.67$ ,<br>p = 0.717  |
| Self-disconnection occurred in past year*                        | 36.1%<br>(20.8-53.8)                     | 64.4%<br>(55.6-72.5)                  | 46.9%<br>(39.7-54.2)              | $\chi^2 = 13.78$ ,<br>p = 0.001 |
| Median number of years using prepayment<br>(interquartile range) | 2.5<br>(1, 6)                            | 2<br>(1, 7)                           | 3<br>(1, 8)                       | $\chi^2 = 5.21$ ,<br>p = 0.074  |

\*Statistically significant differences between response groups

Reported expenditure on electricity remained similar to the 2010 results. Other financial indicators and non-monetary indicators of material wellbeing than household income were also included in the 2011 questionnaire (Table 6.4). Outside help to pay for electricity remained similar overall, at 20.3% (14.7-26.7) in 2011, compared with 23.5% (19.2-28.2) in 2010, although fewer reported receiving Government assistance in 2011, indicating a shift from public assistance to private assistance for those experiencing hardship. To indicate access to other utilities, respondents were asked which telecommunications services they had at home, and which they could not obtain due to prohibitive costs. Home (fixed line) telephones, internet, and mobile phones on a plan were considered similarly unaffordable across

both years. Water metering is not widely used in New Zealand, and payment for water is usually recovered through local area housing rates, with the majority of respondents billed in this manner. As described in the introductory chapters, a common phenomenon among those suffering fuel poverty and those using prepayment metering overseas, is the “heat or eat” scenario (51, 52, 88, 99, 168). To explore this in the prepayment population the follow-up survey asked “do you ever cut back on food costs to pay for electricity?”, and almost half (49.0%) reported doing this at least sometimes.

**Table 6.4: Indicators of financial hardship and other utility stress**

| Indicator                                                                  | 2011 Results |             | 2010 Results |             |
|----------------------------------------------------------------------------|--------------|-------------|--------------|-------------|
|                                                                            | %            | 95% CI      | %            | 95% CI      |
| Unable to pay telephone, gas, or water bills by due date in past 12 months | 35.6         | 28.8 - 42.7 | 40.4         | 35.3 - 45.7 |
| Received outside help to pay for electricity in past 12 months             |              |             |              |             |
| Grant or loan from family/friends                                          | 17.5         | 12.5 - 23.6 | 13.9         | 10.6 - 18.0 |
| Government grant                                                           | 2.1          | 0.6 - 5.2   | 7.0          | 4.6 - 10.2  |
| Government loan                                                            | 0            |             | 1.9          | 0.9 - 4.2   |
| Telecommunications services unable to obtain due to cost                   |              |             |              |             |
| Home telephone                                                             | 18.2         | 13.0 - 24.4 | 17.9         | 14.1 - 22.3 |
| Mobile on plan payment scheme                                              | 23.8         | 18.0 - 30.5 | 23.1         | 18.9 - 27.9 |
| Mobile on prepayment scheme                                                | 3.1          | 1.2 - 6.6   | 2.8          | 1.4 - 5.2   |
| Home internet                                                              | 17.1         | 12.1 - 21.2 | 20.1         | 16.2 - 24.7 |
| Water billing method*                                                      |              |             |              |             |
| Local area housing rates                                                   | 74.3         | 67.5 - 80.2 |              |             |
| Metered – Unrestricted volume                                              | 5.2          | 2.5 - 9.3   |              |             |
| Metered – Volume-based                                                     | 13.9         | 9.4 - 19.6  |              |             |
| Cut back on grocery spending to afford electricity*                        |              |             |              |             |
| Never                                                                      | 50.5         | 43.3 - 57.8 |              |             |
| Sometimes                                                                  | 27.3         | 21.2 - 34.2 |              |             |
| Often                                                                      | 13.4         | 8.6 - 19.0  |              |             |
| Always                                                                     | 8.3          | 4.8 - 13.0  |              |             |

\*New question in 2011

#### 6.4.2 Advantages and disadvantages of prepayment metering

A high level of general satisfaction with prepayment metering, and their electricity company were indicated by the respondents, and advantages and disadvantages named in open-format responses were similar to those found in the 2010 survey. An

interesting disadvantage described in 2011 by 1.4% of respondents, which was not found in the 2010 survey, was the stigma associated with being a prepayment customer, typically used in New Zealand by low-income households, for example *“you feel like you use prepay because you’re a credit risk”*. When asked to rate their level of agreement with the statement *“some people like the ability to budget with prepayment meters and say the benefits outweigh the risk of running out of credit”*, most respondents agreed or strongly agreed in both years.

Participants were asked to indicate their agreement with seven common responses to the open questions from the 2010 survey in the follow-up survey, which also align with those in overseas studies of prepayment metering. Table 6.5 displays the agreement and disagreement with each of the statements to allow for comparison of divergent views; a neutral response category was also included, but is not reported here. Opportunities for decreasing consumption of electricity is often limited in low-income households (110), and given New Zealand’s low indoor temperatures I hypothesised that prepayment metering would encourage restricting use of electric space heating. The findings support this notion, with 57.0% of respondents agreeing with the statement *“my prepayment meter makes me cut back on using my heaters”*, while only 11.4% of respondents disagreed. While the majority agreed that prepayment metering avoids a large monthly bill, aids budgeting, and is convenient, responses to the statements around concerns about the cost of electricity and self-disconnection were mixed. Prepayment metering did not, however, eliminate worry about being able to maintain the supply of electricity.

**Table 6.5: Agreement with statements of commonly reported advantages and disadvantages of prepayment metering**

| Statement                                                                 | Agree |             | Disagree |             |
|---------------------------------------------------------------------------|-------|-------------|----------|-------------|
|                                                                           | %     | 95% CI      | %        | 95% CI      |
| My prepayment meter helps me budget                                       | 77.2  | 70.6 - 82.9 | 3.6      | 1.5 - 7.3   |
| My prepayment meter makes me cut back on using my heaters                 | 57.0  | 49.7 - 64.1 | 11.4     | 7.3 - 16.8  |
| My prepayment meter is convenient                                         | 67.3  | 60.2 - 73.9 | 6.7      | 3.6 - 11.2  |
| My prepayment meter means I never worry about the cost of electricity     | 30.6  | 24.2 - 37.6 | 35.2     | 28.5 - 42.4 |
| My prepayment meter means I don't have a big bill at the end of the month | 88.6  | 8.3 - 92.7  | 2.1      | 0.6 - 5.2   |
| My prepayment meter makes me worry about having no electricity            | 29.0  | 22.7 - 36.0 | 31.6     | 25.1 - 38.7 |
| My prepayment meter shows me how much electricity each appliance uses     | 40.6  | 33.6 - 47.9 | 30.2     | 23.8 - 37.3 |

### 6.4.3 Self-disconnection

Self-disconnection patterns remained broadly consistent, and indicate that self-disconnection remains problematic over time for the cohort (Table 6.6). A greater proportion (8.3%) did not respond to the question asking whether they had self-disconnected or not in 2011. The mean number of self-disconnections in the past year remained constant at four times (mean 4.6, s.d. 7.0), and median of 3.5. Again in 2011 the length of time the last self-disconnection lasted also varied widely, ranging from, most commonly, an hour or less, up to more than a week. The median length of time of the last self-disconnection was three and a half hours. The number without electricity for 12 or more hours during the last self-disconnection event remains concerning, at 40.0% in 2011. One third (33.0%) were without electricity for 24 or more hours. Among these households experiencing long self-disconnection events, 17% were without electricity for 24 hours or one full day, 4% for two days, 4% for three days, 2% for four days, and 3% for a week. Reasons given for the last

self-disconnection event and descriptions of the worst thing about the last self-disconnection event were similar to the 2010 results.

**Table 6.6: Reported self-disconnection outcomes in 2011 and 2010**

| Reported self-disconnection outcome                | 2011 |             | 2010 |             |
|----------------------------------------------------|------|-------------|------|-------------|
|                                                    | %    | 95% CI      | %    | 95% CI      |
| Self-disconnected                                  |      |             |      |             |
| Never                                              | 28.4 | 22.1 - 35.2 | 38.7 | 33.7 - 44.0 |
| More than 12 months ago                            | 18.0 | 12.9 - 24.2 | 9.7  | 7.0 - 13.4  |
| In the past 12 months                              | 45.4 | 38.2 - 52.7 | 52.6 | 47.3 - 57.9 |
| Frequency of self-disconnections in past 12 months |      |             |      |             |
| 1                                                  | 26.4 | 17.6 - 37.0 | 20.8 | 33.7 - 44.0 |
| 2                                                  | 19.5 | 11.8 - 29.4 | 32.7 | 7.0 - 13.4  |
| 3 - 5                                              | 37.9 | 27.7 - 49.0 | 29.6 | 22.6 - 37.3 |
| ≥6                                                 | 18.4 | 10.9 - 28.1 | 17.0 | 26.2 - 36.0 |
| ≥10                                                | 10.3 | 4.8 - 18.7  | 9.4  | 24.4 - 34.0 |
| ≥15                                                | 5.7  | 1.9 - 12.9  | 5.0  | 2.2 - 9.7   |
| Duration of last self-disconnection event          |      |             |      |             |
| ≤1 hr                                              | 35.0 | 25.7 - 45.2 | 33.3 | 26.8 - 40.4 |
| 2 hrs                                              | 5.0  | 1.6 - 11.3  | 11.8 | 7.6 - 17.2  |
| 3 - 5 hrs                                          | 16.0 | 9.4 - 24.7  | 13.3 | 8.9 - 18.9  |
| 6 - 11 hrs                                         | 4.0  | 1.1 - 9.9   | 3.6  | 1.5 - 7.3   |
| 12 - 23 hrs                                        | 7.0  | 2.9 - 13.9  | 9.3  | 5.6 - 14.2  |
| 24 - 47 hrs                                        | 20.0 | 12.7 - 29.2 | 17.4 | 12.4 - 23.5 |
| 48 - 71 hrs                                        | 4.0  | 1.1 - 9.9   | 6.2  | 3.2 - 10.5  |
| ≥72 hrs                                            | 7.0  | 2.9 - 13.9  | 5.1  | 2.5 - 9.3   |
| ≥1 week                                            | 3.0  | 0.6 - 8.5   | 3.6  | 1.5 - 7.3   |

### 6.4.5 Longitudinal analysis of self-disconnection

To test whether there the rate of self-disconnection observed was statistically different between the 2010 survey and the 2011 follow-up survey, a paired data analysis was performed by James Stanley (R 15.2, R Institute, Vienna, Austria). For this analysis, respondents to the 2011 survey who provided valid answers were classified according to the possible responses being “*never self-disconnected*”, “*yes, in the past 12 months*”, and “*yes, more than 12 months ago*” (n=175). For this analysis, those that self-disconnected more than 12 months ago were grouped together with

those who never self-disconnected; therefore, only self-disconnection in the past 12 months is examined here.

In 2010, 47.1% reported self-disconnecting in the last 12 months, while 49.4% reported this in 2011. Over a third (36.6%) report having self-disconnected in the past 12 months in both years. This adds further evidence to the original survey findings that a group of those currently using prepayment metering are particularly vulnerable, experiencing pervasive hardship and regular self-disconnection events. It supports the conclusion that prepayment metering may not be appropriate for this sub-group as it can “hide” the difficulties faced, as acknowledged by a retailer responding to an earlier survey conducted by the Electricity Commission (213). However, for some, self-disconnection was not an ongoing concern, with 12.0% reporting self-disconnection in 2010, but not in 2011, and 12.6% reporting self-disconnection in 2011, but not in 2010. Almost two out of five households (38.9%) reported not having self-disconnected recently in either survey, supporting the evidence that for some consumers, self-disconnection is unproblematic. However, this analysis has not investigated any connections between self-disconnection and self-rationing or thermal comfort indicators, so no conclusions can be drawn about the extent to which the use of prepayment metering may still have detrimental effects, even when self-disconnection is not an outcome.

A McNemar test (implemented using the coin package in R; (316)), a variant of the chi-squared statistical test that accounts for the pairing of the data, was performed to assess the marginal homogeneity of the group, i.e. whether the cohort were proportionally more likely to self-disconnect in either 2010 or 2011. The McNemar test found no statistical difference in the responses between the two years ( $\chi^2= 0.32$ ,  $p=0.879$ ).



#### 6.4.5 Thermal comfort and heating practices

While it was not possible to collect indoor temperature data, the questionnaire included a section to explore whether the households are achieving indoor environments that provide thermal comfort (Table 6.7). Respondents were asked whether they felt their house had been cold in the winter months (June, July, and August) in 2011, whether they used heating during the winter months, and whether they ever had the house colder than they would have liked during the winter months.

Respondents were also asked to indicate on how many day/nights in the winter months their homes had been cold enough that they shivered inside. Shivering was reported by more than two thirds (67.5%, 95% CI 60.5-74.1), and almost two in five households shivered on at least four occasions. Assuming the representativeness of this sample, extrapolating these results to the nationwide population of prepayment meter users, 35,548 households nationwide experienced shivering indoors on at least one occasion, with 20,380 households shivering indoors on at least four occasions. Respondents were also asked on how many day/nights in the winter months they had been able to see their breath condensing inside. Although no studies investigating the specific conditions that this phenomenon occurs in, it was indicated that it is generally accepted that it is in cold conditions that this is possible to observe. Over half (57.2%, 95% CI 49.9-64.3) reported problems; one in four households experienced this on four or more occasions. One respondent wrote the following poignant note alongside a response of four or more nights: *"always; we are so used to it that we almost have a laugh when we always see 'our breath' inside our house we call it: ghosts"*. Again, this translates to 30,123 households using prepayment metering who were able to see their breath condensing indoors at least once during the winter, and 14,640 on at least four occasions.

**Table 6.7: Self-reported indicators of inadequate thermal comfort**

| <b>Thermal comfort indicator</b>                  | <b>Proportion</b> | <b>95% CI</b> |
|---------------------------------------------------|-------------------|---------------|
| House was cold this winter                        |                   |               |
| Never                                             | 21.6              | 16.1 - 28.1   |
| Sometimes                                         | 28.9              | 22.6 - 35.8   |
| Often                                             | 20.6              | 15.2 - 27.0   |
| Always                                            | 27.8              | 21.7 - 34.7   |
| Used heating when cold this winter                |                   |               |
| Never                                             | 15.5              | 10.7 - 21.3   |
| Sometimes                                         | 28.9              | 22.6 - 35.8   |
| Often                                             | 27.3              | 21.2 - 34.2   |
| Always                                            | 27.8              | 21.7 - 34.7   |
| House was ever colder than preferred this winter  |                   |               |
| Never                                             | 29.9              | 23.5 - 36.9   |
| Sometimes                                         | 34.5              | 27.9 - 41.7   |
| Often                                             | 20.6              | 15.2 - 27.0   |
| Always                                            | 13.9              | 9.4 - 19.6    |
| Number of occasions shivered indoors              |                   |               |
| Never                                             | 30.9              | 24.5 - 38.0   |
| One day/night                                     | 7.2               | 4.0 - 11.8    |
| Two or three day/nights                           | 21.7              | 16.1 - 28.1   |
| Four or more day/nights                           | 38.7              | 31.8 - 45.9   |
| Number of occasions saw breath condensing indoors |                   |               |
| Never                                             | 40.7              | 33.7 - 48.0   |
| One day/night                                     | 7.2               | 4.0 - 11.8    |
| Two or three day/nights                           | 22.2              | 16.5 - 28.7   |
| Four or more day/nights                           | 27.8              | 21.7 - 34.7   |

Respondents were asked to indicate what kinds of heating sources were available to them, and which ones they used in the winter months of 2011 (Table 6.8). Many households own and use more than one heater, so percentages do not add to 100. Electric heating was used by 65.0% of respondents (including those using heat pumps, fixed or portable electric heaters), compared with 74.8% of the New Zealand population (175). Electric heating sources were also available, but not in use in the households of 24.2% respondents. Respondents specified the “other” heater types most commonly as additional clothing/blankets, followed by no heating, the oven, dehumidifier or ventilation system, and electric blankets or hot water bottles.

Table 6.8: Heater types and use in winter 2011

| Heater type                              | Primary heater |             | Own, used heater |             | Own, did not use |            |
|------------------------------------------|----------------|-------------|------------------|-------------|------------------|------------|
|                                          | %              | 95% CI      | %                | 95% CI      | %                | 95% CI     |
| Portable plug-in electric heater         | 23.7           | 17.9 - 30.3 | 42.3             | 35.2 - 49.6 | 14.4             | 9.8 - 20.2 |
| Enclosed fire / woodburner / multiburner | 23.2           | 17.5 - 29.8 | 26.3             | 20.2 - 33.1 | 2.1              | 0.6 - 5.2  |
| Heat pump                                | 12.4           | 8.1 - 17.8  | 13.9             | 9.4 - 19.6  | 1.0              | 0.1 - 3.7  |
| Unflued gas heater                       | 11.3           | 7.2 - 16.7  | 22.7             | 17.0 - 29.2 | 4.6              | 2.1 - 8.6  |
| Open fire                                | 6.2            | 3.2 - 10.6  | 7.7              | 4.4 - 12.4  | 5.7              | 2.9 - 9.9  |
| Flued gas heater                         | 6.2            | 3.2 - 10.6  | 6.8              | 3.7 - 11.3  | 3.1              | 1.2 - 6.7  |
| Electric fixed heater (NOT heatpump)     | 2.6            | 0.8 - 5.9   | 8.8              | 5.2 - 13.7  | 8.8              | 5.2 - 13.7 |
| Wood pellet burner                       | 0.5            | 0.0 - 2.8   | 1.6              | 0.3 - 4.5   | 0.5              | 0.0 - 2.8  |
| Central heating                          | 0.5            | 0.0 - 2.8   | 1.6              | 0.32 - 4.45 | 0                |            |
| Other                                    | 11.9           | 7.7 - 17.3  | 6.8              | 3.6 - 11.3  | 0                |            |

When asked which heater was used as the primary heater for their household (Table 6.8), 11.9% of the respondents gave “other” answers, most commonly that they did not use or have any heating, followed by the “*extra padding method*” as one respondent described adding additional clothing and blankets.

Reasons important for using the heater type identified as the primary heater were explored (Table 6.9), with more than one answer per respondent accepted. Most often respondents agreed that their primary heater was convenient, followed by the heater giving ‘instant heat’, and having no other choice. It was also important to many that the heater was cheap or easy to budget with, heated the whole house or was portable. “Other” reasons that were specified by respondents included that they were able to obtain cheap or free firewood, comments about thermostats, and comments about the way that they used heating in their house, typically describing heating only one part of the house, or not being able to afford heating for long periods or at all.

**Table 6.9: Agreement with commonly reported reasons for using primary heating type**

| Reasons for using primary heating type | % Agreed | 95% CI      |
|----------------------------------------|----------|-------------|
| It's cheap                             | 34.0     | 27.4 - 41.2 |
| It's easy to budget with               | 25.8     | 19.8 - 32.5 |
| It's convenient                        | 43.3     | 36.2 - 50.6 |
| I like the way it looks                | 7.7      | 4.4 - 12.4  |
| I can move it from room to room        | 22.7     | 17.0 - 29.2 |
| It heats the whole house               | 29.4     | 23.1 - 36.3 |
| It gives 'instant heat'                | 38.7     | 31.8 - 45.9 |
| I have no other choice                 | 37.1     | 30.3 - 44.3 |
| Other                                  | 15.0     | 10.3 - 20.8 |

Given the high rate of electric space heating use in New Zealand and in this group, I investigated the relationship between using electric space heating (heat pump, fixed, or portable electric heaters) on thermal comfort indicators, restricting grocery expenditure to afford electricity, and self-disconnection, using the chi squared test. No differences were identified between households that used electric space heating, and households that did not.

**Table 6.10: Electric space heating use during winter 2011 and thermal comfort, hardship, and self-disconnection**

| Outcome                                                           | Used electric space heating<br>Proportion (95% CI) | Did not use electric space heating<br>Proportion (95% CI) | Chi-square and<br>p-value  |
|-------------------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------|----------------------------|
| House was cold this winter                                        | 77.1 (68.0 - 84.6)                                 | 79.5 (69.2 - 87.6)                                        | $\chi^2=0.16$ ,<br>p=0.684 |
| House colder than preferred this winter                           | 72.2 (62.8 - 80.4)                                 | 66.7 (55.5 - 76.6)                                        | $\chi^2=0.69$ ,<br>p=0.406 |
| Shivered inside this winter on at least one occasion              | 69.4 (59.8 - 77.9)                                 | 67.5 (56.3 - 77.4)                                        | $\chi^2=0.08$ ,<br>p=0.771 |
| Saw breath condensing inside this winter on at least one occasion | 57.4 (47.5 - 66.9)                                 | 59.8 (48.3 - 70.4)                                        | $\chi^2=0.11$ ,<br>p=0.745 |
| Agreed prepayment encourages restricting heater use               | 51.4 (41.6 - 61.1)                                 | 64.3 (53.1 - 74.4)                                        | $\chi^2=3.82$ ,<br>p=0.282 |
| Restricted grocery spending to afford electricity                 | 45.5 (35.9 - 55.2)                                 | 54.2 (42.9 - 65.2)                                        | $\chi^2=1.45$ ,<br>p=0.228 |
| Self-disconnection event in past 12 months                        | 45.5 (35.9 - 55.2)                                 | 45.2 (34.3, 56.5)                                         | $\chi^2<0.01$ ,<br>p=0.976 |

## 6.5 Discussion

### 6.5.1 Review and synthesis

The present study sought to gather longitudinal information on the experience of consumers using prepayment metering to pay for electricity, particularly focusing on patterns of self-disconnection. Self-reported thermal comfort indicators and heating practices were also explored.

Respondents to the 2011 follow-up survey were similar in demographic profile to the nationwide survey undertaken in 2010. Māori and Pacific peoples were both over-represented among prepayment meter users in New Zealand. Household incomes were very low with over half under \$40,000, compared with the national median household income from regular sources of \$62,853 in 2011 (314). A high proportion were housed in rental accommodation; home ownership rates were less than half those of the general population (175). Rental housing in New Zealand is generally of poorer quality than owner-occupied housing (40), and those in rental sector accommodation experience poorer health and greater excess winter mortality (162). A high proportion of prepayment meter users were state housing tenants compared to the general population, although this may not offer relief from either unsafe indoor temperatures or fuel poverty. Many state houses are insufficiently insulated to bring indoor temperatures to World Health Organization recommended levels (66), without additional heating, despite an energy efficiency retrofitting programme being undertaken to improve the thermal quality of state housing (177).

As outlined in Chapter Two (see section 2.7.1) the poor quality of private rental housing (40, 41), and lack of regulation in this area pose a significant problem and contributes to fuel poverty (10). While only 6.7% of the respondents rated the condition of their housing as poor or very poor, tenants of typical low-income rental housing tend to overestimate housing condition (122). Tenants of private rental housing in New Zealand are more likely to report that their house is damp, too cold

in both the bedrooms and living room, and expensive to heat than landlords of private rental housing (176). Landlords were willing to pay more for a heating appliance than for any improvements to insulation (176), which is not an efficient or sensible approach and may not provide any benefit to a fuel poor household if they are unable to afford to use any heating at all. "Other" heating appliances were reported as the primary heating source by 11.9% of prepayment meter users, but when asked to specify the majority described using no heating, or wearing additional clothing as a "heating" method. This compares to just 2.3% of the general population who were using no heating according to Census 2006 data (9).

Few respondents had received government assistance for electricity costs, despite government figures stating that 37,443 hardship grants for electricity were made in 2011, the majority over the winter months just prior to the follow-up survey (47). This indicates that this particularly deprived group may not be receiving or applying for entitled benefits. However, the number of those receiving outside help to pay for electricity was only slightly decreased, but those receiving a grant or loan from friends or family increased, showing the burden of assistance shifting from the public to the private sphere, along with the burden of disconnection from an essential service (216). Changes were made to the welfare system, which came into effect during the mailing period of the first survey,<sup>36</sup> and included changes to the assistance available to households for expenses such as electricity. This may have reduced eligibility, or perceptions of eligibility, and encouraged fewer of the participants to seek Government assistance if private assistance could be obtained in the first instance. Access to a home telephone and home internet services were unaffordable for one in six respondents (18.2% and 17.1%, respectively), and bill stress, defined as the inability to pay any of their telephone, gas, or water bills by the

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<sup>36</sup> <http://www.msd.govt.nz/about-msd-and-our-work/newsroom/factsheets/future-focus/hardship-payments.html> - last accessed 25 November 2012.

due date due to constrained finances, was experienced by over one third. Almost half the respondents reported cutting back on grocery spending to afford electricity.

Although no temperature measurements were taken in this study, the majority of respondents reported poor thermal comfort levels, indicative of unhealthy indoor temperatures, with 78.3% reporting that their house was cold in the winter months. As hypothesised, prepayment metering was found to encourage restriction of space heating, 57.0% agreed that using their prepayment meter encouraged them to cut back on heating, while only 11.4% disagreed. Of note, more than two thirds (67.6%) reported shivering indoors on at least one occasion, and more than a third (38.7%) on four or more occasions. A previous Irish study that investigated both actual measured indoor temperature and self-reported thermal comfort, reported 56.6% of fuel poor household experienced shivering episodes indoors (64). More than half (57.2%) of the respondents reported being able to see their breath condensing indoors during the winter months on at least one occasion, and more than a quarter (27.8%) experienced this on four or more occasions. This was despite the majority of respondents (84.0%) reporting using heating when it was cold during the winter months, at least sometimes.

Most commonly, respondents used electric heating sources; however 42.3% reported using portable electric heaters, which are relatively inefficient and ineffective as compared to electric air-source heat pumps which were used by only 13.9%. Despite this, using electric space heating (including heat pumps, fixed, or portable electric heating) over the winter was not associated with thermal comfort indicators, self-disconnection, or restricting grocery spending to afford electricity. Unflued gas heaters were used by 22.7% of households, as is still common in New Zealand, despite health concerns around indoor emissions of nitrogen dioxide (317). As noted, a high proportion used no heating. These results, combined with what is known about the typically low indoor temperatures of New Zealand households (9,

177, 188), suggest that few households using prepayment metering will achieve thermal comfort, defined as indoor temperatures of 18-24°C as recommended by the World Health Organization for safeguarding health and avoiding physiological stress (66, 120).

The results indicate that high levels of satisfaction with prepayment metering generally are maintained, although self-disconnection remains a problem for prepayment meter users over time. Almost half (45.4%) the respondents had experienced at least one event in the past year. The severity of self-disconnection may have increased over the study period, as the frequency of self-disconnection increased slightly. Similarly, the duration of the last self-disconnection experienced by one third (33.0%) of households that self-disconnected increased in the past year, from 12 to 24 hours or more, although further statistical analysis would be required to confirm this. A small group of these households who were experiencing what could be argued as extreme fuel poverty were without electricity for days, with 13.0% disconnected for two or more days and 3% for a week.

Matched data analysis was performed to gather longitudinal information about patterns of self-disconnection among the 2011 respondents. Over a third (36.6%) reported having self-disconnected in the past 12 months in both the 2010 and 2011 surveys. This, together with the information discussed above regarding the frequency and duration of self-disconnections, further supports the evidence from the 2010 survey that, for a subset of prepayment metering consumers, the problematic consequences of self-disconnection are likely to pose health risks. For these consumers, the purported enhancement of budgetary control offered by prepayment metering alone, is not a suitable solution to previous problems with paying for electricity.



On the other hand the matched analysis also indicated that, for some consumers, self-disconnection is a transitory problem, and may have fewer harmful outcomes, with around a quarter of households (24.6%) reporting recent self-disconnection in only one of the two survey waves. Almost two out of five households (38.9%) reported not having self-disconnected recently in either survey, supporting the evidence that for some consumers, self-disconnection is unproblematic. However, caution must be taken in the interpretation of these results, as other results above have highlighted that self-rationing of electricity, particularly of space heating, but also self-rationing of other expenses in order to afford electricity, including restricting grocery spending, are also concerning outcomes of using prepayment metering.

### **6.5.2 Strengths and limitations**

This study provides the first coordinated collection of information about the self-reported thermal comfort levels and heating practices of households using prepayment metering in New Zealand. Although indoor temperatures were not measured, questions investigating self-reported thermal comfort have been shown to provide reasonable indications of inadequate indoor temperatures (64).

Limitations of this study include that the sample is limited to those who participated and consented to follow-up in the 2010 survey. Examination using 2010 data found there were few differences between the response groups that did not consent, consented and responded to follow-up, and consented and did not respond to follow-up. However, nothing can be discovered about the group that did not respond to the original 2010 survey.

Data analysis performed here included matched analysis of the two survey datasets to explore longitudinal patterns of self-disconnection, however as noted, further analysis could potentially explore connections between self-disconnection and self-

rationing outcomes. There is also the potential to compare responses to questions that provide indicators of thermal comfort with other datasets collected in other research undertaken by *He Kainga Oranga*, which could help to build up a picture of self-reported thermal comfort over a range of groups at risk of, or experiencing, fuel poverty.

### 6.5.3 Initial policy recommendations

The surveys have shown that the population using prepayment metering has low levels of home ownership, and experience marked material and financial hardship compared to the general population. Most of these households would be unable to finance energy efficiency measures to increase the thermal efficiency of their homes, or purchase more energy efficient heating devices, and these are unlikely to be prioritised within constrained household budgets, particularly if the household occupies a private rental dwelling. The present study has found that self-reported thermal comfort levels are inadequate, and therefore supports the following policy recommendations to improve the thermal performance of the housing stock, some of which have also been raised by other studies, for example, those recently summarised by the Children's Commissioners' Expert Advisory Group on Solutions to Child Poverty (184, 185), and are consistent with suggestions by leading experts in the field of fuel poverty research and policy (79, 81). It also supports the recommendation from the previous survey that self-disconnection statistics be regularly collected and reported to allow for monitoring. These recommendations are further discussed in Chapter Nine.

- That minimum household energy efficiency levels be set for dwellings, first focusing on improving the private rental stock;
- That a housing "*Warrant of Fitness*" rating scheme be developed and implemented, with a requirement to provide this information at point of sale or tenancy;

- That minimum requirements for the provision of energy efficient heating appliances be introduced for dwellings, first targeting the private rental stock;
- That minimum insulation and energy efficiency requirements for dwellings as set out in the Building Code continue to be revised and lifted at regular intervals to increase the thermal efficiency of the housing stock;
- That minimum insulation and energy efficiency requirements for new build dwellings approach the *passivhaus* standard increasingly used internationally;
- That mandatory reporting of self-disconnection is introduced, and rates are monitored and published in the same way in which disconnection for late or non-payment of post-payment customers statistics are published.

#### 6.5.4 Summation and direction

This study has provided quantitative data showing that prepayment metering encourages the restriction of space heating in already cold homes, and that consumers using prepayment to pay for electricity are unlikely to be achieving adequate indoor temperatures for safeguarding health. It provides further support for strengthening policy to improve the thermal efficiency of the housing stock. Patterns of self-disconnections among electricity prepayment meter consumers remained stable and problematic over the one year follow-up period. Mandatory reporting of self-disconnection would enable monitoring over time, and provide a basis for policy development to mitigate the disadvantages of prepayment metering as currently used in New Zealand.



## Chapter Seven:

### **Integrating the evidence to examine the outcomes for households with children using prepayment metering for electricity.**

#### 7.1 Overview

The integrative phase of the mixed methods research programme discussed in this chapter reports on analysis of the two survey datasets to explore the outcomes for households with children using prepayment metering for electricity. Together with Chapters Five, Six and Eight this chapter contributes to meeting the first, second and fourth overall thesis objectives identified in Chapter One (see section 1.6.3). In particular it begins to meet objective three, namely: To use a multiphase mixed methods research approach to provide a broad range of evidence, *with data from the research phases integrated to increase the value and function of the findings to specific sub-populations such as children* (emphasis added). The purpose of the research was to provide timely and relevant contributions to policy discussion on child poverty; particularly in response to the investigations of evidence to support policy by the *Children's Commissioner's Expert Advisory Group on Solutions for Child Poverty* (184, 185). A background links the literature discussed in Chapter Two and the survey findings which raised questions about the outcomes for children who live in households using prepayment metering, along with the opportunity for strategic research dissemination to contribute to policy discussion that provided the rationale for this research phase. As there was no further data collection undertaken for this analysis, the methods are discussed in brief, before the results comparing outcomes of households with and without children that use prepayment metering are outlined. A short discussion summarising the findings and highlighting the implications for future research and policy end the chapter.

### 7.1.1 Acknowledgements

The chapter is an expanded version of a paper, accepted for publication with the *New Zealand Medical Journal*, much of which is reported verbatim below, for which I undertook the majority of the work and was the lead author. I thank my co-authors for their useful contributions, and the two anonymous reviewers for their comments.

### 7.2 Background and rationale

As highlighted in the introductory chapters, limited research specifically explores the outcomes of fuel poverty for children (53, 118), and children have not been the focus of policy, even in the United Kingdom where policies to address fuel poverty have received priority (7). Negative outcomes of cold indoor temperatures and fuel poverty for children include: reduced calorific intake in winter (evidencing 'heat or eat' household budget restrictions) (51); increased risk of under-nutrition, overweight, or acute hospitalization (52); poorer health and development outcomes for children under three years of age (92); and risk of mental health problems and increased antisocial behavior among adolescents (74). As would be expected, despite the limited investigation of fuel poverty in New Zealand outlined in Chapter Two, there is some evidence to suggest that children are exposed to fuel poverty. For example, local research relating to fuel poverty and children found increasing home temperatures of asthmatic children reduces symptoms and days off work and school (77, 78). Of children under 15 years of age admitted to Wellington Hospital, 52% lived in housing that their parents stated was colder than they would like, 14.2% of households had been unable to pay their electricity bills by the due date, and 7.5% had had their electricity disconnected due to late or non-payment of bills (158) (around 4.2 times the national disconnection rate). A longitudinal study following families from the birth of a child in 2009-10 reported that at the survey wave undertaken when the babies were nine months old, 18% reported putting up

with feeling cold to save on heating costs, 11% reported using no heating in the house, 20% reported dampness, and 22% condensation in the room the baby slept in (313). No local research specifically focusing on the outcomes for and experiences of fuel poverty among children has been reported to date.

The previous two chapters described the investigation of the advantages and disadvantages of using prepayment metering to pay for electricity from a consumer's perspective using a nationwide postal survey and subsequent follow-up postal survey. The studies particularly focused on self-disconnection outcomes and patterns, and self-reported thermal comfort. Parents and caregivers responding to the 2010 survey commented on the negative impacts of electricity prepayment metering on their children, for example, one parent wrote: *"the kids get sick of me telling them to conserve power"*, indicating increased family tension (305). The consequences of self-disconnection were more problematic, with 15% of respondents to an open question asking for the worst thing about their last self-disconnection event mentioning their children, commonly stating: *"not being able to prepare baby's bottle"*, or *"can't cook my kids dinner"* (305). Although not a focus of the original study design, these comments indicated there are specific issues faced by families using prepayment metering which may increase hardship experienced by children in these households. Given that New Zealand has high rates of child poverty, and poor child health and wellbeing equity in general (318), households with children, who use prepayment metering to pay for electricity, may be particularly vulnerable to the disadvantages of using this payment method.

As described, one goal underpinning this thesis was to provide policy-relevant research, influenced by the literature investigating the effective translation of research to policy as outlined in Chapter Four. The purpose of the present research phase was to integrate the data from the two postal surveys, responding to the request for evidence from the *Children's Commissioners' Expert Advisory Group* during

their investigation into child poverty and policy solutions to address this problem. I proposed to explore whether the data that I had could provide any insights into the outcomes for children using prepayment metering, as these studies had already shown that this group experienced significant hardship compared to the general population, and just over half (54.3%) of prepayment meter users had reported at least one child under the age of 18 living at the address. The analysis I undertook and that is reported here was then developed into a paper for submission to the *New Zealand Medical Journal*, a publication that is often well-reported by the media. I then submitted the paper to the *Children's Commissioners' Expert Advisory Group* for consideration for inclusion in their *Working Paper on Housing Policy Recommendations to Address Child Poverty*, that my primary supervisor was a lead author on (184).

### 7.2.1 Aims

To investigate the outcomes of households with children that use prepayment metering to pay for electricity, as compared to households without children, and disseminate the findings to contribute to current policy discussions regarding child poverty.

### 7.2.2 Specific objectives

The specific objectives of the analysis were:

- To examine indicators of hardship in households with children using prepayment metering for electricity;
- To determine whether households with children are more likely to report self-disconnection in the past 12 months;
- To examine indicators of thermal comfort among households with children using prepayment metering for electricity.



### 7.3 Methods

As the survey methods have been fully described in the previous two chapters, only a brief summary is provided here. The initial survey undertaken in 2010 (Chapter Five), was a nationwide postal survey undertaken with the support of three major electricity retailers in New Zealand who provided an anonymised random sample to investigate the advantages and disadvantages of using prepayment metering from a consumer perspective (305).

The 2010 survey sample included a total number of 768 customers, calculated presuming a response rate of 50% (384); providing adequate study power assuming 50% frequency of self-disconnection in the population. The final response rate for the 2010 survey, which included a rigorous protocol of repeat mailings was 47.9%. Of the 359 respondents to the 2010 survey, 324 (90.2%) agreed to postal follow-up and were included in the 2011 sample. The 2011 survey (Chapter Six) achieved a response rate of 61.0% using a similar protocol. In both years ethics approval (Category B) was obtained and respondents were offered a \$20 supermarket voucher to thank them for completing the survey, sent on receipt of the survey form.

Survey data for both years were entered into a Microsoft Access database and analysed using Epi Info version 3.4 (Center for Disease Control, Atlanta, GA). The uncorrected chi-squared test was used for significance testing, with an alpha level of  $\leq 0.05$ .

### 7.4 Results

Households with children made up 54.3% of the respondents to the 2010 survey (n = 185 households with children), and 47.8% of the 2011 survey (n = 89 households with children). The 2010 survey found that most households with children using prepayment have one (39.3%) or two (31.4%) children living at home, with around

three in ten households reporting three or more (29.2%) children living at home. Comparison of responses to the 2010 survey found few socio-demographic differences between those who did not consent to postal follow-up, those who consented but did not respond to the 2011 survey, and those who consented and responded to the 2011 survey. Statistically significant differences were found between the groups for households with children (chi square = 9.53, p value = 0.009), who were over-represented in the group that consented, but did not take part in the 2011 survey.

The average expenditure per month on electricity differed in households with children (\$175.06 in 2011, and \$158.78 in 2010) and households without children (\$128.38 in 2011, and \$119.48 in 2010). For households with children, the median expenditure per month of \$160.00 in 2011 was unchanged from 2010, whereas in households without children, median expenditure rose to \$120.00 per month in 2011 from \$100.00 in 2010. As this analysis did not, however, control for household size, it is unclear to what extent the greater expenditure seen in households with children achieves additional energy services not related to those required by individuals (i.e. whether additional heating is achieved or whether the additional expenditure is used for personal hygiene, cooking, etc.).

Results from the 2010 survey found that households with children were significantly more likely to report that they first found out about using prepayment from family or friends (Table 7.1). Indicators of 'bill stress' were marginally significantly more common for households with children ( $p \leq 0.10$ ). These bill stresses included: starting prepayment metering because of debt accruing on the electricity account; being unable to pay any of the telephone, gas, or water bills in the past year; and having help from family or friends to pay for electricity in the past year. The likelihood of experiencing a self-disconnection event in the past year was also marginally

significantly higher among households with children, with 57.8% reporting an event compared with 47.4% of households without children.

**Table 7.1: Self-disconnection and bill stress in households with and without children in 2010**

| <b>Outcome</b>                                                                       | <b>Children<br/>Proportion (95% CI)</b> | <b>No Children<br/>Proportion (95% CI)</b> | <b>Significance<br/>Chi-square and p-value</b> |
|--------------------------------------------------------------------------------------|-----------------------------------------|--------------------------------------------|------------------------------------------------|
| Started using prepayment because debt had built up on the electricity account        | 26.5% (20.3-33.5)                       | 18.6% (12.8-25.6)                          | $\chi^2=2.99$ , p=0.084                        |
| First found out about using prepayment metering from family or friends               | 60.0% (52.6-67.1)                       | 45.5% (37.5-53.7)                          | $\chi^2=7.14$ , p=0.008                        |
| Self-disconnection event in past 12 months                                           | 57.8% (50.4-65.0)                       | 47.4% (39.5-55.6)                          | $\chi^2=3.68$ , p=0.055                        |
| Unable to pay any of telephone, gas, or water bills by due date in past 12 months    | 44.9% (37.6—52.3)                       | 35.3% (27.8-43.3)                          | $\chi^2= 6.64$ ,<br>Probability=0.084          |
| Had a grant or loan from family or friends to help pay electricity in past 12 months | 17.3% (12.1-23.5)                       | 10.9% (6.5-16.9)                           | $\chi^2=2.82$ , p=0.093                        |

Results significant at an alpha level of  $\leq 0.05$  are highlighted in this and all following tables.

Results from the 2011 follow-up survey similarly found trends that households with children were experiencing greater bill stress than childless households. Receiving help from family or friends over the past year to pay for electricity was marginally significantly more likely among households with children. The follow-up survey also investigated whether households using prepayment metering restrict grocery spending to afford electricity. Almost three of five households with children (56.8%) reported cutting back on groceries to pay for electricity, compared with two of five (41.2%) childless households ( $p \leq 0.05$ ).

When asked if they would be able to access \$500 in the next week for a family emergency, the trend was for households with children to report more difficulty in both survey years (Table 7.2). Households with children were statistically significantly more likely to report that the money would be unattainable. Households with children were four times as likely to report that they could use a money-lender in 2010, (16.2% compared to 3.8% of childless households,  $p \leq 0.01$ ) an

indicator of a precarious financial position. In 2011, the difference was reduced, but the absolute numbers increased with more households in both groups reporting they could use a money-lender. Even so, households with children remained over two and a half times more likely to report that they would use a money-lender (22.5% in households with children, 8.5% without children,  $p \leq 0.05$ ).

**Table 7.2: Options to access \$500 in the next week in case of family emergency for households with and without children**

| Options to access money in a family emergency | 2010 Survey results          |                                 |                                 | 2011 Follow-up survey results |                                 |                                 |
|-----------------------------------------------|------------------------------|---------------------------------|---------------------------------|-------------------------------|---------------------------------|---------------------------------|
|                                               | Children Proportion (95% CI) | No Children Proportion (95% CI) | Significance Chi-square p-value | Children Proportion (95% CI)  | No Children Proportion (95% CI) | Significance Chi-square p-value |
| Self-fund                                     | 28.6% (22.3-35.7)            | 35.3% (27.8-43.3)               | $\chi^2=1.71$<br>p=0.191        | 30.3% (21.0-41.0)             | 48.5% (38.2-58.8)               | $\chi^2=6.36$<br>p=0.012        |
| Family or friends                             | 33.5% (26.8-40.8)            | 23.7% (17.3-31.2)               | $\chi^2=3.94$<br>p=0.047        | 25.8% (17.1-36.2)             | 20.6% (13.1-30.0)               | $\chi^2=0.71$<br>p=0.399        |
| Work and Income                               | 16.8% (11.7-22.9)            | 15.4% (10.1-22.0)               | $\chi^2=0.12$<br>p=0.731        | 16.9% (9.8-26.3)              | 14.4% (8.1-23.0)                | $\chi^2=0.21$<br>p=0.649        |
| Bank                                          | 10.8% (6.7-16.2)             | 16.0% (10.6-22.7)               | $\chi^2=2.01$<br>p=0.156        | 14.6% (8.0-23.7)              | 18.6% (11.4-27.7)               | $\chi^2=0.52$<br>p=0.470        |
| Money-lender                                  | 16.2% (11.2-22.3)            | 3.8% (1.4-8.2)                  | $\chi^2=13.71$<br>p=0.000       | 22.5% (14.3-32.6)             | 8.2% (3.6-15.6)                 | $\chi^2=7.34$<br>p=0.007        |
| Not available                                 | 31.4% (24.7-38.6)            | 21.8% (15.6-29.1)               | $\chi^2=3.92$<br>p=0.048        | 36.0% (26.1-46.8)             | 22.7% (14.8-32.3)               | $\chi^2=3.97$<br>p=0.046        |

Indoor temperature data were not collected from participants in this study; however, the follow-up survey included questions to investigate self-rated thermal comfort. Similar indicators have been used in other studies as a proxy for objective measurements when assessing whether indoor temperatures are likely to fall within healthy ranges, and to indicate whether households suffer fuel poverty (64, 66, 84). There were no significant differences between the groups for four of the indicators, although at least two thirds of the respondents to the survey reported problems achieving thermal comfort overall (Table 7.3). However, households with children were statistically significantly ( $p \leq 0.01$ ) more likely to report being able to see their breath condensing inside their home on at least one occasion during the winter

months, with 71.3% of households with children reporting this problem, compared to just under half of childless households.

**Table 7.3: Indicators of thermal comfort in households with and without children in 2011**

| <b>Outcome</b>                                                    | <b>Children Proportion (95% CI)</b> | <b>No Children Proportion (95% CI)</b> | <b>Significance Chi-square and p-value</b> |
|-------------------------------------------------------------------|-------------------------------------|----------------------------------------|--------------------------------------------|
| House has been cold this winter                                   | 80.7% (70.9-88.3)                   | 75.0% (65.1-83.3)                      | $\chi^2=0.86$ , p=0.355                    |
| Used heating when cold this winter                                | 83.0% (73.4-90.1)                   | 85.6% (77.0-91.9)                      | $\chi^2=0.24$ , p=0.625                    |
| Had house colder than would have liked this winter                | 71.9% (61.4-80.9)                   | 67.4% (57.0-76.6)                      | $\chi^2=0.45$ , p=0.503                    |
| Shivered inside this winter on at least one occasion              | 70.5% (59.8-79.7)                   | 66.3% (55.9-75.7)                      | $\chi^2=0.36$ , p=0.548                    |
| Saw breath condensing inside this winter on at least one occasion | 71.3% (60.6-80.5)                   | 48.4% (38.0-58.9)                      | $\chi^2=9.82$ , p=0.002                    |

Reasons for having the house colder than they preferred over the winter months were not significantly different between households with and without children. There were also no significant differences in the heating types used as the main heating source. More households with children named “other” heating sources as the main heating source, most commonly these were specified as using no heating, or using additional blankets or clothes, though again the small difference (15.7% compared with 9.3% of childless households) was not significant. When asked what the reasons for using the heater type specified as the primary heating source were, the only significant difference between the groups was that households with children were less likely to identify convenience as a reason than households without children (34.8% compared to 49.5%,  $p \leq 0.05$ ).

## 7.5 Discussion

The results of this analysis suggest that, among prepayment consumers, households with children experience greater levels of hardship. This is in the context of

prepayment customers already experiencing financial hardship compared to the general population, with lower levels of home ownership, low household income, and high rates of bill stress, while paying 3-38% more per unit of electricity by using this payment method depending on regional pricing differences (47, 172, 305). Households with children were significantly more likely to report cutting back on grocery spending to afford electricity than childless households (56.8% and 41.2%, respectively), which has other flow-on effects on health and wellbeing (51, 52, 92, 319). Although only marginally significant, there was a trend for increased self-disconnection in the past year among households with children, with 57.8% reporting an event compared with 47.4% of households without children. The problems highlighted here are likely to affect a significant number of children. Based on the most recent national figure of prepayment metering consumers from 2008 (256), around 28,000 households using prepayment metering have at least one child under the age of 18. This translates to approximately 16,100 households with children experiencing at least one self-disconnection, while restricting grocery spending is an outcome for approximately 15,900 households with children.

As the surveys were not designed to look at households with children specifically, the samples are too small to be definitive; however households with children were significantly more likely to report being able to see their breath condensing indoors on at least one occasion during the winter months than childless households. Almost three quarters (71.3%) of households with children experienced this problem, compared to just under half (48.4%) of childless households. Although reasons for this are complicated, with several potential contributing factors including greater indoor humidity due to higher household occupancy and heating and behavioural practices, households experiencing this problem are unlikely to be achieving indoor temperatures adequate for safeguarding health. Despite there being no differences between the groups for the remaining indicators of poor thermal comfort used, more

than two thirds of study respondents overall reported problems achieving thermal comfort and, by inference, healthy indoor temperatures.

### **7.5.1 Implications for future research and policy**

Children living in households that use prepayment metering are likely to be living in fuel poverty, as well as experiencing the effects of general poverty, both factors which are harmful to child health and wellbeing (74, 77, 78, 318). As discussed, the literature highlights that children have generally been excluded from fuel poverty research and policy targeting, despite children also being identified as a group vulnerable to fuel poverty (7, 53, 72, 74). This is also true of the local situation where fuel poverty has received very little attention, and no research has been undertaken with children in fuel poverty. Further research that specifically focusses on both the experiences of and outcomes for children in fuel poor households is urgently needed to support policy that targets children.

An official definition of fuel poverty must be developed in order to allow measurement of the scale and depth of the problem in New Zealand and for targeting and monitoring of multi-sectoral policies required to address widespread fuel poverty. This study highlights the importance of retaining minimum standards for healthy home temperatures as part of a definition of fuel poverty, as the results suggest that although consumers using prepayment metering report sub-optimal thermal comfort levels across the board, the indoor environments of households with children are even less satisfactory.

This analysis supports the policy recommendations arising from the two surveys and broader policies to reduce fuel poverty which should include at minimum: extension of energy efficiency retrofitting of housing and heating appliances with specific targeting towards fuel poor households; improvements in the private rental housing stock which should include the introduction of a mandatory housing

'warrant of fitness' as suggested by the Office of the Children's Commissioner's Expert Advisory Group on Child Poverty (185); and protections for consumers using prepayment metering to pay for electricity, who are at particular risk of the effects of fuel poverty (305). Furthermore, targeting households with children who use prepayment metering may be justified as this analysis shows that within this already deprived population, households with children are especially vulnerable.



## Chapter Eight:

### A qualitative description of the influence of prepayment metering on electricity budgeting and consumption behaviour

#### 8.1 Outline

This chapter describes part of the qualitative component stemming from the project: *Metered Out: Household Management of Electricity Use*. The project was jointly developed with Helen Viggers, who led the study, and was funded by a University of Otago Research Grant in 2011. The study had a mixed methods design, with quantitative analysis led and completed by Helen Viggers, and a qualitative component which I led, with Professor Howden-Chapman also contributing to the project. The *Metered Out* study was complicated as the original design could not be carried out, due to recruitment strategies which did not work as anticipated. Despite this, the study yielded a large volume of rich data; one section of the qualitative data exploring the relationship between household budgeting and prepayment meter use, which is included here.

This chapter contributes towards meeting the first, second, third and fourth overall thesis objectives outlined in Chapter One (see section 1.6.3). It opens by describing the background and rationale for the *Metered Out* study development. The methods section outlines the original design of the study and the actual study methods that were eventually used, including reflection on these research methods. The remainder of the chapter turns to the analysis and discussion of this section of qualitative results from the *Metered Out* study.

## 8.2 Background and rationale

The purpose of the *Metered Out* study was to investigate how prepayment meters facilitate (or not) budgeting for electricity, and whether other in-home display devices, may be more appropriate budgeting aides for low-income households. The first postal survey showed that respondents expressed a high level of agreement with the statement; *“some people like the ability to budget with prepayment meters and say the benefits outweigh the risk of running out of credit”*. However, the surveys did not explain how prepayment meters enable household budgeting, or describe how householders interacted with prepayment meters. Reflecting on the concerning preliminary survey results that some especially constrained households experience frequent and long duration self-disconnections, we wondered whether another form of in-home display would allow households to gain greater awareness of the electricity consumption of their appliances and facilitate budgeting without the risks of problematic self-disconnections. These questions were supported by overseas literature indicating that prepayment meters were seen as a useful budgetary tool by the industry and consumers, though consumer advocates often disagree (110, 212, 215). As prepayment metering is a more expensive method of payment in New Zealand, has additional transactional costs, and also requires up-front payments (172), we wanted to better understand the relationship between household budgeting and prepayment meter use.

During the study development, we engaged with the New Zealand Federation of Family Budgeting Services, who indicated that they were interested in assisting us with recruitment for the study. The research was of importance to the organisation as they had suggested prepayment metering for households where other methods of payment (such as equalised budget billing) have proved inadequate. In contrast, Colton argued that unlike equalised budget billing, *“prepayment meters do not allow low income households to budget for seasonal high energy bills”* (110, p294). The New Zealand Federation of Family Budgeting Services also expressed some concerns

around the disadvantages of prepayment metering, particularly the risk of self-disconnection and pricing, and were therefore eager for research to contribute to understanding the interaction between budgeting and prepayment metering.

## 8.3 Methods

### 8.3.1 *Metered Out: Original design*

In this project, we planned to explore the decisions of households as they either switched from post to prepayment metering, or attempt to control their electricity use through other means. In particular, one method of control to be examined was the use of a plug-in in-home display device to monitor the cost of electricity use by individual appliances. Three interviews with the account holder in 20 households in the Wellington region struggling with electricity payment were planned over a six-month period. We envisaged recruiting ten households planning to move to prepayment metering in the immediate future, with the other ten intending to stay with conventional payment methods. We intended to monitor the indoor temperature and relative humidity in the living room and one bedroom to explore whether prepayment metering encouraged restriction of electric space heating and contributed to exposure to unhealthily cold indoor temperatures. The interviews were planned to be roughly three months apart and would span the winter heating season. At the middle interview the households were to be given an education module on household electricity consumption and a “cost-plug” in-home display unit to help them monitor and (if they chose) modify their energy use (see Appendix Four).

### *Aims*

The specific aims of the project were to:

- Compare households in budgeting difficulty, who were making the change to prepayment metering with those remaining on post-payment plans (including understanding of energy use, stresses about bill payment, health issues to do with the use of energy in their home, the actual amount of electricity used and household warmth achieved);
- Examine any additional learning that the households developed after using the “cost-plug” for three months.

### 8.3.2 Ethical considerations

Ethics approval (category B) for the study was obtained. Participants were offered (and accepted) \$25 vouchers for the supermarket of their choice at the completion of every interview, and the cost-plug meter given to them during the study was theirs to keep or pass on as they saw fit. Potential participants were contacted and had the study briefly explained via telephone, and interviews were undertaken at their homes at a time convenient to them. At the beginning of the first interview the study was fully explained, and an information sheet was given to the participants with any further questions answered, before a consent form was signed. Participants were welcome to withdraw from the study at any stage, with no disadvantage to them, although supermarket vouchers could not be supplied without completion of the interviews. Participants were also advised that the research was fully independent from their electricity companies. The results would be anonymised, although we commented that if they told other people that they were participating in the project, it may be possible for them to be identified by people who were familiar with them, as selected quotes would be included in the final papers. Results are presented here using pseudonyms.

### 8.3.3 Recruitment in action

We had planned to recruit 20 participants through the branches of the New Zealand Federation of Family Budgeting Services operating within the Greater Wellington region. Although the national office of the New Zealand Federation of Family Budgeting Services was aware that their budgeting clients do frequently move onto prepayment metering, in practice we were unable to follow this up by recruiting participants seeking budgeting advice and moving onto prepayment. Helen Viggers ran a workshop speaking with budget advisors from five of the local branches, during my maternity leave, and although they were receptive, no referrals were received. When I returned in July, no interviews had been scheduled and only one referral had been received. I resumed contacting the budget advisors, who had attended the workshop, however only one further referral was received. Neither person referred was able to be contacted despite numerous attempts and further contact with the budget advisors.

Due to the proposed design to have three waves of interviews beginning around the time of consumers moving onto prepayment metering, discussions were held with several other organisations offering budgeting advice within the region, including the Salvation Army, the Wellington City Mission, the office of the local Member of Parliament for Wellington Central, and Downtown Community Ministry. These services usually stated that their clients were not using prepayment and that they did not have any knowledge of their clients moving on to prepayment so could not assist with recruitment.

For these reasons, the decision was made to recruit prepayment meter users, who had indicated on their 2010 Prepayment Meter User Survey form that they could be contacted to discuss face-to-face follow-up, and who lived in the Greater Wellington region. Fourteen potential participants were identified in this way, and eight of these were recruited into the study. The remaining six chose not to take part, could

not take part until a later date outside the study timeframe, or could not be contacted. After speaking with the first six participants we identified that none of these participants had 'self-disconnected' due to financial reasons in the past year in contrast to the survey result that 52% of respondents had. We therefore widened the recruitment area in order to capture a broader range of experiences with using prepayment, in an effort to achieve maximum variation in the sample (105, 107). Along with this, we further redesigned the study with the new goal of having three groups of participants for comparison, prepayment consumers not experiencing self-disconnection, prepayment consumers having problems, and post-payment consumers having problems, aiming to have six participants in each group.

After further engagement, Downtown Community Ministry agreed to work with us to recruit participants, who were struggling with their electricity bills. However, they stated that they were unfamiliar with prepayment metering and that none of their clients used them to their knowledge, so they could not recruit participants going on to prepayment metering. We discussed having Downtown Community Ministry refer six participants, although unfortunately only two referrals were made, and only one of those could be contacted and took part in the study.

Thus far only nine participants had been recruited and interviewed in the Greater Wellington region. Purposive sampling was used to identify further potential participants who had consented to face-to-face follow-up, and who had returned a survey form in 2011 indicating that they had self-disconnected due to financial reasons. Eventually a further three participants were recruited, one in the Manawatu, and two in the Wairarapa, bringing the total sample number to 12.

#### **8.3.4 Final sample – reflection**

The recruitment process for this study could be viewed as flawed, in the sense that we were ultimately unable to answer some of the research questions we had

originally intended to answer. For example, how does using prepayment metering compare with using a cost-plug in-home display device in helping households having difficulty managing their household electricity? Is prepayment metering a fair and necessary motivator, through the threat of consequential self-disconnection, for households who have difficulty managing household electricity consumption? Reflecting on how we could answer those questions at the conclusion of the interviews, I felt that the original design would enable those questions to be answered more conclusively when including the quantitative data gathered (not reported in this thesis), or comparing the three groups we had subsequently aimed to recruit.

The participants sampled at the conclusion of the project did present a broad range of demographic and household characteristics. They also varied by the duration of prepayment meter use, the experience of self-disconnection, and the extent to which they reported interacting with their prepayment meters. We spoke with two participants who were not using prepayment metering; one (Haley) who was recruited through the 2010 survey, but had recently shifted house and was no longer using prepayment metering, and one (Susie) who was experiencing severe financial hardship and was using Downtown Community Ministry's budgeting service under a total money management model. This participant reported debt on her electricity account, rental arrears, and significant other financial problems including debt with Work and Income, and recent repossession of her vehicles, though during the course of the study her situation improved due to the budgeting assistance she was receiving.

On reflection the distinction between the three groups as envisaged was not as clear-cut as anticipated after the initial interviews, and even without recruitment problems the envisaged classification of these groups may not have been accurate representations of electricity consumers. For example, some participants, who on

face-value reported 'no problems' with prepayment metering revealed extreme self-rationing of electricity to avoid self-disconnection over the subsequent interviews. Transcription and coding in the initial stages of analysis also highlighted that the distinction between 'no problems' and 'problems' was unclear for some of the prepayment consumers. Emma, for instance, reported significant problems, although she was achieving what could be argued as a higher standard of living than some of the other participants. Her home was larger, warmer, and she was materially better off than others, though following the unexpected death of her husband she had found herself experiencing a rapid decrease in income and was now somewhat trapped in a home she could not easily afford to run or maintain. In contrast, Fiona reported no problems with budgeting and being comfortable with the level of heating used, yet the house was very cold. Susie was the only participant that we were able to recruit through the several community agencies we contacted; all others were recruited through the surveys. I have therefore refrained from making use of these previously clearly defined groups in the following final analysis.

It should also be noted that all participants using prepayment metering in this study were customers of Genesis Energy, using *Incharge Prepower*, as no other retailers were offering prepayment metering in their areas, at the time of the study. While it is not the focus of this thesis to critique any one company, there are striking differences between the prepayment metering services offered between electricity retailers due to the lack of any regulation in this area.

### 8.3.5 Interviews

Although the original study design had planned to capture those who were moving onto prepayment in order to learn how the participants used prepayment to assist with budgeting and identify any issues with 'self-disconnection', none of the participants recruited into the study were new to prepayment. Emma, who was the



newest to prepayment metering, had used it for over a year. The interview schedules for the three participants in the Manawatu and Wairarapa were combined so that only two interviews were held with these participants. Interviews were structured in two sections, with a short answer component gathering data for quantitative analysis, interview schedules, and a semi-structured qualitative interview section to follow (see Appendix Four). The questions prompted participants to discuss how they first found the move on to prepayment, whether they had ever 'self-disconnected' while becoming acquainted with the device, and whether they had used their prepayment meter to discover how much electricity different appliances used. We also asked information about housing histories, heating practices, and asked participants to discuss their ideas about healthy homes. The semi-structured interview approach, which largely predetermined the interview topics, was informed by the knowledge gained from the surveys. This is consistent with the qualitative descriptive method as described by Neergaard and colleagues (107), although more structured than is usual in other qualitative methods. Where participants raised differing views or topics, we investigated these further, both at the time and in subsequent interviews, and amended the interview schedules as required.

Due to the time taken to recruit participants, the time between interviews was shorter than originally planned; while we aimed for six to eight weeks, for some participants the time between interviews two and three was just under three weeks in order to complete all data collection in 2011. I undertook the majority of the initial interviews with Helen Viggers, which allowed for discussion of the data following each interview and helped to inform the questionnaire development for the second and third interviews. The majority of the final interviews were undertaken alone. Where interviews were jointly completed, Helen Viggers lead the short answer section and I lead the qualitative component, with some crossover to elicit further discussion.

Demographic profiles and household characteristics, completed using both information from the surveys and interviews, are displayed in Table 8.1 below. The following abbreviations for some of the income sources of the respondents are used in the table: Working for Families Tax Credits –tax breaks available to some employed parents (WFF); New Zealand superannuation – a universally provided state benefit for those over 65 (NZ Super); Government superannuation scheme – a retirement scheme for former Government employees (Govt Super). Also received by some participants were the state-welfare benefits: Accommodation Supplement (AS); Disability Allowance (DA); Unemployment Benefit (UB); Invalid’s Benefit (IB).

**Table 8.1: Metered Out: Participant demographic profiles and household characteristics**

| Pseudonym | Gender | Age | Ethnicity            | Employment                              | Household income    | Home ownership            | Household occupancy / relationships                             | Payment method                | Years using payment method          | Interview details                                         |
|-----------|--------|-----|----------------------|-----------------------------------------|---------------------|---------------------------|-----------------------------------------------------------------|-------------------------------|-------------------------------------|-----------------------------------------------------------|
| Emma      | Female | 56  | NZ European<br>Māori | Part-time (WFF)                         | \$20,000 - \$40,000 | Owner-occupier            | Participant, Adult child<br>2 Children, Boarder                 | PPM                           | 1                                   | 1. KO/HV 2/8/11<br>2. KO/HV 20/9/11<br>3. KO/HV 8/12/11   |
| Brian     | Male   | 76  | NZ European          | Retired (NZ super)                      | ≤\$20,000           | HNZC                      | Participant                                                     | PPM                           | 15                                  | 1. KO/HV 9/8/11<br>2. KO 20/9/11<br>3. KO/HV 9/12/11      |
| Margaret  | Female | 79  | Dutch                | Retired (NZ super + Govt super)         | \$20,000 - \$40,000 | Owner-occupier (freehold) | Participant, Husband                                            | PPM                           | 10 (estimated)                      | 1. KO/HV 9/8/11<br>2. KO 30/11/11<br>3. KO 14/12/11       |
| Fiona     | Female | 66  | NZ European          | Retired (NZ super)                      | Unsure              | HNZC                      | Participant, Husband                                            | PPM                           | 10 (estimated)                      | 1. KO 8/11/11                                             |
| Haley     | Female | 33  | NZ European          | Parent (husband full-time) (WFF)        | \$40,000 - \$60,000 | Private rental            | Participant, Husband<br>3 Children                              | Direct debit                  | Began during study (used PPM 2 yrs) | 1. KO 8/11/11<br>2. KO 6/10/11<br>3. KO 15/12/11          |
| Niranjan  | Male   | 56  | Sri Lankan<br>Tamil  | Full-time                               | \$60,000 - \$80,000 | Owner-occupier            | Participant, Wife<br>Wife's parents,<br>2 Children (1 disabled) | PPM                           | 5                                   | 1. KO/HV 21/8/11<br>2. KO/HV 2/10/11<br>3. KO/HV 17/12/11 |
| Dylan     | Male   | 48  | NZ European          | Full-time (WFF)                         | \$40,000 - \$60,000 | Owner-occupier            | Participant, Child (50% custody), Boarder                       | PPM                           | 3yrs                                | 1. KO/HV 23/8/11<br>2. KO/HV 4/10/11<br>3. KO 14/12/11    |
| Regan     | Male   | 65  | Australian           | NZ Super, AS, DA                        | \$20,000 - \$40,000 | Owner-occupier            | Participant, Wife<br>2 Children, (Teenage daughter, Grandson)   | PPM                           | 14                                  | 1. KO/HV 8/9/11<br>2. KO 30/11/11<br>3. KO 14/12/11       |
| Erin      | Female |     | Māori                | Part-time (two jobs – one seasonal, UB) |                     | Private rental            | Participant, 2 Children                                         | Budgeting agency direct debit | Began during study                  | 1. KO/HV 29/9/11<br>2. KO 1/12/11<br>3. KO/HV 22/12/11    |
| Susie     | Female | 67  | Māori                | Retired (NZ super, DA)                  | ≤\$20,000           | Private rental            | Participant                                                     | PPM                           | 15 (estimated)                      | 1. KO 11/10/11<br>2. KO 29/11/11                          |
| Melissa   | Female | 27  | NZ European          | Part-time (WFF, AS, UB)                 | ≤\$20,000           | HNZC                      | Participant, Partner, Child                                     | PPM                           | 11                                  | 1. KO/HV 2/11/11<br>2. KO 12/12/11                        |
| Grace     | Female | 53  | NZ European          | No (student, IB)                        | \$20,000 - \$40,000 | Private rental            | Participant, Adult Child, Boarder                               | PPM                           | 11                                  | 1. KO/HV 2/11/11<br>2. KO 12/12/11                        |

### 8.3.6 Analysis

Separate from the Metered Out project, the aims of the analysis undertaken for this chapter are:

- To further explore the relationship between household budgeting and prepayment meter use; and
- To contribute deeper understanding of the advantages and disadvantages of using prepayment metering from a consumer perspective highlighted by the postal surveys.

As outlined in Chapter Four, the methodological approach used for the qualitative component of this study was qualitative description as described by Sandelowski (105, 106). Through this approach the analysis provided below is a qualitative content analysis, designed to remain “*data-near*”, grouping data topically to allow comparison between the experiences of participants with different circumstances (105). I used counting to summarise and provide an indication of the extent to which the results presented were experienced across the demographic range of participants sampled in “*quasi-statistical*” style, however these frequency counts are not intended as stand-alone results and should be read in conjunction with the content analysis as displayed (105, 107). For this reason, I have often listed the anonymised names of participants who presented these views, as opposed to providing numerical counts, so that readers can choose to match views with the demographic profiles of participants in Table 8.1 for further context.

I have taken a “*factist*” view of the information provided by participants during the interviews, where accounts are presumed true and accurate (304), even though in some cases the opportunity to contrast differing answers given in survey responses existed. This was perhaps due to their embarrassment about discussing sensitive information face-to-face where participants reported greater hardship in their survey

responses, or greater recall with prompting in interviews when asked about self-disconnection, for example. For others rapport achieved over the course of the interviews may have encouraged greater disclosure of hardship in interviews. However, I do not believe that interrogation of truth and fact in that sense is particularly helpful in achieving the aim of exploring the ways in which interactions with prepayment metering technologies assists participants with household budgeting. This analysis is driven by naturalist and pragmatist theoretical underpinnings; this study does not seek to interpretively transform the data, in the manner of Foucauldian discourse analysis, for example (106, 320). Rather, my goal was to display the informational content of the data, and interpret from this information where policy solutions to reduce the disadvantages of using prepayment metering may be useful to minimise the contribution of prepayment metering to fuel poverty in New Zealand.

Analysis of the data presented here was undertaken by me, with stakeholder checking (321) through discussion with Helen Viggers, and also with my supervisors. Transcription of the interviews was completed some-time after the interviews had taken place; following a period away from the interview data and subsequently to analysis of the survey data. However, this allowed a synthesis of ideas from both projects to inform the concepts built into the analysis of the interviews. Discussion during the short answer section was also transcribed and contributed to the qualitative data. I view transcription of qualitative data as a useful first stage in the coding process, allowing thorough knowledge of the breadth of the data to be gained. As noted, only one section of data from this project is discussed in this thesis. For this analysis, all three interviews were assessed and sections where participants discussed prepayment metering or budgeting were selected for inclusion. Initial codes were developed, and then discussed with Helen Viggers; after completing the analysis the results were discussed with my supervisors.

## 8.5 Results

Much of what was discussed by the participants in relation to prepayment metering and budgeting can be organised into three broad categories: **prepayment metering in general**; **budgeting**; and their **sociotechnical interactions** with the prepayment meter. While the codes used to identify these themes arose from the data, I acknowledge that the semi-structured nature of the interviews shaped the discussion, and furthermore, as described, the interview schedules were informed by the results of the surveys. These three themes discussed in detail below are tightly inter-related and influence each other, rather than having a clear linear or hierarchical structure.

### 8.5.1 Prepayment metering in general

#### *Prepayment as a payment method*

Overall prepayment metering was seen as a useful payment method, with Brian, Fiona, Dylan, Regan, Susie, Melissa, and Grace saying that they would like to continue using prepayment meters for electricity. Fiona, Susie, Melissa, and Grace had used prepayment metering in previous dwellings and had them installed when moving into their current properties, Melissa noting that:

*Melissa: "I actually got it shifted from my old place to here, I was willing to pay, it was a hundred dollars, but I was happy to pay it because I didn't want to lose it."*

Brian was emphatic about retaining his prepayment meter, saying: *"I'd fight you tooth and nail for that one!... I won't get rid of it I'm telling you!"*

Niranjan also wanted to continue using prepayment metering though this was due to his difficulties with other household members using what he felt was excessive

and/or unaffordable electricity. He felt he would ultimately prefer to go back to post-payment, because he resented paying higher rates on prepayment metering, and said: *“this is something ah, I would say, something I don’t want but there is no other choice for our situation”*. Similarly, Emma found prepayment metering simultaneously *“helpful”* for budgeting, but *“inconvenient”* in other respects:

*Emma: “It’s inconvenient, I do have more of an idea of what I’m using, but it’s still inconvenient. You know not just, it’s inconvenient um to have to keep an eye on your meter, it’s also inconvenient to have to go and buy, power.”*

#### Recommending prepayment metering

Some people described having recommended prepayment metering to others, which is consistent with the survey results that over half (52%) of respondents discovered prepayment metering through family and friends. For example, Brian, living in a state-housing block, told us:

*Brian: “And I must say that since I’ve had mine in there all the tenants around have changed. Because they’re all getting big bills and they say how much did you pay this month, and I said well I think \$25 this month, and OH! (Laughter) Yeah. We’ve discussed it, but a lot of them have changed.”*

Similarly, after she started using prepayment, Susie said she found that *“going on that [prepayment] you can budget it, and I told everybody ‘go on it, it’s fabulous!’”*

Melissa felt that prepayment metering was good for everyone, having been a beneficiary and solo-parent when she commenced prepayment metering, but she highlighted that even those without financial constraints could reduce their consumption using prepayment metering.

*Melissa: "I think even if you're quite well off and what-not, I still think that they're a good idea. Because in the long run I think they do in a way urge you to be more careful with what you use, because you can actually see, what amount of money you're using. So if you think, if you use, if they use say \$100 a week they could look at it and go 'woah! that's a lot of money so what can we turn off that we don't need', or, so, it does, I reckon it's a good incentive."*

For most the feeling was that prepayment would be useful for those who needed help budgeting, however Emma, Haley, and Grace expressed some reservations about access to outlets for purchasing credit, particularly for elderly or those with children. Margaret and Dylan were concerned that if people did not have money available when they required credit, they would self-disconnect. Dylan explained that he would:

*Dylan: "maybe suggest prepaid... But you'd have to weigh it up because, being prepaid you've gotta have the money there, there's no, there's nothing on tick. So if you're bad at budgeting or you think you're gonna get away with it for another week and you run out of it then that's your fault. It just depends on your circumstances. Like it suits me perfectly. Whereas it might not suit other people because they'd run out too much."*

Regan again highlighted the stigma around using prepayment metering and said that he:

*Regan: "...wouldn't suggest they change to one of these... No, most people don't like them. Most people shudder at the thought of having 'em."*

Niranjan preferred not to recommend prepayment metering, and instead suggested that those having difficulty with electricity bills use an equalised or smoothed billing arrangement, saying of prepayment metering: *"So this is a last resort I would say."*



### *System complaints*

As expected from the survey results, most participants expressed satisfaction with prepayment meter use generally; however there were a number of **system complaints** identified.

#### *Contact with electricity companies*

For prepayment meter customers there was limited contact with electricity companies, unless they had a particular problem and approached the company. For example, Niranjana and Dylan talked about contacting the company to arrange credit when crediting services were unavailable due to system failures, and receiving varying responses on different occasions. Melissa had received a bill in error despite having been using prepayment for some time. During the study period, the electricity company had written to prepayment consumers and included a meter menu sticker, detailing the directions for accessing information through their in-home display, and Brian, and Niranjana commented that this was helpful. Most would receive an annual letter from the company shown to us by one participant that identified the availability of low-user tariffs (although it appears these are not offered by the company to prepayment consumers), and suggested that savings could be made if they were using under the low-user threshold, and that for further information they should call the company. The other reasons the electricity company would contact participants were to inform them of tariff increases, or discuss having meter readers come to the property.

#### *Pricing structures*

It was difficult for the participants to compare prices between prepayment metering and other payment methods. This was especially true for long-time prepayment meter consumers, who had not received any written summaries of usage information for several years, or information comparing equivalent post-payment pricing. While some were under the false impression that pricing was cheaper than post-payment, others (Niranjana, Regan) were aware that it was more expensive, and

commented that they felt this was unfair, particularly with regards to losing the prompt payment discount despite paying in advance. There was some media coverage concerning this prior to the study commencing (47, 261), however this media was not raised during the interviews.

Regan commented on broader market implications of prepayment meter pricing:

*Regan: "...it should be cheaper if anything. Even if it's not much... And they rave on about it being, you know cost-efficient and all that kind of rubbish themselves you know saving power so we don't run out in winter, I thought well all the money you get they should be able to keep up the power to people! ... Especially on prepaid meters, where people could take more care with it, and you could get it a little bit cheaper as well. You wouldn't have to worry about them running out of power in the winter and, having the power blackouts would we?!"*

For those who were aware of paying higher prices the general feeling was that, like the risk of self-disconnection, was a small disadvantage compared with the overall benefits that prepayment metering offers. Brian highlighted this while discussing large electricity bills received by his neighbours:

*Brian: "...alright well my kilowatt costings might be slightly higher than their kilowatt costings and that's probably taking in the lines charges and all that but you don't see that. So subconsciously you're getting cheaper power, well that's me anyway."*

#### Access to outlets for purchasing credit

It appears from both the survey and interview results that many people using prepayment metering may have limited access to outlets to purchase electricity. As noted by Emma and Haley, other options for purchasing credit such as telephone payments or internet payments are limited or unavailable; the company the

participants were with did not allow credit card payment for prepayment metering. Survey respondents from several smaller communities (for example in Wainuiomata, Hastings, and some Taranaki region settlements) commonly reported there were only one or two outlets that they are able to purchase electricity from. The hours that self-disconnection may occur are not aligned with the opening hours of outlets and some participants reported having to travel further afield to the next township in order to purchase electricity if they were running low on credit or had self-disconnected. Outlet access was considered enough of a barrier that some of the interview study participants would not recommend prepayment metering, either at all, or to those who may have mobility problems or limited transport. For example, when asked if she would recommend a prepayment meter, Haley, who was no longer using prepayment at her new address, said:

*Haley: "I'm just thinking of when I had it and I had to go all the way down to the one shop, it's quite a way to go, and then worrying about paying it, you know worrying about paying for petrol in the car doing that extra trip that's not really needed."*

#### "System down"

Survey results indicated that some prepayment meter users experienced problems purchasing credit from outlets because of system outages with their electronic payment technologies. Similar difficulties were shared by Emma, Nirranjan, Dylan, Melissa who had problems ranging from long delays at the stores, having to go to other stores, having to make another trip back to the outlet to try again, or seek emergency credit from their electricity company to avoid self-disconnection when problems could not be resolved.

#### Switching impossible

Emma described not being able to switch between companies, or back to post-payment billing from prepayment metering if she decided she wanted to, due to the

prohibitive cost of having the meter changed and also the cash bond that would be required by the most companies before post-payment billing commenced.

*Interviewer: "Right, so the options for you to switch now are very limited?"*

*Emma: "They're very, no they're more than limited. Obviously, you know, unless I um, want to, um save up another two hundred and fifty dollars, ... and give it to them to sit on, and then have my meter removed, and all of that, it's... You know."*

Regan described similar barriers to switching, which they had considered when they first moved into the house and began to use prepayment metering and again more recently when considering listing their property for sale.

*Regan: "No, a couple of times we've thought about it, ah, but it was with a different company. And one didn't want to know about it, and the other one was going to charge some ungodly amount... But I've got no intention of paying anything to change it..."*

#### Location and physical traits of the meter

The location of the prepayment meter and in-home display units varied for the participants, but overall it seemed there was a tendency for these to be installed close to the original meter boxes. For some participants that meant that the in-home display was actually outside (Dylan, Melissa, Grace), or up high enough that they needed to climb on a chair to use the in-home display (Margaret, Niranjana, Regan, Melissa). In all, it appears that a lack of consideration for the functionality and intended use of the in-home display may occur when prepayment metering installations take place, which in some cases restricted the potential benefits of using prepayment metering (for example feedback). The cost of shifting the meter to a preferred location was described by Margaret as *"so expensive that we just left it"*.

Emma, Margaret, and Susie commented on their meter's warning alarms as the credit level dropped. While Margaret and Susie found these helpful, for Emma the "horrific noise" of the repeating alarm when the credit level dropped below \$10 was a stressor, particularly when she was aware of her credit balance and intended to credit her meter the following day.

*Emma: "I don't really want the alarm to go off. I mean I'm an intelligent person I go and I look at it, surely I should have a choice as to whether or not it's on and I don't. So I resent that because it does wake the children up, so."*

Regan discussed the stigma associated with prepayment meters, noting that his wife was "horrified" when they moved into the house with the previously installed prepayment meter "Because all the bad people have prepays. That's why they put them in the Housing Corp". Margaret also commented that she didn't like the look of the prepayment meter "hanging there" in the hallway, and remarked "I know somebody and they've boxed it in, but I don't like that either!" Feelings of stigma were not restricted to within the home, Regan describing his wife's original reservations about purchasing credit at a shop, although she had grown used to it and appreciated the benefits of prepayment over time. This was also the reason that they considered removing the meter when thinking of selling their house. He agreed when asked if prepayment meters were used more widely that more people would appreciate them and would be less likely to stigmatise their use.

#### Meter readers

As was noted by some of the survey participants, the electricity company had recently resumed obtaining regular meter readings carried out in person by a meter reader. There was some frustration expressed about this by Margaret, Niranjan, and Regan, given that electricity was being paid for in advance. In particular, for Margaret the reason that they had initially begun using prepayment metering was to avoid the need to provide access for meter readers, which is why they had

investigated shifting their meter from its current indoor location to outside. However, she commented that she had read a newspaper article describing people “*by-passing the meter*” and wondered whether it was because of this.

### *Self-disconnection*

Self-disconnection had been experienced by Margaret, Niranjana, Dylan, Susie, Melissa, and Grace.

#### *Outcomes of self-disconnection*

For four of the participants (Margaret, Niranjana, Dylan, Melissa) the reason for self-disconnecting was forgetting to check the meter. However, Susie and Grace experienced self-disconnection for financial reasons and both had been without electricity for at least 12 hours at least once in the past year. The duration of self-disconnection was tied to the reason for self-disconnection, with those who ran out due to forgetfulness usually able to credit their meter fairly quickly, they also reported self-disconnection occurring less frequently. Similarly, the consequences of self-disconnection were less severe, although inconvenient, for those who were financially able to reconnect shortly after being disconnected. Dylan illustrated the inconvenience of self-disconnection, having to make an extra trip to the outlet and then back home during his lunch break, before returning to work:

*Dylan: “I’d left at six o’clock in the morning and my boy rang me up at eight o’clock saying ‘the shower’s cold, there’s no hot water’... and there were no lights or anything, no power. So I said, ‘oh well, not much I can do about it’. And they couldn’t get power because I’ve got the card. So I just, at lunch, I shot out at lunchtime from work and, got it, put it on.”*

## System factors influencing self-disconnection

### *Disconnection hours*

For some participants, the time that self-disconnections came into effect was problematic. If participants ran out between the hours of 8am and 4pm they were disconnected, or if they had run out of credit after 4pm disconnection occurred at 8am the following working day, ie during the weekends, and on public holidays disconnections were not supposed to occur. However, Susie and Grace noted that the daylight savings cycle affected the disconnection hours, in one cycle they were disconnected at 9am, and in the other 8am. Grace also commented that she had once been disconnected during a public holiday weekend when she had put off purchasing credit thinking she could do it later that day. Disconnections occurring at 8am meant that participants had to wait for their outlets to open, often up to two hours later, before they could purchase credit, which could be an inconvenience or require an extra trip to purchase credit. This also meant that they had to be organised if the household wanted to have breakfast and showers before the disconnection time.

### *Minimum credit amount*

After experiencing self-disconnection, as a result of financial constraints, Susie and Grace commented that the \$20 minimum credit amount was difficult to raise, and that a \$10 amount would have been more affordable. This is consistent with the survey findings, indicating that for those experiencing severe fuel poverty, prepayment metering does not provide relief when there is limited discretionary use of electricity and household budgets are constrained.

### *Emergency credit*

Susie and Grace also discussed the removal of emergency credit which used to be provided by their electricity company and is no longer available, unless as Susie explained with a reference to the late Mrs Muliaga, the situation is life-threatening.

*Susie: "When I first started on it there was a \$5 emergency power and when you put your \$20 or your \$25 that deducts off straight away, on the machine, but they don't seem to do that, they said 'is it life-threatening?' I was like 'oh no!' I don't want to go down that track like that one up in Auckland. I said to her 'I'm just diabetic and I've had my tea'..."*

Since emergency credit is no longer an option, Susie described that if she knew she would self-disconnect at 8am before the shop opened on the day her income payment would allow her to purchase credit, she would get up earlier to make sure she had eaten so as not to affect her diabetes.

It is unclear whether providing emergency credit would reduce the duration or frequency of self-disconnections as a result of financial constraints, as it does not address the underlying contributing factors to fuel poverty such as income poverty, electricity prices, and household and appliance energy efficiency. However, it is possible that a small amount of credit could buffer a small shortfall, if the balance could be made up over the next crediting period. A small number (2%) of survey respondents reported difficulty clearing emergency credit advances, resulting in periods of self-disconnection after using emergency credit.

### **8.5.2 Budgeting**

Participants were asked about their general household budgeting strategies, as well as being asked to describe how they budgeted for their electricity. While some had structured budgets, allocating and paying a set amount for different expenses, for example Dylan who described using a spreadsheet and paying set amounts on his bills fortnightly as he was paid, others, like Haley, explained that they had a "rough figure" in mind and would redistribute their finances as required. Three key codes



were highlighted within the theme of budgeting: prioritising expenses; bill stress; and payment routines.

### *Prioritising expenses*

With the exception of Margaret, who was from the most affluent household in the study, participants described prioritising household expenses when budgeting to varying degrees. Most agreed that housing costs, either mortgage or rental payments should be covered first, followed by electricity, and other expenses.

Niranjan explained that when budgeting his household expenses, priority was determined on a scale of requirement versus luxury, describing paying “*musts*” including the mortgage and electricity first, then working out other “*needs*”, and finally “*wants*” including holidays and “*special activities*”. This explanation provides a useful depiction of the management of household budgets which was similar for many of the other participants.

Some participants talked about needing to factor in possible healthcare spending when choosing what to prioritise, for example, Emma had a child with asthma:

*Emma: “I don’t take the children, as I say, my four-year-old has asthma and you know going to the after-hours costs \$15 and our GP costs \$12, so I mean um I have to cut back on electricity to take her. Or I cut back on food.”*

### *Needing electricity*

Electricity was considered very important to the participants, ranked by most after only housing costs. Electricity was agreed by participants across the spectrum to be essential to maintain a normal lifestyle, for example:

*Brian: “Yeah, it’s part of life, you know. Yeah. Otherwise I’d be starving, filthy, dirty!”*

*Margaret: "Oh! Well, look, the few times we've had a power cut you're absolutely stuck! Because you can't use anything. (Laughter) So it is quite important."*

*Susie: "Otherwise I've got nothing"*

While some participants commented on the high cost of using electric space heating, discussed further below, others who used electric heating and especially needed to be warm to stay well, felt that electricity was essential.

*Fiona: "Oh well it's an essential really isn't it, keep warm. Because my husband is not a well man at all. Keep him as comfortable as possible."*

Emma also highlighted that electricity is important to maintain a safe environment, raising the use of candles as an example, consistent with media stories of candle fires in households unable to afford electricity bills or prepayment credit.

*Emma: "Well um, using candles is all very romantic and very nice (laughter) but I have two children for whom it's actually a danger to um not make sure that you have electricity, so it's obviously very important."*

Participants usually agreed that older people, babies or young children, and those with an illness might need to use more electricity than other people. Erin discussed the case of Mrs Muliaga in relation to whether some people might have a special need for electricity:

*Erin: "I mean like that lady that needed it for her machine and they cut the power off. You know that's wrong! That they, yeah, like, I say it's good now that they get you to tell them if you need it for those reasons. Yeah. But um, yeah I think if you've gotta use it, if I had to use power, to keep one of my kids alive or something, oh darn yeah! I'd use it! And I'd make that my priority to pay. Because I need that."*

Haley also described her reaction to the question by her electricity company regarding whether anybody in the house is medically reliant on electricity for health and safety, saying of electricity:

*Haley: "Um, it's yeah, very important. Yeah, um, I mean we just switched power companies recently, they came door-knocking, so I said 'yeah, ok'. And um one of the questions they ask is do you depend on electricity, is there anyone who needs it for life purposes and I say 'yes, me, I do'. I suppose we could live without it."*

This question was brought about after changes to the disconnection guidelines by the Electricity Authority after the death of Mrs Muliaga. Her case was directly commented on, unprompted, by three of the participants (Niranjan, Erin, Susie).

#### Cutting back on food

In several other overseas studies and the follow-up postal survey, participants commonly described restricting grocery spending in order to pay for electricity. The extent to which participants cut back on food costs varied. For example, when asked if she ever had to choose between paying for electricity and other things, Haley described managing her monthly electricity payments as follows:

*Haley: "Yeah. Or just like move the budget around, so that I can get the bill paid, I always try to take advantage of the prompt payment discount, because I'd hate to pay more if I didn't have to. Yeah, um, so if that means spending a bit less at the supermarket that week."*

For Susie and Brian, both single pensioners, the rationing of grocery expenditure was more prominent and regular, and Susie justified the small luxury of having a pet by explaining that she did not buy special food for her cat:

*Brian: "Well there's quite a few weeks where I don't buy food at all. Boy I get sick of baked beans and spaghetti though yeah! ... I never go hungry even though I don't buy food. I've been to WINZ and had a couple of food packages you know?"*

*Susie: "I usually cut back on fruit and stuff. Yeah and it's the little things like, and I hate margie, but now and again I use it, because... Because the butter is so expensive. And, I watch my meats. You know, what I buy for my meats and stuff like that. ... And my cat's not expensive to keep, so. He eats what I eat, and yep."*

Erin was also economising on grocery spending under her new budgeting scheme:

*Erin: "Because at the moment I'm living, as, I'm living where everything gets paid, but there's not much left for food at the end. Yeah."*

### ***Bill shock and bill stress***

Participants described varying degrees of either bill shock when electricity bills arrived, particularly bills using an actual read after an estimated bill, or bill stress, where they were unable to pay an electricity bill by the due date. Even those who had used prepayment metering for several years recalled bill shock, for example Melissa commented: *"I do remember the power bills! They were ridiculous!"*

Most of the participants agreed that they spent less on electricity when using prepayment metering. While they did agree that they were more careful about their electricity consumption, some participants, particularly Dylan and Melissa, felt that the reduction in their electricity expenses was so dramatic that they could not account for a corresponding reduction in electricity consumption.

*Melissa: "I mean there was only me and my son then, and we only had one TV in the house, you know and we were cooking like, teeny little meals, and sometimes my power bills were \$300 plus a month, and I just couldn't believe it. So, because I*

*couldn't afford that. And going, I mean when I first got the power, the prepay I was only putting, I think about \$15 a week in, and I was only using about 12 of it. So, you know that was quite a while ago, and I mean \$12 a week, you know that's what, \$48 a month, compared to 300 plus, it was a big difference... I don't understand how you can go from one massive power bill, get your meter put in and it to be less than half. So it just makes me wonder how they calculate those extra costs."*

#### Avoiding bill stress with PPM

Getting regular feedback on the cost of the electricity they were using enabled participants to better manage their budgeting for electricity, and prevented the bill shock they had previously experienced when using post-payment.

*Fiona: "Well like I say you can look how much per you're using, and then pay it fortnightly and we're not going to have a big bill in one month, and then getting another in. Yeah that's why [I like it]."*

*Grace: "I can't cope with a bill when it comes in once a month and trying to guess what the hell it's gonna be. It's too scary."*

#### Avoiding debt and disconnection with PPM

Participants also commented that by paying in advance they were unable to "rack up a big bill" as Melissa put it. Susie similarly explained that using prepayment metering helped her to avoid debt and disconnection, although she experienced relatively frequent periods of self-disconnection while using prepayment metering.

*Susie: "No if I was on the bill I'd probably have the power turned off all the time. Do you know what I mean? It just gets, over the top, yeah."*

For some of the participants, the reason for going on to prepayment metering was that they had accrued debt on the electricity account. Emma and Niranjana described being under bill stress, and receiving disconnection notices before moving onto

prepayment metering, though both had avoided disconnection; Emma saying: *"I was, well I was threatened that they would cut it off, yes."*

### *Contact with electricity companies*

As described above, the contact with electricity companies was perhaps too limited for those using prepayment. More detailed and regular information, particularly comparing different payment plans, and more tailored advice could usefully be provided by the company to their prepayment consumers. However, the limited contact was not viewed particularly negatively by participants, probably because most identified only having negative interactions and indicated that if they were not in contact with their electricity company it was because there were no issues to be resolved. Both participants, who were not using prepayment metering expressed frustration with recent interactions with their electricity companies in relation to making payments on their accounts.

Erin had several recent interactions, both letters and phone discussions, with her electricity company regarding the significant debt that had built up on her account and described teleconferences that had taken place with her budget advisor present. She expressed extreme frustration with the company's lack of *"empathy"*, when trying to arrange a manageable payment scheme from her budget advisor's office:

*Erin: "the last conversation I had with them I was basically pleading with this lady to give me a bit of leeway, and then that's when she whacked the extra thirty bucks on! And I'm ringing from my budgeter's office! And she knows I'm there because I've just told her I'm there. And I've explained 'all my money comes to my budgeters and they pay my bills, and 'oh well if you don't have this blah-de-blah-de-blah paid then we're going to you know give you another thirty bucks fee'. And then I got the power bill and the thirty buck fee was on there. I thought 'oh my gosh, you know, you're not getting it!' I was getting really irate, and my budgeter was like, 'Hang up*

*now, Erin! Hang up now!' (laughter) 'Say goodbye!' (laughter) 'No I haven't finished yet!' Oh, but yeah, and that really disappointed me you know? I thought 'oh my gosh, you people have no empathy'. I know they're doing their job... but, I have spelt it out to them in pure black and white that I am struggling really bad, and I've had to resort to doing this, this, and this, but it made no difference."*

For Haley, the recent contact with her electricity company regarding her payment method was not because she was already experiencing bill stress, although it had the potential to create bill stress by putting her into credit on her electricity account, thus rendering her unable to allocate that money towards other bills which were due earlier. She had used prepayment metering in her previous house, and was recruited into the study via the 2010 survey. After moving, she had preferred to pay via credit card over the telephone, and although this was convenient, she felt some pressure from the company to shift to a direct debit payment, which would also avoid the fee she was paying for every transaction. She had some concerns regarding the potential for payments to exceed her credit limit, creating bank fees and further problems, but eventually decided to commence direct debit payments from her credit card account, preferring to use her credit card for the rewards scheme as she did with her other household bills. However, when the company set the direct debit up it was not processed immediately, and when the due date for the bill approached she contacted the company again, concerned she would lose the prompt payment discount. They extended the due date, however, the new date approached without the payment being processed, so she again contacted the company. This time they processed the payment over the telephone to ensure that she would receive the prompt payment discount, but the next week the direct debit payment was also processed, so she had paid the bill twice from her credit card account and now had considerable credit on her electricity account.

### *Top up routine*

Participants described having a particular routine to manage crediting their prepayment meter, usually adding credit weekly or fortnightly, depending on the schedule of their income payments. Most talked about buying credit on a set day, usually a week day. Niranjana scheduled the purchasing of his credit on a weekend, so that when he ran low or ran out of credit he had extra time to purchase credit and top up the meter before the disconnection time on Monday morning. Because of this strategy, while he had run out of credit, he had never experienced an interruption of electricity supply or actual self-disconnection.

If circumstances allowed, there was a tendency for participants to describe putting a larger amount of credit on the prepayment meter and checking it less often. Margaret was currently using the meter this way, while Regan described having done that in the past when he had been working, and Emma suggested that she would do that if her finances were not so constrained.

### *Having a set amount*

Whatever the frequency, participants usually topped up their meter with a set amount of credit that they had determined over time, perhaps using a slightly lower amount in the summer. A common strategy was to build up credit on the meter by continuing to add their set amount up to a certain point:

*Regan: "When I've had it loaded up I've skipped a week of buying power, um because I know I can, you can buy something extra. But not because I couldn't afford it."*

*Fiona: "I have a look at that when I go in on pay day, and about now, just say I've got about \$20 left, but I'd still put another 50 in. Just to keep it up to that standard because of the cold weather. And then in the summertime I can budget it well with that because we're not using the heater."*



Similarly, several participants discussed saving credit for winter by adding a slightly higher amount than they used in the late summer-autumn months, so that when they needed to use heating there was some credit already in the meter. For some participants, having a little credit saved on their prepayment meter provided some security should any unforeseen problem arise that would affect their finances, as they would be able to skip some regular crediting of their meter.

*Melissa: "...usually when it starts, when I know that it's going to cool down, I usually just consistently put the same amount, so that when we start winter, there's like a buffer there. So that if anything goes pear-shaped I don't have to worry too much."*

### **8.5.3 Sociotechnical interactions with meter**

As discussed in Chapter Four, electricity meters have been examined through the theoretical lens of sociotechnical systems theory. This acknowledges the interplay between the technological functions of metering devices, such as prepayment meters, and the social practices of people using these technologies within their homes (286). In the present study, participants' sociotechnical interactions with their prepayment meter centred around three key themes: deductive use of prepayment meters; feedback; and micro-budgeting of electricity end uses.

#### *Deductive use of prepayment meters*

Almost all of the participants described having used their prepayment meter deductively to put dollar figures on different electricity end-uses within their homes. Participants could commonly tell us how much it cost to put a load of washing through the washing machine and drier, or how much extra they would use when cooking a roast, for example.

*Regan: "Ah, ages ago when they first put this meter in, when we went from the other meter to this meter, I found that if I turned everything off, and just run one thing at a time, I could find out how much I was using."*

*Grace: "... we figured all that out when we got the dishwasher installed, and it actually worked out cheaper for us to use the dishwasher once every second day, than to fill the sink up two or three times a day."*

*Fiona: "Yeah, when I put my washing machine on, and, then I put it in the drier, it wouldn't even be \$2."*

Some long-time prepayment meter consumers (Dylan, Regan, Melissa), had done this when they first commenced using prepayment. They explained that they did so less now that they had a better idea of how much electricity they usually consumed, were comfortable with their payment routines, and did not need to make extra savings.

When getting a new appliance, participants described checking their meter more frequently and perhaps adjusting the amount of credit they purchased. For example, Regan had recently installed a heat pump and was in the process of working out how much it cost to run on different heating schedules. Margaret and Melissa described getting new chest freezers and noticing changes in electricity consumption.

*Margaret: "...we bought a new deep freeze, and we could tell that we used less electricity."*

*Melissa: "I looked at what I had, I switched it on and I checked the next day but then I thought it would've used slightly more freezing, starting that initial. And um, it*

*really, like after having it running, there really hasn't been any increase, I wouldn't say I've even noticed."*

Others (Brian, Regan, Grace) described changes in circumstances, for example retiring from work, or going through divorce, as times when they turned to their prepayment meter to find ways to make savings on their household expenses by reducing electricity consumption.

*Brian: "Well it's only probably in the last, 12-18months that I've discovered by switching the hot water off, I'm not using power as it were. Yeah. My dollars are accumulating so... it was a budgetary process. Ah, because prior to that I was actually working... So being the miserable me that I am, I kept looking round, looking round, oh I can do this do that, and that's when it was yeah. But no I'm about at the bottom of the issue now."*

### **Feedback**

As with the routine established for crediting their meters, most participants had a routine of when they would check the meter. Even some long-time prepayment meter consumers checked their meters daily, but for others who perhaps had less need to reduce their spending, checks were performed less often, although usually at least weekly.

*Brian: "Oh well I mean I'm in the habit you know, I get up and have a shave and while I'm there I just push the buttons and see what my meter reading is, you know what I've used that night, or what's gone through."*

*Fiona: "and I always look at that [prepayment meter] every day, just to observe it."*

Participants described the effect of getting regular feedback from their prepayment meter on their management of electricity consumption and budgeting for electricity,

enabling them to anticipate what they would spend. Most of the participants knew how much they would normally spend daily on electricity.

*Melissa: "With a power bill, you use for a month, and then you have to pay for that while you are using for another month. You know, and it's just so you don't know what, what you're using, you don't know, when you've had um more use, you know what particular week or things like that. It's just with that [prepayment meter] it's so much easier, because if you're using more well you know straight away, because it starts, if it starts beeping saying it's below ten dollars earlier than it usually does, you know you've used more."*

Participants also described being able to quickly discover unusually high electricity consumption, such as if an appliance was not working properly, which prevented them from accumulating avoidable expense. For example, Regan described discovering when his hot water cylinder thermostat malfunctioned.

*Regan: "...if it's \$30 for a couple of weeks in a row, and I've suddenly got 40 on there, then I check why. If we're not doing anything much different. And it's generally the hot water. It's boiled a couple of times."*

### *Micro-budgeting of electricity end uses*

Being able to access feedback through their prepayment meter, combined with knowing how much different electricity end uses within their home cost, meant that participants were able to micro-budget electricity end uses. This was particularly useful for those on constrained budgets; prepayment metering enabled them exert some choice within their electricity budget that they may not otherwise experience with post-payment billing. This was illustrated by Grace who had described choosing not to use lighting in the living room when they were watching television, for example.

*Grace: "We're in control of it a little bit more, by you know being able to go onto the meter, see how much we've used that day and... you've got all your read outs that you can, figure out where you're up to and what's happening. I think just sort of knowing, what things cost and being aware of that, yeah, just makes it a lot easier to plan out what you're going to do."*

Similarly, Susie described rationing her electricity before pension day when her credit was low:

*Susie: "And you think 'oh!' because like Sunday I had two days and like 'oh! Is it going to last me until Tuesday?' So I started switching and making sure everything was off, you know just making sure, just to tide me over, don't do the washing, until the things in."*

#### Cost of electric heating

Although there was a large volume of data collected in relation to heating practices which was not selected for analysis here, several participants talked about the high cost of electric heating in relation to budgeting or household electricity use, so some mention of this is justified. For example, participants described cutting back on using electric heating to save electricity expenses, having to budget a significantly larger amount for electricity to use heating in winter even if a comfortable temperature was not achieved, or worrying about using heating. Fiona, Niranjana, and Susie described using electric blankets instead of space heaters to save on electricity. Using blankets or wearing extra clothes was mentioned by nine participants as a means to save on heating costs. Both Haley and Erin, who were not using prepayment metering worried about the electricity bill they would receive after using electric heating.

*Emma: "...I've got electric heaters but I'm not about to use them because they cost money. They're not, you know it's not something that is economical to use."*

*Brian: "I must say this about, that's the wall electric heater there. It was put in 12 months after I came in, there used to be a fireplace there, I turned it on one winter, and it went on and on and on, the meter spun round and round and round, but you could put an ice block on it and it would never melt, you know, so I've never used it since."*

*Interviewer: "And when you've used the heating did it make you feel comfortable since we last talked?"*

*Haley: "Um, like physically comfortable? Yeah! ...Because I was uncomfortable thinking about how much it was going to cost."*

#### Conservation

Participants felt that they did their best to conserve electricity, using enough to be comfortable, while allowing some small 'luxury' use of electricity. None of the participants described themselves as being wasteful with electricity, all practiced conservation to some extent, though not all for financial reasons. They often commented that prepayment metering encouraged conservation, although some reflected that there were lifestyle factors, and habit and upbringing influenced electricity use.

Four participants also reflected on the broader environmental reasons for conservation. For example, Margaret discussed conservation of electricity and water, contrasting prepayment use and volumetric metering as normal in her country of birth, The Netherlands, compared with New Zealand.

*Grace: "Yeah I mean we're pretty limited we've only sort of like got this kind of electricity you know we really need these wind farms and this solar power, yeah I'd like to see, lots of different alternatives in use, but, until that happens yeah. And it's up to us to be responsible, for our planet. And we don't get another chance."*

*Being comfortable with usage*

While describing their electricity use and conservation of electricity, some of the participants described being comfortable with the amount of electricity that they used, both in terms of the amount they spent and the end uses they achieved.

*Fiona: "Well I use my stove, and I try and work it so that it's not too long to cook and that. Making a roast, I do the same. And... I don't abuse the hot water, you know what I mean? ... don't use it for just rinsing a cup and that. That saves it too. ... Don't leave the radio on all the time, things like that... I don't go stingey on it!"*  
*(laughs)*

*Cutting back*

This was in contrast with those who felt that they had no choice but to cut back and use the least amount of electricity possible, which created additional stress for those already feeling the pressure of economic stressors.

*Emma: "I don't use it, (laughs) I conserve, I don't use the electricity if I can get away with it I switch off lights and everything else... you go from room to room and you shut off the lights, you know that's the way we were brought up... I am using the minimum."*

*Erin: "...if it [electricity] was cheaper I wouldn't be so worried about having that heater going all the time. If it was cheaper. And I would feel better about keeping the house warm for us, you know. Yeah I wouldn't feel 'oh gosh I've gotta turn that off now because, you know, it's going to thing the power'. I mean I go around the house going 'gosh, youse are wasting power!' You know, so yeah, I probably um, wouldn't feel as guilty about trying, you know, using this stuff if it was cheaper, yeah."*

*Interviewer: "So do you find that it weighs on your mind quite a lot?"*

*Erin: "Yes, yes I do. Yep, and that is with everything else that weighs on my mind love! (laughs) Yeah, that's just another bundle. Yeah at the moment I am very worried about my power, I am."*

Some people described using even small appliances, such as the kettle minimally, or not having extra appliances that would use electricity. For Brian, cutting back on electricity and micro-budgeting was extreme. He had developed a routine which saw him turning the hot water cylinder on overnight on just two nights a week, leaving it off the rest of the time and using the residual hot water sparingly as this saved on his electricity costs. He jokingly describing this as "mean".

*Brian: "Well what I do is I turn off the hot water cylinder. That's only turned on every third day. Because the residual hot water is enough to keep me going, with quick showers. ...Mean eh?!"*

#### *Luxury use*

When describing 'luxury' use of electricity participants noted that extreme conservation was inconvenient, and often apologised for, justified, or joked about their 'extra' electricity use. Even those who were under extreme pressure to conserve electricity noted some small luxuries, for example, leaving the television on standby, or having two televisions going in the household simultaneously at times so different channels could be viewed. Avoiding actions commonly advertised as energy efficient was also presented as a 'luxury' by participants, for example, when describing using the clothes drier, having long showers, or using hot water washes in the washing machine.

*Fiona: "I use the drier in this weather, when I'm not feeling well. And I do the washing about four times a week."*



*Margaret: "When I was trying to be very good and, doing that [cold water washes] and the man had to come. And he said to me um, 'you're doing cold washes' and I said 'oh yes!' and he said 'well, it's not good for your washing machine', so I thought 'well that's it then' I mean sorry, but um."*

#### Other people's electricity use

Most of the participants discussed other people's electricity use as well as their own individual use of electricity. Other people within the household contributed to their electricity spending and their electricity use needed to be budgeted for, whether or not it was presented as problematic and a source of household tension.

*Dylan: "...it's not normally leaving lights on, I can't say that because they're pretty good here, I've told them. And my boarder she's quite good so, she knows that I'll tell her off if she leaves the lights on."*

*Niranjan: "Just going on, ah it's like it's not only a single person, it's a group of different people with different knowledge, so it's not easy to sort of come to the common understanding."*

*Erin: "So yeah, it's a matter of, you become the great nag around the house, eh? You know? 'Oh stop nagging us!' 'Oh I just want you to turn it off, so that we can save power!'"*

Those who discussed the electricity use and bills of other people they knew outside the household usually did so contrasting their lower use on prepayment metering with what was established as the normal higher and more wasteful or extravagant use of electricity by others.

*Brian: "I've seen people around here get into serious trouble where they use power like it's going out of fashion. You know and at the end of the month, hello!"*

*Somebody out there wants three or four hundred dollars. Which I think is absolutely extravagant, you know."*

*Haley: "I remember my mother-in-law rang, like when we had the snow and she said 'oh have you got all the electric blankets on early?' and I said 'no! We don't have electric blankets! We just get into bed and warm up!'... I spose like, underlying it must be a cost in my mind because I just sort of think 'well, you're going to get warm in bed eventually anyway, you've got blankets in bed, it's going to, so it's sort of pointless, and it's extra costs, that's, sort of, extravagant maybe'. Yeah."*

*Regan: "Four, three big ones and one, well it's bigger than our TV the smallest, yeah so gee! He'd be chugging through the power!"*

Some participants (Margaret, Erin, Grace) described a lack of awareness of electricity use by teenagers as a group, relating stories of their own household or their grandchildren.

*Margaret: "I don't know it is so much the cost, it is just that I ah, sort of was brought up, to not waste things you know? So you sort of try to, although I don't think the grandchildren know about it at all! (Laughter) When you say to them 'turn the light off!', 'oh I'm going back there again'. Yeah."*

*Erin: "Teenagers are truly amazing! Like oh my gosh, once they turn on the TV stand here and watch it, walk over to the radio, turn that on, listen to that for two minutes, and then off they go somewhere! (laughter) And those things just get left on. 'Oh I can't wait 'til you guys have to do it all for yourselves eh, I really can't!' Then they'll know what I've been on about."*

## 8.6 Discussion

The qualitative data presented above usefully extend the information gathered in the surveys regarding the advantages and disadvantages of prepayment metering from a consumer perspective and help to better explain the interplay between prepayment metering and fuel poverty in New Zealand.

Participants of this study expressed satisfaction with prepayment meter use in general. Most were long-time users of prepayment metering, with only three currently using prepayment having done so for five years or less. Most participants agreed that more households across the socioeconomic spectrum than currently use prepayment metering would benefit from them, and would be happy to recommend them to most people, indeed some had already recommended prepayment metering widely. Barriers to recommending prepayment to households considered vulnerable included limited outlet access to purchase credit, and the risk of self-disconnection.

At least some complaints with the prepayment metering system used were identified by most participants. System complaints about prepayment metering may be particularly easy to address through introducing fairly basic regulations, which would reduce most of the disadvantages associated with prepayment metering for the majority of the prepayment meter consumers we spoke with. Contact with electricity companies was limited unless problems arose, and participants initiated contact themselves; mixed feedback was given about interactions with the electricity company in these instances. When their electricity company did contact them the information they provided was not always well tailored to those using prepayment metering, for example when describing low user tariffs that the company does not actually offer to their prepayment metering customers.

Most of the participants stated they would not be easily able to afford and/or be willing to pay a charge to remove the meter and move to post-payment in order to

take advantage of the low user tariff, and in any case most wanted to continue using prepayment. Another difficulty prepayment customers had was with comparing the price they would be paying for their usage on different plans, because most of them considered their electricity use in dollar terms, rather than the number of units used over a period of time. Retailers could easily provide this useful information by individually tailoring these annual letters and including the amount used per annum, comparing different prices for the different plans they offer, removing the need for consumers to telephone for further information as currently suggested. These complaints should be simple for companies to rectify and may not require any mandatory regulations, introducing a guideline may be sufficient. On a positive note, the company should be commended for sending the new meter menu guide stickers to their prepayment meter consumers, this was useful and well received, and had enhanced feedback information accessed by pointing some consumers to functions they were not already using.

The other system complaints, especially pricing structures and the limited options for switching in the prepayment meter sector, will require more involved Government intervention to address as current market function cannot be relied upon to solve these issues, though these problems are not insurmountable. Similarly, the market has shown itself unreliable in addressing problems with the physical traits of the meter, though stronger evidence of this was found in the surveys which highlighted the *Glo-bug* meter used by Mercury Energy as especially problematic (305). The poor location of some metering devices needs to be addressed, and international evidence suggests this could be achieved through engaging with electricity companies. Consumer Focus in the United Kingdom recently reported that all prepayment suppliers have responded to their earlier research showing similar findings, that for some prepayment meter consumers the poor location of devices was considered no longer 'safe and reasonably practicable', by moving or replacing these meters free of charge (255).

Outlet access and limited other payment options may also require at least guidelines to address, although access to purchasing prepaid mobile phone credits is easily available, therefore it should not be difficult to improve options for purchasing electricity credit. Concerns relating to the need for a meter reader to visit properties regularly present an anomaly, as it seems unnecessary to visit every property using prepayment metering in the absence of suspicion of interference with the meter. This complaint may not be easily dealt with, but if the broader system issues with advanced metering are resolved the requirement for meter readers may be removed in most cases.

The problem of self-disconnection presents a greater policy challenge. However, for four of the six participants who had experienced a self-disconnection event the cause was forgetfulness rather than financial hardship. Other prepayment metering programmes provide easily accessible emergency credit, for example, *Southern Electric*<sup>37</sup> and *npower*<sup>38</sup> electricity companies in the United Kingdom provide limited emergency credit which can be activated through the prepayment meter unit. This requires no contact with the electricity company, and for those participants who described going out and purchasing credit shortly after self-disconnection occurred the availability of emergency credit could provide an avenue for instant reconnection, if not preventing these self-disconnection events altogether. Where self-disconnection is a result of financial hardship, reducing the minimum credit amount from \$20 to \$10 as suggested more affordable by participants who had the experience of having previously been able to purchase \$10 credit amounts, may help to reduce the negative outcomes of self-disconnection. Changing the hours that disconnections come into effect may also reduce the rates and outcomes of self-disconnections. For example, the instances of self-disconnection when participants

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<sup>37</sup> <http://www.southern-electric.co.uk/GasAndElectricity/PayAsYouGo/EmergencyCredit/> accessed 9 September 2012

<sup>38</sup> <http://www.npower.com/Home/customerservices/payment-information/Information-for-prepayment-customers/emergency-credit/> accessed 9 September 2012

described waiting two hours in the morning for their outlet to open to purchase credit could be eliminated or the duration reduced if a midday shut-off, as currently used by Mercury Energy was adopted. It should not be difficult for electricity companies to remove the variability in disconnection times caused by daylight savings either, and unanticipated public holiday disconnections could also be avoided.

Consistent with other international studies (57, 168-171), the participants generally described careful and considered budgeting strategies, with detailed accounting for expenses, including the cost of electricity end uses. Most described some form of *“mental budgeting”*, and Emma commented that on her previously higher income this was not necessary, both of these scenarios being consistent with the literature (171). This is at odds with the findings presented by recent local qualitative research, where stakeholders were prominently reported to suggest that poor budgeting skills were a root cause of fuel poverty for households (94). Participants used payment routines, particularly with their prepayment meters, also for other bills, that they had developed over time. A high priority was placed on paying for electricity, which was usually described second only to rent or mortgage payments. Some participants indicated that prepayment metering helped them to avoid disconnection and, or, debt build up they felt they would experience on post-payment billing. A number of the participants had experienced bill shock, and felt that prepayment metering was useful in avoiding this, particularly as most credited their prepayment meters weekly. In contrast with the concerns raised by consumer advocates that prepayment metering does not allow budgeting for seasonal use (110), many of the participants described saving credit on their prepayment meter, and keeping a ‘buffer’ or amount on the meter throughout the year in case of unforeseen circumstances which would make it difficult for them to avoid disconnection. Although it is also true that for those who are very constrained, it

may be difficult to pay any extra when living week-to-week, and some participants reported regularly letting their credit drop below \$10 before crediting the meter.

The interviews gave insight into the sociotechnical interactions that participants had with their prepayment meters and detailed descriptions of using their prepayment meters to deductively ascribe costs to electricity end uses were provided. Interacting with their prepayment meters allowed micro-budgeting of their electricity end uses; through the feedback they gained when checking their meters, which prompted them to adjust their electricity consumption behaviours. Compared to the other prepayment metering programmes offered by the other electricity retailers in New Zealand (for example, Mercury Energy's *Glo-bug* which was highlighted as extremely problematic by survey respondents), the in-home display used by the participants of this study, who were all customers of Genesis Energy, provides an acceptable range of information. Therefore, it does provide feedback required to improve household understanding of electricity consumption and the associated reduction potential found in other studies of prepayment metering programmes (111).

The increased feedback participants described achieving through interactions with their prepayment meter enhanced their ability to make informed choices about their electricity end uses. Sometimes this helped them to manage their household budgets more generally, through reducing their electricity expenditure. However, it is not clear whether prepayment metering as currently available would be advisable for a household in the situation described by Erin, who was using post-payment billing and experiencing severe financial hardship, with other factors also contributing to this household's fuel poverty such as poor household and heating appliance energy efficiency. Other households describing income poverty and poor thermal comfort indicators, and were using prepayment metering, most strikingly Susie and Grace, had also experienced problematic self-disconnection, despite self-rationing, or

reducing their electricity consumption, through interactions with their prepayment meter. For Brian, self-disconnection was not an outcome, though extreme self-rationing of electricity was the alternative.

To put the usage reported by Brian in context, he reported checking his meter the day of the second interview, and the meter reading stated he had used \$77 in the last month, spanning August-September, when significant space heating of his dwelling would be expected to maintain a safe indoor temperature. Using the *Powerswitch* website (as described in Chapter 3) with the household details of Brian (1-2 people, someone at home during the day, electric hot water cylinder, electric plug-in heating, electric cooktop and stove), the estimated power usage for his area was 7500kWh per annum, and using current prices for the prepayment plan and company he used, the annual cost was calculated at \$2,062<sup>39</sup>. The daily fixed charge for this plan is \$0.75, and the variable rate is \$0.24/kWh (last updated January 2011, four months after the second interview, the variable rate was the same at the second interview, the daily rate unknown). Using these prices, the daily rate used \$22.50 of the monthly price, leaving \$54.50 to purchase 227kWh of electricity. Although Brian indicated that he considered this to be a high use month, compared to a summer month, if we assume he uses the same amount every month, he would use 2724kWh in a year, just over a third of that estimated by the *Powerswitch* calculator. These calculations show the extent to which Brian rationed his electricity use severely in order to avoid self-disconnection.

Using the *Powerswitch* calculator, Susie, who was in a similar situation to Brian though living in the Manawatu region and using a heat pump for space heating, was estimated to use 5940kWh at a cost of \$1810<sup>40</sup>. The significant reduction compared to

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<sup>39</sup> <http://www.powerswitch.org.nz/powerswitch/results/7d30afce99e99151ee7ef9595b24ca5eef1f69ab> accessed 9 September 2012

<sup>40</sup> <http://www.powerswitch.org.nz/powerswitch/results/7d30afce99e99151ee7ef9595b24ca5eef1f69ab> accessed 9 September 2012



Brian is likely due to using a heat pump as the main source of heating compared to the relatively inefficient plug-in electric heater. Geographic differences in the price of electricity also complicate direct comparison of these cases. Susie reported crediting her prepayment meter with \$25 weekly, a total of \$1300 per annum. Despite experiencing problematic self-disconnection the calculation shows that Susie is also self-rationing her electricity considerably, as she reported through restricting her use of heating, and uses only 72% of that estimated by the *Powerswitch* calculator.

The dichotomous choice between problematic self-rationing and problematic self-disconnection illustrated here is a classic dilemma - either choice results in negative outcomes. Colton argued that low-income households have little discretionary electricity consumption and few opportunities to reduce consumption (110). Therefore, prepayment metering cannot provide the industry-claimed benefits of budgetary management through increased awareness and reduced electricity consumption in low-income households, because they ignore the nature of low-income energy usage that is dependent on dwelling and appliance characteristics, typically less energy efficient than for higher-income households (110). Either way, for these households experiencing severe energy hardship, obtaining sufficient household electricity for expected as typical for a modern lifestyle is unaffordable, and unachievable, and prepayment metering increases the difficulties they experience.

## 8.7 Summation and conclusion

In sum, the qualitative data presented here shed light on the nature of sociotechnical interactions with prepayment meters that enable improved household budgeting of electricity. Together with the survey results, this information helps to explain how addressing system problems with prepayment metering by introducing some simple

mandatory regulations, could reduce the disadvantages currently experienced by many consumers using prepayment metering. However, like the survey, the qualitative data also raise questions as to whether there are adequate protections that could be provided to the group experiencing severe energy hardship, and who also expressed their desire to continue using prepayment metering.

## Chapter Nine:

### Integrating prepayment and fuel poverty: from practice to theory

An important part of mixed methods research is *integration*, though there is considerable debate within the mixed methods literature about when, how, and why integration should be carried out (274, 291, 301, 322-324). For example, integration may occur as early as research question development, or in research phase designs, data analysis (such as in Chapter 7), or in an overall discussion of the mixed methods research programme (301, 322, 324). In multiphase, sequential mixed methods designs, as illustrated by this thesis, the development and design of subsequent stages can draw from analysis and conclusions of previous phases. For the most part, the literature agrees that at a minimum, conclusions from both qualitative and quantitative research phases must be integrated together to form meshed conclusions (322).

This chapter specifically sets out to use integration in the form of synthesis of the data, results, and conclusions from the research phases to contribute to the practical and theoretical understanding of fuel poverty in New Zealand. It aims to meet the second, third and fifth overall thesis objectives identified in Section 1.6.3, namely:

- To examine whether prepayment meter users are at increased risk of fuel poverty compared to the general population of New Zealand;

- To use a multiphase mixed methods research approach to provide a broad range of evidence, *with data from the research phases integrated to increase the value and function of the findings* (emphasis added);
- To use the learning gained from undertaking this thesis to suggest an approach to defining and measuring fuel poverty in New Zealand.

The first part of this chapter explores the links between prepayment meter use and fuel poverty by using three different methods of estimating rates of fuel poverty and data from the two surveys discussed in Chapters Five and Six. Although the qualitative interview data from Chapter Eight is not directly included in this analysis, it informs and contributes to the decisions around thresholds for measuring fuel poverty using different definitions and strategies, and the conclusions drawn from these results. The second part of this chapter describes my suggestions for defining and measuring fuel poverty in New Zealand, based on the knowledge gained over the course of the thesis literature review and research processes.

### **9.1 Assessing the links between prepayment metering and fuel poverty**

To define individual households quantitatively as fuel poor using the Boardman definition, specific and detailed data on the quality and energy requirements of individual housing, as well as income data is required. As outlined in Chapters One and Two, due to the limited data available in New Zealand this thesis has investigated those using prepayment metering with the rationale that these households are likely to experience increased risk of fuel poverty. During the thesis planning stage, anecdotal evidence from meetings with key stakeholders suggested that lower-income households are more likely to use prepayment metering, and was indicated by the surveys of retailers offering prepayment metering undertaken by the Electricity Commission (213, 256). This was further supported by the evidence

from the price comparison analysis in the first research phase that prepayment metering is more expensive than other payment methods (see Chapter Three, (172)). Therefore, the decision was made to further investigate prepayment meter users as a group under the rationale that this group is at increased risk of fuel poverty than the general population and that they are an easily identifiable group. However, it has not previously been known whether prepayment metering can indeed be used as a proxy tool for identifying the fuel poor in New Zealand as hypothesised, or to what extent those using prepayment metering in New Zealand can be classified as fuel poor? This section seeks to begin to answer these questions.

Several questions asked of survey participants can be used as indicators to create estimates of fuel poverty rates among the population of prepayment meter users in New Zealand. To make clear that these are estimated measures of fuel poverty that do not strictly adhere to the Boardman definition, I have borrowed Lloyd's phrasing 'potential fuel poverty' (10). In this section I compare three types of estimated measures of fuel poverty rates: actual expenditure potential fuel poverty; required expenditure potential fuel poverty; and composite measures of potential fuel poverty.

### **9.1.1 Actual expenditure potential fuel poverty estimated measures among prepayment meter users**

At one end of the spectrum, using the reported annual expenditure on electricity as a percentage of household income, it is possible to calculate the number of households using prepayment metering that experience *actual expenditure* potential fuel poverty. However, actual energy expenditure has been shown to be a poor indicator of fuel poverty due to the energy and other expenditure self-rationing behaviours typical among fuel poor households (6, 7, 61, 168, 228, 247). Therefore it is likely to underestimate the number of households in fuel poverty if the Boardman definition (10% threshold) is used. (For further description of self-rationing evident in some

households using prepayment metering in New Zealand see Chapter Eight.) While the majority of prepayment meter users reported using electricity for hot water heating and cooking, some household energy use is not reliant on electricity, for example water or space heating using gas, space heating using a wood-burner, cooking using gas. However, as electricity is the only energy expenditure measure used here, this will also underestimate the number of households defined as actual expenditure fuel poor.

Respondents were asked to report gross annual household income in \$20,000 brackets for the last year, and calculations here were based on three income points (high-, mid-, and low-point) within these brackets. For the high-point income estimate, if a respondent reported annual household income of \$40,001-\$60,000, the actual expenditure ratios were calculated using \$60,000 as the annual household income figure. If a respondent reported annual household income of greater than or equal to \$100,001, a figure of \$120,000 was used as the reported annual household income. A mid-point value and the low-range value for each income bracket was also used. It should be noted that the income figures here have not been adjusted for housing costs as information on housing costs was not collected in the survey, which is likely to result in an underestimate of the number of households in fuel poverty at any given threshold.

Reported here is the number of households reporting annual electricity expenditure at a range of gross annual household income thresholds (Table 9.1): those spending greater than or equal to 5%, 10%, 15% and 20% of household income. This is also consistent with the approaches to defining and measuring fuel poverty used in both Scotland and Northern Ireland and as suggested by Liddell and Colleagues (82) outlined in Chapter 2, that use a range of fuel poverty thresholds to more fully describe the phenomenon as it is observed in the community. Respondents with missing data (those who reported that they did not know either their expenditure or

income, or did not respond to either question) were excluded from this analysis. The number of respondents for this analysis in was 269 (from 359 respondents), using data from the 2010 survey, which provides the largest, most nationally representative dataset.

**Table 9.1: Estimated potential actual expenditure fuel poverty rates using different income estimates and thresholds**

| Reported electricity expenditure as a percentage of reported household income |       |       |       |       |
|-------------------------------------------------------------------------------|-------|-------|-------|-------|
| Estimated income                                                              | ≥5%   | ≥10%  | ≥15%  | ≥20%  |
| High-range                                                                    | 32.3% | 5.2%  | 1.5%  | 0.7%  |
| Mid-point                                                                     | 45.4% | 23.4% | 10.8% | 4.1%  |
| Low-range                                                                     | 67.7% | 40.5% | 32.7% | 31.2% |

Due to the large income brackets used in the survey, the rates of estimated potential actual expenditure fuel poverty for each threshold are spread over a large range. However, the figures illustrate the extent to which decisions around thresholds can alter rates of fuel poverty. They also help to explain why using a scale rather than using one threshold measurement to describe the phenomenon can be useful in that it provides a fuller picture of the number of households that may already be facing hardship or extreme hardship, through to those who are at risk of hardship in the event of a change in circumstances.

*Households using prepayment metering experience greater estimated rates of potential actual expenditure fuel poverty than New Zealand households generally*

As discussed in Chapter Two (see section 2.6.3) there is limited data to assess fuel poverty in the New Zealand population, although some comparable statistics of national average household energy expenditure by average household income decile

are available. Compared to the national population, the figures above indicate that prepayment meter users appear to be spending more on electricity as a percentage of total household income. New Zealand households in the lowest income decile spent 13.1% of their total average household income on total household energy in 2010, while households in the second lowest income decile spent 7.1% and households in the third lowest income decile spent 5.3%.<sup>41</sup> Comparatively, New Zealand households in the highest income decile spent just 1.6% of their total average household income on total household energy in 2010.

In contrast, an estimated 23% of prepayment meter consumers spent greater than or equal to 10% of household total income on electricity in 2010, using the mid-point income estimate range. This roughly equates to prepayment metering households being around 1.8 times more likely to experience actual expenditure potential fuel poverty than New Zealand households in the lowest income decile. This figure does not include spending on other household fuels, although 12.8% of households using prepayment metering reported using gas cooking and 10.6% gas hot water heating. No questions were asked in 2010 to indicate what fuels were used for space heating, or how many households used solid fuels. This suggests that households using prepayment metering may be at even greater risk of experiencing actual expenditure potential fuel poverty than the general population.

### **9.1.2 Estimating rates of required energy expenditure and household income potential fuel poverty among prepayment meter users**

Another way of estimating fuel poverty rates is to use the approach set out by Lloyd, first described using data from 2001 (163), and later updated with 2008 data (10).

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<sup>41</sup> These figures are based on Statistics New Zealand's data which are licensed by Statistics New Zealand for re-use under the Creative Commons Attribution-Noncommercial 3.0 New Zealand license.



Lloyd calculated the required energy expenditure of a house and the required household income to avoid fuel poverty, and compared these with actual household income figures to estimate the number of households in potential fuel poverty.

Although Lloyd used 2008 electricity prices for standard billing, I have not updated these in order to be able to compare to his national estimates. It is likely that these calculations underestimate the rates of required energy expenditure fuel poverty among survey respondents, due to prepayment metering prices being more expensive than standard billing, electricity price rises and also increases to other living costs since that time correspondent with a period of economic downturn. Other assumptions from Lloyd's calculations are that the dwelling sizes average 100m<sup>2</sup>, which is lower than recent floor areas and may underestimate the number in fuel poverty (10). Conversely, he also assumed space heating is provided by electric resistive heating, which may overestimate the number in fuel poverty where cheaper alternatives are used. This is particularly problematic with the recent increase in electric heat pump use nationwide.

Lloyd calculated the required energy expenditure in three climatic zones across the country as set out by the Department of Building and Housing and the New Zealand Standard 4218.2009 governing the required level of insulation for dwellings.<sup>42</sup> Climate Zone 1 encompasses the top of the North Island, including the far north, Auckland and Manukau cities, and Thames Coromandel. Climate Zone 2 covers the rest of the North Island from the northern boundaries of the Waikato and Hauraki districts, excluding the central plateau. Climate Zone 3 includes the central plateau of the North Island, and the South Island.

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<sup>42</sup> see Appendix B of NZS4218:2009, p32 <https://law.resource.org/pub/nz/ibr/nzs.4218.2009.pdf> - last accessed 13 July 2013

Lloyd calculated the required minimum household income range for each climate zone based on the estimated required electricity expenditure range and the 10% threshold of fuel poverty from the Boardman definition.

**Table 9.2: Estimated required electricity expenditure and household income ranges by climate zone**

| Climate Zone | Required Electricity Expenditure Range | Required Household Income Range |
|--------------|----------------------------------------|---------------------------------|
| 1            | \$2,000 - \$2,400                      | \$20,000 - \$24,000             |
| 2            | \$2,900 - \$3,900                      | \$29,000 - \$39,000             |
| 3            | \$4,100 - \$4,750                      | \$41,000 - \$47,500             |

(Data in this table sourced from (10), p140)

For the calculation of required energy expenditure fuel poverty for the survey respondents, the climatic zone of each respondent's address was assigned, and the mid-point figures of the assumed average required electricity expenditure and household income level estimated by Lloyd (Table 9.2 above) (10) was compared to the reported electricity expenditure and income level for each respondent. Although Lloyd used the average of the estimates for the cities of Christchurch and Dunedin to calculate the required energy expenditure and household income for Climate Zone 3, in the estimates here I have used the estimated figures from Dunedin city. The rationale for this was that where Climate Zone 3 covers the entire South Island and central plateau of the country, for the surveys, prepayment meter users in Christchurch city and the surrounding areas were excluded due to the September 2010 earthquake. All survey respondents classified as living in Climate Zone 3 were living in the deep south region (Dunedin, Mosgiel, Invercargill, Bluff, and Gore), and are most likely to have the required energy expenditure and therefore household income, similar to that estimated by Lloyd to be required in Dunedin City.

As household income was reported in \$20,000 brackets, these calculations require some assumption to be made about the actual gross household income. For example if the high point of the income range \$0-\$20,000 were used, no respondents would have an income *lower* than the lowest income required to avoid fuel poverty in Climate Zone 1. Similarly, assuming that households in Climate Zone 2 reporting an annual household income of \$20,001-\$40,000 have an income of \$40,000, this places them *above* the highest income threshold of \$39,000 required to avoid fuel poverty in that climate zone. For this reason, I have used the simpler assumption that households have the mid-point figure of the reported gross income bracket.

As has been discussed (see Chapter Two, and (8, 11, 82) in particular), it is useful to assess the expenditure and income patterns across the spectrum when considering fuel poverty. Consistent with this, I have chosen to report households in four electricity consumption categories here. Respondents who reported both *lower electricity expenditure* than the midpoint of the range estimated to be required for adequate electricity services, and a *lower household income level* than the midpoint of the range estimated to be required, are reported as *fuel poor and self-rationing*. Respondents who reported *lower electricity expenditure* than that estimated to be required for adequate electricity services, but a *higher household income level* than that estimated to be required, are reported as *electricity self-rationing*. It is not clear whether the circumstances of these households would allow for purchasing adequate electricity services, or whether they are self-rationing for financial reasons, for example to cope with rent or mortgage payments or to service other costs or debt. They may also be using other energy sources, such as gas or firewood. Therefore, the most conservative approach is to exclude these households from those counted as fuel poor under the Boardman definition used in Lloyd's estimates. Some respondents also reported higher electricity expenditure than that estimated as required for adequate electricity services. Those who reported *higher electricity expenditure*, but *lower income levels* than those estimated to be required, are described

here as *fuel poor*. Those who reported, both *higher electricity expenditure* and *higher income levels* than those estimated to be required, are reported as *electricity over-sufficient*.

As in the calculations above, respondents with missing data (those who reported that they did not know either their expenditure or income, or did not respond to either question) were excluded from this analysis. Two further respondents for whom address data were not provided were also excluded. The number of respondents for this analysis in 2010 was 267 (from 359 respondents to the survey).

**Table 9.3: Estimated required expenditure and income potential fuel poverty among prepayment meter users**

| Electricity consumption categories |                                                          |                                          |                                                           |                                                             |
|------------------------------------|----------------------------------------------------------|------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------|
|                                    | Fuel poor + self-rationing (Low income, Low expenditure) | Fuel poor (High expenditure, Low income) | Electricity self-rationing (Low expenditure, High income) | Electricity over-sufficient (High income, High expenditure) |
| Proportion of respondents          | 46.1%                                                    | 1.9%                                     | 41.6%                                                     | 10.5%                                                       |

Compared with the estimated figure of 25% New Zealand households in potential fuel poverty in 2008 calculated by Lloyd, 46.1% of the prepayment survey respondents had both lower electricity expenditure and incomes, than the mid-point of the electricity expenditure and income ranges required to avoid fuel poverty. An additional 1.9% had incomes lower than that required to avoid fuel poverty under Lloyd’s assumptions, taking the total number of survey respondents in potential fuel poverty to 48.0% – almost double the national estimated rate. Indicative of self-rationing of electricity, 41.6% were estimated to have an income higher than that required to avoid fuel poverty, while also reporting lower electricity expenditure than that required for adequate household energy services. There were also a small number of households (10.5%) that reported both higher electricity expenditure and

incomes than those estimated to be required to avoid fuel poverty, which may indicate overconsumption of electricity, although this could also be an artefact of the limitations of the assumptions.

It is also interesting to assess the rates of fuel poverty across the climate zones, as this gives some illustration of the geographic disparity of energy costs (not completely explained by temperature differences across the country) and fuel poverty in New Zealand (10, 172). It should be noted that although the survey was designed to be a nationwide survey, there are far fewer respondents from Climate Zone 3. This is due in part to the exclusion of Christchurch and the surrounding areas, which meant that one major retailing company did not take part in the study as most of their prepayment metering consumers were resident in that region. There are also fewer areas in the South Island where prepayment metering is offered. The population of the South Island is also lower than that of the North Island.

**Table 9.4: Estimated expenditure and income potential fuel poverty among prepayment meter users compared by climate zone**

| Climate zone       | Electricity consumption categories                       |                                          |                                                           |                                                             |
|--------------------|----------------------------------------------------------|------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------|
|                    | Fuel poor + self-rationing (Low income, Low expenditure) | Fuel poor (High expenditure, Low income) | Electricity self-rationing (Low expenditure, High income) | Electricity over-sufficient (High income, High expenditure) |
| 1 (46.1% of total) | 11.6%                                                    | 1.5%                                     | 23.6%                                                     | 9.4%                                                        |
| 2 (40.5% of total) | 27.3%                                                    | 0.4%                                     | 12.0%                                                     | 0.8%                                                        |
| 3 (13.5% of total) | 7.1%                                                     | 0                                        | 6.0%                                                      | 0.4%                                                        |

A total of 12.5% respondents were spending over the estimated required electricity expenditure midpoint (10). Of those, 89.2% were living within Climate Zone 1, which typically experiences the mildest climates and has the lowest required

electricity expenditure. Overcrowding is also a problem typical of poorer households particularly in the Auckland and Manukau regions, where the majority of respondents from Climate Zone 1 were living, so it is possible that the required electricity expenditure for these households is higher than that estimated by Lloyd, with electric hot water and cooking most commonly used among survey respondents. By the same token, household income may be higher where there are more working occupants, though the household expenses may also require a higher household income than estimated under Lloyd's assumptions. Of those 10.6% of respondents who reported both higher electricity expenditure and higher household income than required under Lloyd's estimates, 9.4% were residing in Climate Zone 1.

*Households using prepayment metering experience greater estimated rates of required energy expenditure and household income potential fuel poverty than New Zealand households generally*

The above figures can be compared to the estimates of potential fuel poverty among the total New Zealand population provided by Lloyd to show that in every geographic region, prepayment meter users are estimated to have higher rates of potential fuel poverty. Nationally, households using prepayment metering are almost twice as likely as the general population to experience potential fuel poverty. These figures could be even higher if expenditure on other energy sources was included.

Lloyd found that in Auckland (Climate Zone 1) 14% of the city population were potentially fuel poor in 2008, while in Wellington (Climate Zone 2) 24% were potentially fuel poor and in Dunedin (comparable with prepayment meter users in Climate Zone 3) as many as 47% of households were potentially fuel poor (10). Dividing the proportion of the total respondents in each climate zone by the sum of the two electricity consumption categories including fuel poor households in Table

9.4 finds that among prepayment meter consumers, 28.4% or approximately double the rate of households in Climate Zone 1 were estimated to be potentially fuel poor. In Climate Zone 2, 68.4% of prepayment meter consumers or almost three times as many households were estimated to be potentially fuel poor. Finally, in Climate Zone 3, 52.6% or just over half of prepayment meter consumers were estimated to be potentially fuel poor, slightly higher than the estimated rate for other households.

### **9.1.3 Using fuel poverty indicators to create a composite measure of potential fuel poverty among prepayment meter users**

While the above two measures are useful in that they are able to be compared to similar national statistics to show that households using prepayment metering, the evidence suggests that these measures do not provide a full picture of fuel poverty broadly defined as an inability to afford sufficient household energy. For example, although only 48.0% of prepayment metering households are estimated to experience required expenditure and income potential fuel poverty, the finding that a further 41.6% of households report spending lower than the estimated required electricity expenditure, despite having higher than the estimated required income to avoid fuel poverty, shows the extent to which self-rationing may occur. Overall, almost 88% of households using prepayment metering were spending less than the estimated required electricity expenditure needed to avoid fuel poverty.

Furthermore, the qualitative data from Chapter Eight highlighted the severity of the self-rationing some households undertook in attempt to avoid self-disconnection, although this was not always successful in preventing self-disconnection. Thus, qualitative and subjective indicators from survey questionnaires can be employed in a composite measure which can take some of this self-rationing behaviour into account, when considering the number of households who may be experiencing fuel poverty.

Healy and Clinch (90) first provided an alternative strategy for measuring fuel poverty using a mix of objective and subjective indicators of fuel poverty to create a composite measure, enabling comparison of the prevalence of fuel poverty in the European Union. Using standardised European Union surveys, Healy and Clinch (90) used the following six indicators to create a composite measure of fuel poverty (p18):

- $\alpha$  = Unable to afford to heat home adequately;
- $\beta$  = Unable to pay utility bills on time;
- $\pi$  = Lack of adequate heating facilities;
- $\delta$  = Damp walls and/or floors;
- $\lambda$  = Rotten window frames;
- $\mu$  = Lacking central heating."

Different weights were then assigned to the indicators to provide a range of scenarios to compare fuel poverty measures across the European Union (90). Overall, the authors concluded that using the composite measure found lower levels of fuel poverty in England, than using the Boardman definition of fuel poverty. Comparison of rates of composite measure fuel poverty across fourteen European countries found that fuel poverty was most prevalent in the southern European countries of Portugal, Greece, Spain, and Italy (90).

Similar composite measures of fuel poverty using proxy indicators from the standardised European Union Statistics on Income and Living Conditions survey were recently used to update these figures by Thomson and Snell (84). As in the earlier study, the authors found that fuel poverty was especially prevalent among southern European countries and also eastern European countries. Composite measure fuel poverty rates were highest in Bulgaria, Cyprus, and Romania (84).

Even where survey questions were kept similar to those asked in national surveys, matching the responses to national surveys by household is not possible for this



exercise. However, using survey questions to create a composite measure of fuel poverty may still be of value to create a fuller picture of the phenomenon among prepayment meter consumers. It may also provide an example of the kinds of questions that may be asked in future studies to measure fuel poverty within the general population.

### *2010 Survey composite measure of potential fuel poverty*

Several of the survey questions from both the original 2010 survey and the 2011 follow-up survey may be used as indicators of fuel poverty to create a composite. I have selected indicators that relate to the key drivers of fuel poverty: financial constraint; adequacy and affordability of heating; and housing quality. Using two indicators that are compared to the estimated required thresholds for avoiding fuel poverty as calculated by Lloyd (10), I have also included some of the geographic elements, for example climate differences and pricing disparity, contributing to fuel poverty in New Zealand.

Healy and Clinch (90) used self-reports of being unable to pay utility bills on time as a subjective indicator of financial difficulty contributing to fuel poverty. However, the measures above showing that the majority of survey respondents are not purchasing adequate electricity to avoid fuel poverty, together with the descriptions of self-rationing from the qualitative interviews presented in Chapter Eight suggest that this may be a weak indicator in the current setting. Only 14.9% of respondents in 2010 reported electricity expenditure above the lowest estimated required amount to avoid fuel poverty. Although 52.6% of respondents in 2010 reported having self-disconnected at least once in the past year, only 29.8% reported that the reason for their last self-disconnection was financial constraint. In 2010, 46.5% (and in 2011, 40.8%) of respondents reported being unable to pay any of their gas, telephone or water bills in the past year. However, the majority of participants were not connected to mains gas, around three quarters did not have a water bill as water was

paid for through the council rates, and around one sixth did not have a home telephone due to the high cost of telecommunications services. Another indicator which could be used is the reported expenditure on electricity compared to the estimated required expenditure for the corresponding climate zone as calculated by Lloyd (10). This could indicate the use of electricity self-rationing by the household, which has been commonly found among both households experiencing and at risk of fuel poverty. However, Lloyd's figures are based on the assumption that electricity is the only fuel contributing to household energy, which may overestimate the number of those in fuel poverty. The majority of respondents reported spending below the lowest estimated electricity expenditure threshold required to avoid fuel poverty. For these reasons I have used the following to indicate financial constraints contributing to fuel poverty:

- Have spent less than the midpoint of the estimated required electricity expenditure range for their climate zone (indicator A);
- Have been unable to pay utility bills in the past year (indicator B);
- Have self-disconnected in the past year (indicator C).

Healy and Clinch (90) used indicators from the European surveys that directly relate to housing quality and conditions that both indicate and contribute to fuel poverty: damp walls and/or floors, and rotten window frames. Although these specific indicators were not included in the prepayment surveys, two questions can be used to provide point towards housing quality which may be contributing to fuel poverty. Self-reported housing condition is used as a subjective indicator of housing quality, with positive responses including the categories very poor, poor, and average (as opposed to good or excellent), as it has been shown that tenants of typical low-income housing overestimate the quality of their housing compared to qualified building inspectors (122) (indicator D). Tenure is used as an objective indicator of housing condition, with rental properties counted as a positive indicator of fuel

poverty (indicator E). Home ownership is not a perfect indicator of fuel poverty as it is more prevalent among older people who may have fixed incomes and inadequate occupancy contributing to the likelihood of fuel poverty. However, it has recently been shown that private rental housing in New Zealand is of poorer quality than housing owned by the occupant (39, 40). Additionally, despite an ongoing programme of improvement, many state sector rental properties are also of insufficient thermal quality for occupants to avoid fuel poverty without additional heating (37, 177).

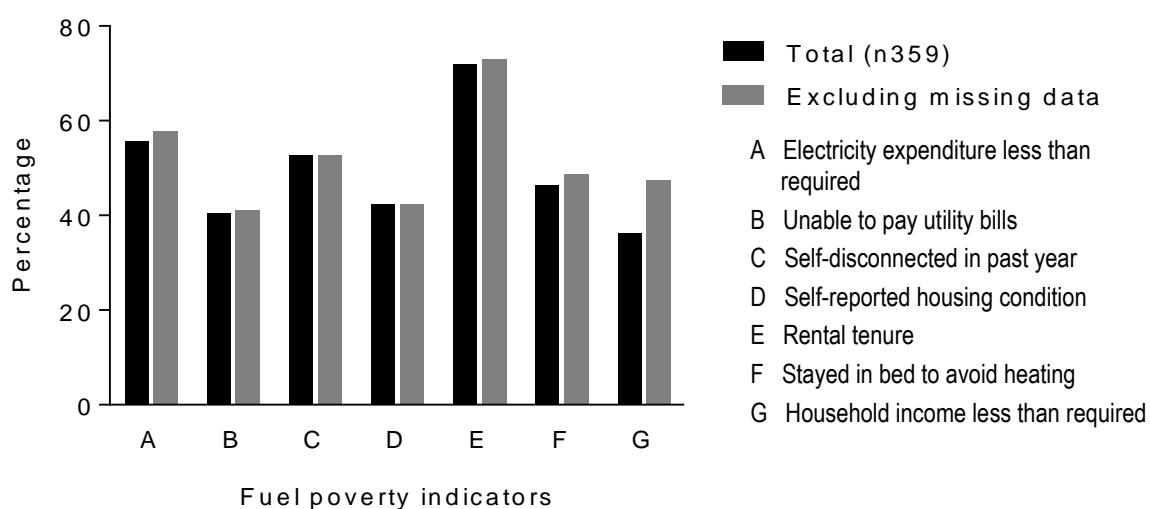
In the absence of questions regarding the available heating sources in 2010 due to survey space constraints, I have selected the question “Have you stayed in bed longer to save on heating costs?”, with “have done a little” or “have done a lot” counted as positive responses, as a subjective indicator of cold indoor temperatures (indicator F). Heating practices and thermal comfort indicators of survey respondents were more fully explored in the follow-up survey in 2011, and these have been incorporated into a composite measure using the 2011 data in the following section.

Household income is a relatively easy measure to assess within the community, as opposed to the current difficulties with assessing housing quality, and can easily be compared to the estimated required household income thresholds in each climate zone as calculated by Lloyd (10). For this reason, the final indicator used in the composite measure is having a household income less than the midpoint estimated required household income to avoid potential fuel poverty in the corresponding climate zone (indicator G).

For these calculations, each respondent was assessed for all seven indicators. Figure 9.1 below shows the proportion of positive responses to each indicator, using the total number of respondents (depicted in black), compared to the proportion of

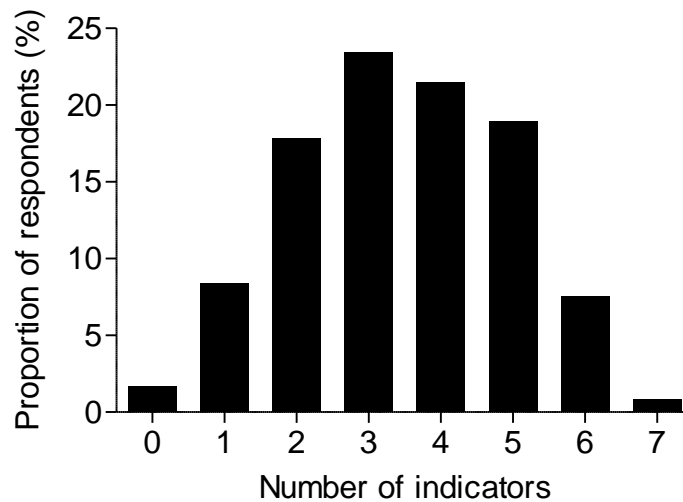
positive responses to each indicator excluding those that had missing data for that indicator (shown in grey). The graph shows that the proportions vary little when those with missing data are excluded from the calculations, with the exception of having a household income below the estimated required amount for the corresponding climate zone (G).

Figure 9.1: Proportion of total respondents reporting fuel poverty indicators compared to proportion excluding missing data



When indicator G is included in the composite measure of potential fuel poverty, Figure 9.2 shows how many indicators were reported by respondents.

Figure 9.2: Total number of indicators reported by respondents using indicators A through G (n = 359)

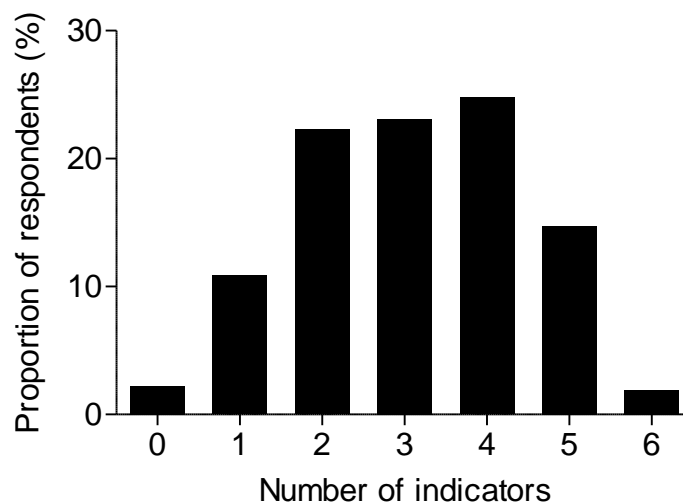


Only 0.8% of respondents had all seven indicators, while using a threshold of three or more indicators, 72.1% of respondents experience fuel poverty. Setting the threshold at four or more indicators finds 48.7% of respondents in potential fuel poverty. Although a threshold of four or more indicators more closely aligns with the estimated rate under the required electricity and household income model explored above, the threshold of three or more offers a rate of fuel poverty using the composite measure that is in between that for fuel poverty under Lloyd’s assumptions and those who are fuel poor or electricity self-rationing (89.6%) under Lloyd’s assumptions. A threshold of three or more indicators may therefore offer the most accurate estimate of households, who are potentially fuel poor in the sense that they are unable to afford sufficient energy, given the likely underestimate of fuel poverty under Lloyd’s assumptions caused by relying on household income when circumstances such as overcrowding lifts the household income level, particularly in Climate Zone 1.

Indicator G is partly an indicator of financial constraint, which can also be assessed using indicators A, B, and C. It is also the only indicator which had sufficient missing data for the figures to be markedly different when respondents with missing

data were excluded from the analysis (shown by figure 9.1). Therefore, it is also interesting to explore the rates of potential fuel poverty using only indicators A through F to make up the composite measure.

Figure 9.3: Number of indicators reported by respondents using indicators A through F (n = 359)



When only the six indicators A through F are used for the composite measure, 64.6% of respondents have a composite score of three or more indicators, while 41.5% have four or more indicators.

A large proportion of respondents were missing data from at least one indicator, with 30.9% missing data when seven indicators were used, although this was lower at 12.6% when only six indicators (A through F) were used. Figures 9.4 and 9.5 explore whether the results would be markedly different when those who were missing data, shown in grey, were excluded from the calculations, showing the number of indicators reported by respondents using both seven and six indicators respectively. The figures illustrate that little difference in the proportion of those reporting any number of indicators is found when those with at least one piece of missing data were excluded.

Figure 9.4: Number of fuel poverty indicators reported using indicators A through G for total respondents compared to excluding respondents with missing data

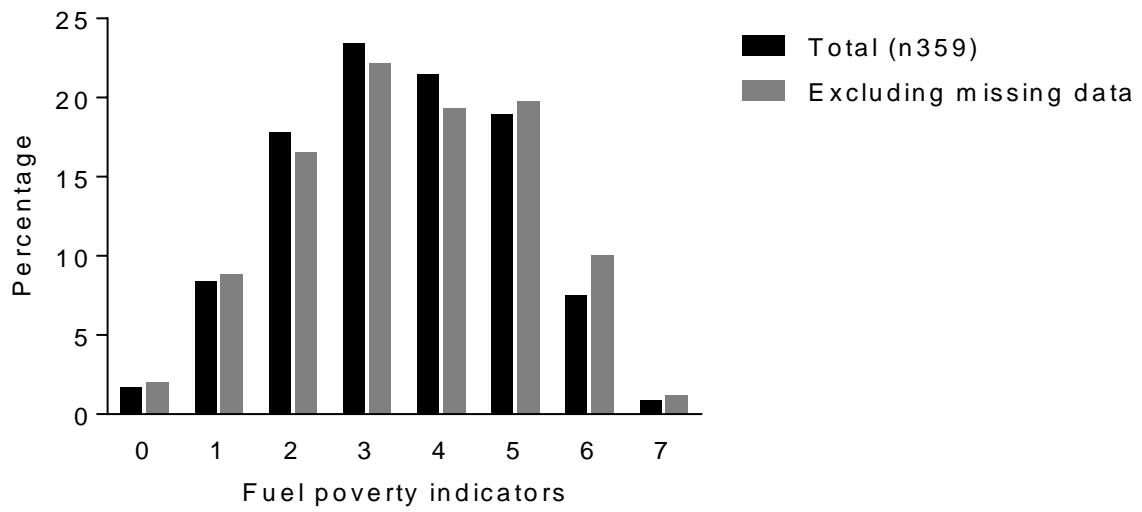
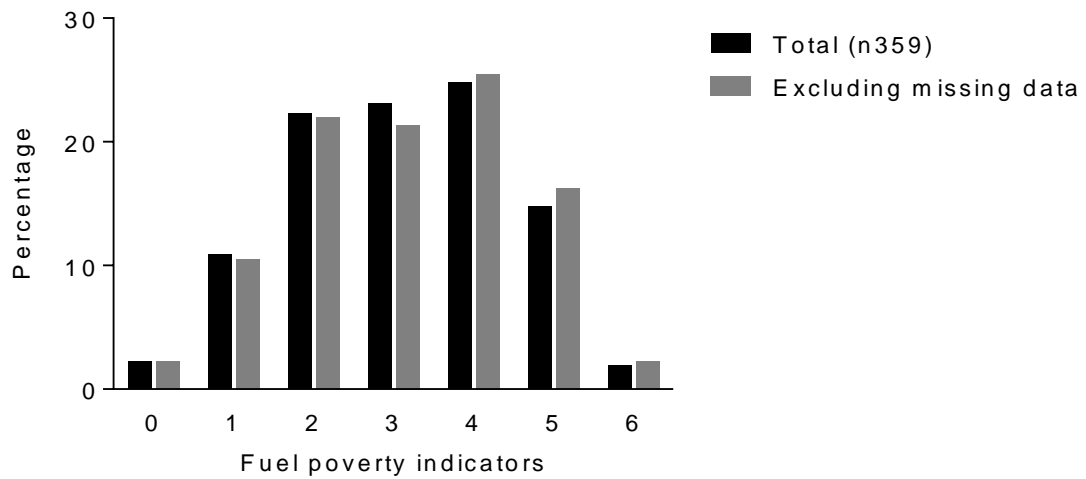


Figure 9.5: Number of fuel poverty indicators reported using indicators A through F for total respondents compared to excluding respondents with missing data



### 2011 Survey composite measure of potential fuel poverty

The 2011 survey more fully explored heating practices and thermal comfort indicators among prepayment meter consumers. When compared to the one available thermal indicator used in 2010 taken from the General Social Survey (indicator F), staying in bed to avoid using space heating (53.1%), all thermal indicators from the follow-up survey had higher rates of positive responses as shown by Figure 9.6. Three indicators had only slightly higher positive responses: agreeing with the statement that prepayment metering encourages restriction of space heating (indicator H, 56.8%); having observed breath condensing indoors on at least one occasion this winter (indicator I, 57.8%); and using electric space heating as their primary heating source (indicator J, 56.8%). Having the house colder than occupants would have liked had the highest number of positive responses at 69.3% (indicator K), and 67.7% (indicator L) reported shivering indoors on at least one occasion this winter.

Figure 9.6: Proportion of respondents reporting selected thermal comfort indicators in 2011



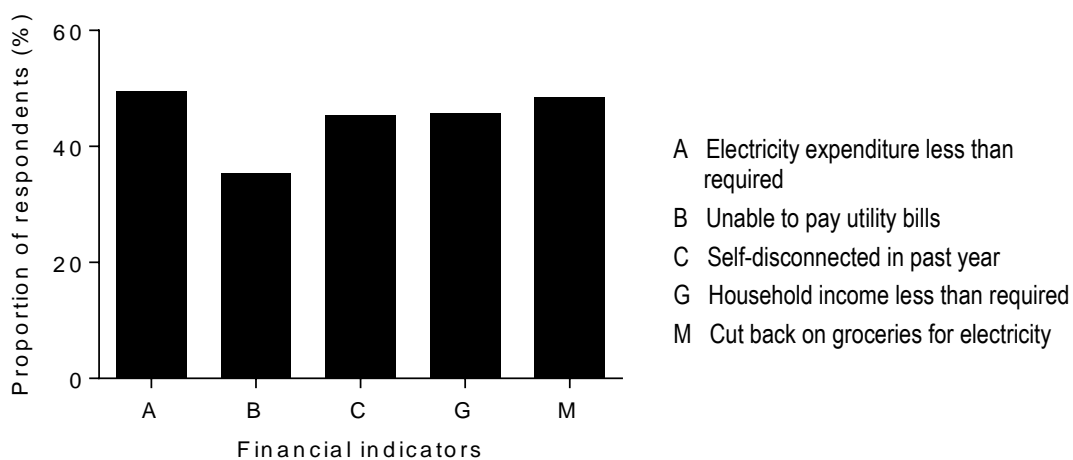
In future development of a questionnaire for a composite measure of fuel poverty, it may be more appropriate to use a less specific question than staying in bed to avoid using space heating to assess thermal comfort. The results above indicate that although some people did not use this particular practice they found their indoor



temperatures insufficiently warm. As previously discussed, although shivering is a physiological response that occurs at different temperatures for different people, most people would agree that having indoor home temperatures cold enough that occupants experience shivering indoors reflects inadequate space heating. Having indoor temperatures colder than preferred is a more subjective indicator as personal preference for indoor temperature also varies, though using this indicator fits with the approach of using consensual measures of fuel poverty under a broader definition that places higher emphasis on qualitative indicators than the traditional Boardman definition. For these reasons, in future development of composite questionnaire for measuring fuel poverty I would suggest that shivering and colder than preferred temperatures be further investigated.

The follow-up survey also asked an additional question indicative of financial constraint to reflect the ‘heat or eat’ self-rationing phenomenon that has been found in earlier international studies: ‘Do you cut back on grocery spending to afford electricity?’ (indicator M). Figure 9.7 compares responses to this indicator to the other indicators of financial constraint used in the composite measure developed from the 2010 survey.

**Figure 9.7: Proportion of respondents reporting selected financial indicators in 2011**



It appears that self-rationing grocery expenses (indicator M, 48.4%) was more common among respondents than other self-rationing indicators such as utility bill stress (indicator B, 35.4%) or running out of prepayment meter credit in the previous 12 months (indicator C, 45.3%). It fell between the indicators of financial constraint taken as the midpoint of the estimated required electricity expenditure and household income ranges to avoid potential fuel poverty calculated by Lloyd (indicator A, 49.5% and indicator G, 45.8%, respectively). Therefore it may also be useful to investigate using this indicator when developing a questionnaire to assess fuel poverty using a composite measure in the general population.

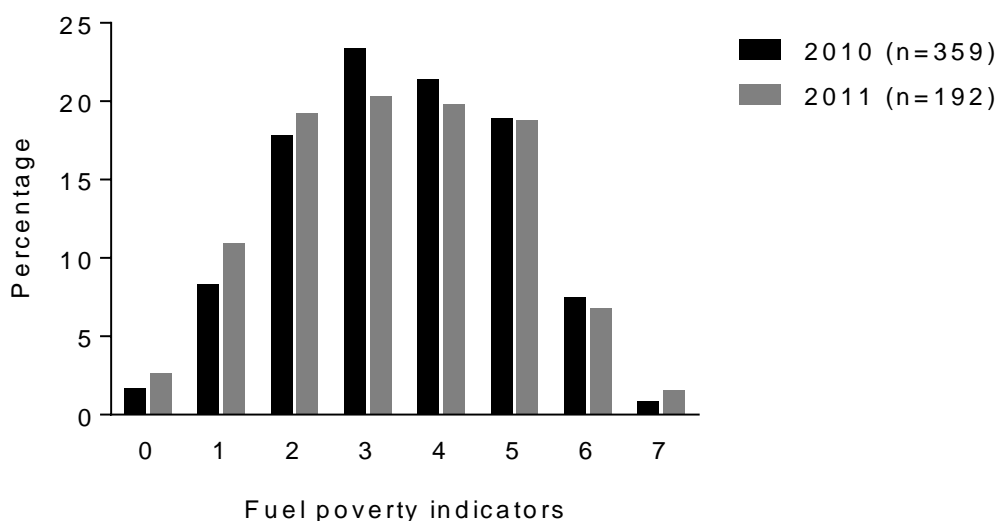
Comparing the results to the seven fuel poverty indicators from the 2010 and 2011 found broadly consistent results (Figure 9.8), with slightly lower rates of composite measure potential fuel poverty among respondents to the follow-up survey (Figures 9.9 and 9.10).

Figure 9.8: Proportion of respondents reporting fuel poverty indicators A through G in 2010 and 2011



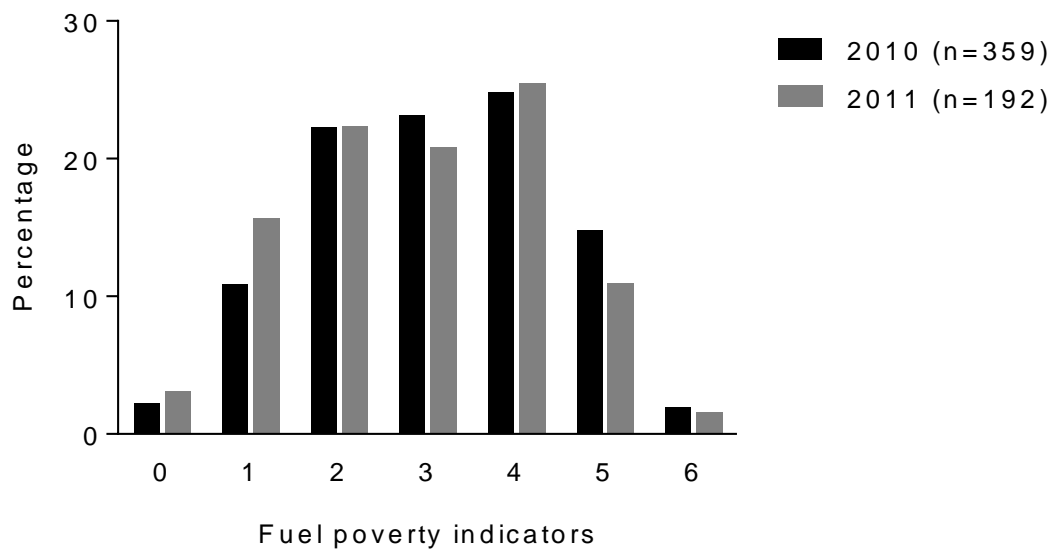
In 2011, using a composite measure made up of the seven indicators A through G, and a threshold of three or more indicators, 67.2% of respondents were potentially fuel poor. When a threshold of four or more indicators is used, 58.9% of respondents were potentially fuel poor.

Figure 9.9: Number of indicators reported by respondents in 2010 compared to 2011 using indicators A through G



Using a composite measure made up of the six indicators A through F (excluding having a household income less than the midpoint of the range estimated to be required to avoid fuel poverty in the corresponding climate zone), and a threshold of three or more indicators, 46.9% of respondents were potentially fuel poor. Using a threshold of four or more indicators, 38.0% of respondents were potentially fuel poor.

Figure 9.10: Number of indicators reported by respondents in 2010 compared to 2011 using indicators A through F



However, as previously discussed, there were some differences found between the groups of those who responded to the follow-up survey, those who consented to follow-up but did not respond, and those who did not consent to follow-up. Therefore the 2010 figures are more likely to be nationally representative results of consumers using prepayment metering.

*Households using prepayment metering experience high rates of composite measure potential fuel poverty*

While this exercise has shown that households using prepayment metering experience high rates of composite measure potential fuel poverty, this cannot be compared to a similar measure of the general population easily. While there are a number of indicators that could be used from existing government surveys (see Chapter Two, section 2.6), they are from several different datasets, for example, the New Zealand Census, the New Zealand Living Standards Survey, the General Social Survey, and the Household Economic Survey. It is possible that some data could be linked across individual households in collaboration with Statistics New Zealand,

though this is a difficult and time consuming process, and is outside the scope of this thesis. There are also several other surveys, from academic studies and private companies, which have measured some fuel poverty indicators, though it is unlikely that these could be usefully combined across households to create a composite measure such as that created here.

While the composite measures used are not directly equivalent, it is interesting to compare the figures of composite potential fuel poverty among prepayment metering with composite measures of fuel poverty in European countries. For example, Thomson and Snell's most recent comparison of composite measure across the European Union used three indicators: ability to keep the home adequately warm; arrears on utility bills in last twelve months; and leaking roof, damp walls/floors/foundation, or rot in window frames or floor (84). Bulgaria had the highest rates of fuel poverty of all of the European Union countries under all of the composite measure scenarios used, ranging from 30.5 – 31.2% (84). In contrast, very low rates of fuel poverty were found in Denmark, Finland and Sweden, for example, in Denmark rates ranged from 2.7 – 4.8% (84). Using the more conservative measure of having four or more indicators of fuel poverty, those using prepayment metering in New Zealand in 2010 had a composite rate of potential fuel poverty ranging from 41.5 – 48.8% (from six or seven indicators, respectively). Using a threshold of three or more indicators, rates ranged from 64.6 – 72.1%.

*Summation: Households using prepayment metering experience greater rates of fuel poverty under all definitions and measures of fuel poverty*

The three measures of fuel poverty explored here illustrate the extent to which different assumptions when defining and measuring fuel poverty can affect the observed rates of fuel poverty in a population. Using the most rigid assumptions that actual expenditure reflects necessary energy use provide the lowest rates of fuel poverty. However, both the international evidence, and the findings from this

research overall suggest that measuring actual expenditure fuel poverty does not truly reflect energy affordability among the population. If a quantitative definition of fuel poverty as in the Boardman definition is used, an estimated required expenditure and income threshold is more appropriate. However, without a current standardised measure of the quality and energy requirements of individual dwellings, measuring required expenditure and income fuel poverty must rely on estimates that use assumptions which may have significant effect sizes. If fuel poverty is more broadly defined, for example, as the inability to afford sufficient household energy, a composite measure of potential fuel poverty such as developed in this thesis finds that households using prepayment metering may be at even greater risk. This research, together with evidence from both other countries and the local setting finds that both households experiencing, and at risk of fuel poverty, tend to self-ration household energy expenditure below required levels for adequate energy services. These results suggest that using a composite measure is likely to better reflect a more valid experience of the phenomenon in the community setting.

In sum, all three measures of fuel poverty explored here support the hypothesis underpinning this thesis, that households using prepayment metering experience higher rates of fuel poverty than the general population. Moreover, exploring the experiences of prepayment metering consumers has shed light on the experience of fuel poverty in New Zealand. However, without accurate measurements of fuel poverty among the general population, it is difficult to ascertain exactly how much more at risk those using prepayment meters are. Nonetheless, these analyses support the conclusions from the individual research phases that better regulation and consumer protections could help to reduce fuel poverty in New Zealand.

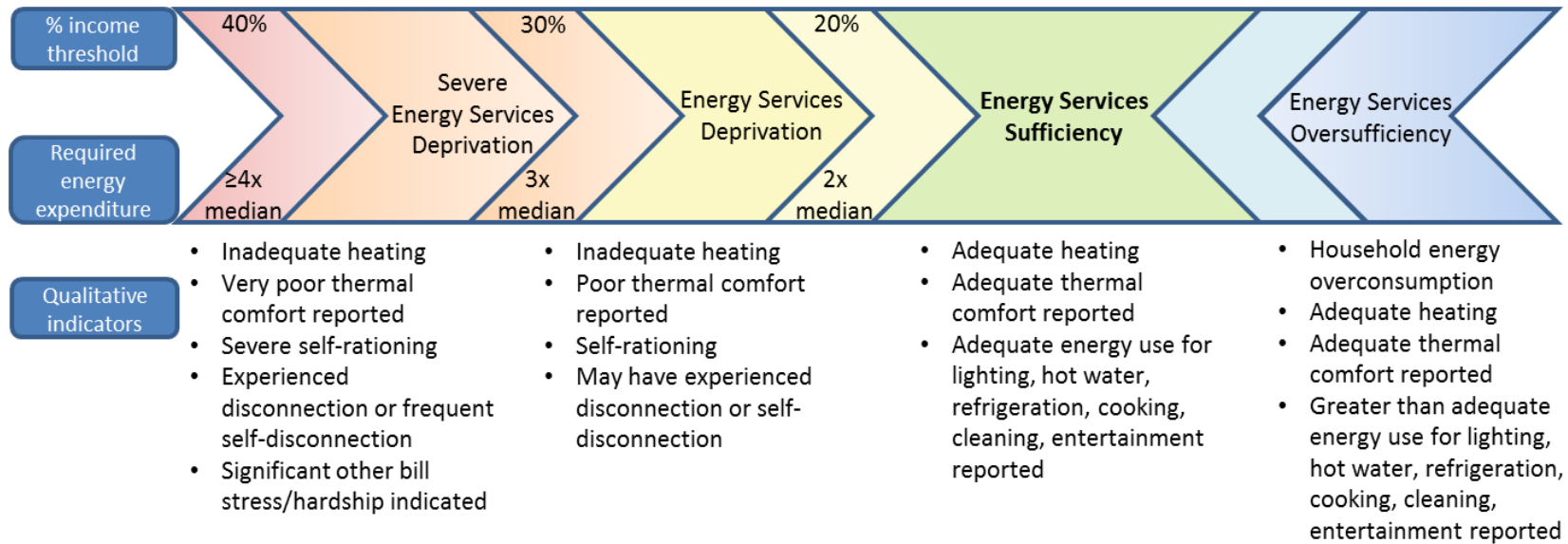
## 9.2 A suggested approach for local definition and measurement of fuel poverty

This chapter now turns to the second goal indicated at the outset, of using the knowledge gained from undertaking both the thesis research and literature review to begin developing a strategy for defining and measuring fuel poverty to be used in the local setting.

As has been described, there are several important factors to consider when developing an official definition and measurement strategy to allow appropriate policies to mitigate fuel poverty to be implemented and evaluated. A particularly difficult problem is the extent to which a definition of fuel poverty enables identification of fuel poor households to usefully target and prioritise policy spending and achieve cost-effective outcomes.

The majority of the literature points towards the benefits of using a scale to measure varying degrees of fuel poverty (see Chapter Two), and this has also been suggested for the local situation (11, 93, 94), and is supported by the above examples. This approach allows for the measurement of energy sufficient households as well as those that experience energy deprivation, and provides a means for viewing both extremes of under and over consumption of energy as problematic. Drawing on the lessons learned from other jurisdictions (8, 61, 63, 72, 80-82), and the initial work undertaken in the local setting (11, 93, 94), Figure 9.11 provides a suggested starting point for a scale of household energy affordability in New Zealand, which provides a definition of fuel poverty and thresholds for measurement. However, significant further development of this scale is required. I have adapted the terminology suggested by McChesney (11), and drawn particularly from the thresholds used in the Scottish setting to provide tentative, though concrete, relative figures for identifying households in each bracket (8).

## Household energy services affordability scale



Energy services deprivation is defined here as occurring when the percentage of income the household *needs to spend* on household energy services exceeds the equivalent percentage of income that is required to purchase the twice the median required energy expenditure for a household with the median household income. Percentage thresholds of income required for estimated median energy expenditure are based on this calculation.

Factors of the calculation for future research include:

Equivalised Household Income – median before housing costs (2009 figure of \$32,500 included above) vs after housing costs  
 Required energy expenditure – median (estimated figure of \$3,400 included above) Correction factors for household occupancy and characteristics should also be considered and updated as improved information on thermal performance of housing becomes available.

Figure 9.11: Scale of household energy services affordability showing relative thresholds based on estimated median energy expenditure and median income before housing costs



The two-way scale and tentative relative thresholds have their limitations and will require significant development for use in the local setting. There is a risk that when defining and naming fuel poverty in the New Zealand setting, a potential argument arises that the World Health Organisation recommended indoor temperatures (66) are unachievable and culturally inappropriate as they are markedly above the current indoor temperatures of local households (9, 188, 189) and unwarranted by local perceptions and expectations of thermal comfort (166). Despite the body of research supporting that these temperature recommendations are maintained in the interests of safeguarding health (66), this argument may override the debate. For these reasons it is important that the defined minimum standard of energy services sufficiency includes a minimum indoor temperature throughout the dwelling of 18°C, although based on the available evidence and World Health Organization recommendations, living room temperatures would ideally be between 20°C and 24°C (66). Consideration of the needs of vulnerable groups, including children, the elderly, and disabled people, along with those who are at home during the day, should also be factored into minimum standards.

This scale is two-directional, indicating that the policy aim should be to move households from both extremes towards Energy Services Sufficiency, acknowledging the balance required to ensure that overconsumption of energy is not encouraged. However, it should not be assumed that because high incomes allow for the potential of overconsumption that this is always the case – for this reason no threshold figures are given at this end of the scale. I have followed the suggestion of Liddell and colleagues (8, 82), that a twice-median required expenditure concept of fuel poverty be readopted, as this was the initial thinking behind the 10% fuel poverty threshold used in the Boardman definition (6, 7, 81).

I have described these thresholds as *required energy expenditures* (elsewhere referred to as *needs to spend* (6, 8)) for household energy rather than *actual energy expenditure*. However, the currently available information requires significant estimation to use

a *required expenditure* definition of fuel poverty in New Zealand. As discussed, required expenditure definitions have been found more appropriate for identifying those in fuel poverty than actual expenditure, largely as the tendency for fuel poor households to self-ration energy consumption results in underestimates of the problem when using actual expenditure in measurement calculations (7, 72, 82).

The figures from the calculations provided by Lloyd (10) have been used to set the tentative income thresholds in the scale. In both of Lloyd's calculations, the estimate of the rate of fuel poverty for Wellington city most closely approximated the total estimate for New Zealand (10, 163). Wellington is also the geographic and climatic middle of the range of cities that calculations were provided for, thus I have used the Wellington figures from the most recent calculation in the present example (10). As outlined previously, those calculations were estimates only, and the threshold levels provided here are also estimates, with increased limitations, and significant further research required to correctly set these thresholds.

Using the average estimated required energy expenditure for Wellington in 2008 to approximate the median, I have assumed the national median required household energy expenditure to be \$3400. According to Perry (306, p66) the median real equivalised household disposable income before housing costs was \$32,500 in 2009 (a figure for 2008 was not provided). Using these figures, the median required energy expenditure approximates 10% of equivalised household income, therefore, the threshold for energy services deprivation (fuel poverty), at twice the median, is 20% of household income – double the figure of British fuel poverty threshold used in the Boardman definition. These figures are used in the scale above, with some hesitation, given the assumptions used in the estimated figures. However, if real equivalised household disposable income after housing costs (\$25,400 in 2009) is used, the required median energy spend approximates to 13%. Therefore, the twice median figure and threshold for fuel poverty, or energy services deprivation, is 26% of household income.

An alternative approach is to base the threshold calculations on the low-income, high-costs definition of fuel poverty suggested for adoption in the United Kingdom, where fuel poor households would have incomes below 60% of the median household income, after household costs and adjusted for household size, in addition to high required energy costs (63, 72). For this calculation, using the above estimated median energy expenditure, the median percentage threshold approximates 22% and the twice median threshold for energy services deprivation is, therefore, 44%.

However, the calculation of required energy expenditure using the Hills (72) approach is more complicated than that used in the scale above, as it is adjusted for household composition and size; though not using a simple floor area adjustment as it is acknowledged that care needs to be taken in order not to set a course for endorsing under-occupancy and energy inefficiency in the wider context (72). The currently suggested definition for adoption by the United Kingdom Government uses the median energy expenditure and includes correction factors for household composition when calculating the required energy expenditure, which includes some adjustment for floor area, but are not solely based on this simpler measure (63, 72). These correction factors are: 1.00 for a couple; 1.15 for a couple with dependent children; 0.94 for a sole-parent household; 0.82 for a single occupant household; 1.07 for other multi-person households (72, p52). Significant further research is required to develop similarly robust correction factors for the local setting if this method is followed, taking into account the local housing stock, heating appliances and fuels, and occupancy. However, critics of the proposed Hills (72) definition have argued that if 60% of the median household income is used, then 60% of the median energy expenditure should also be used (81).

One major disadvantage of both of these approaches is that fuel poverty rates are unaffected by fuel prices because the median expenditure varies with price. Therefore, monitoring of the ratio between fuel prices and household incomes is

also required to indicate household energy affordability (8). The use of another measure of this 'gap' is suggested as an adjunct to the proposed United Kingdom definition (63, 72, 81). There is also a risk in naming these thresholds in that if they are not updated regularly to ensure they are truly relative measures, they will, over time, become absolute thresholds rendering them 'arbitrary' as the 10% figure became in the United Kingdom (8, 72). My recommendation for the local setting is that these calculations are performed on an annual basis to update the percentage income thresholds, and that the monitoring of fuel prices be undertaken and reported alongside the household energy affordability scale described here.

Recent local policy discussion has indicated a preference to avoid using quantitative thresholds in the definition in favour of qualitative indicators only (11, 93, 94). The overseas experience, however, has shown that the inclusion of both quantitative measurements and qualitative indicators may be beneficial to assist with the identification of fuel poor households. It would arguably be more difficult to evaluate the effectiveness of fuel poverty policies if solely qualitative indicators were used to measure population fuel poverty. Based on the research undertaken here, I have offered some qualitative descriptive characteristics of the different levels of household energy services sufficiency. I propose that a short survey tool be developed to be used for the practical identification of the level of energy services sufficiency households are experiencing, similar to that described by Frank et al., (319) (see Chapter Two). These should include a range of fuel poverty indicators, similar to those listed again here to create composite measures of fuel poverty among prepayment meter consumers, with other similar indicators currently used locally (306), and those used overseas as a guide for further development (66, 75, 80, 84, 90).

Fuel poverty indicators used in estimated composite measures of fuel poverty among prepayment consumers:

A Electricity expenditure less than required

- B Unable to pay utility bills
- C Self-disconnected in past year
- D Self-reported housing condition
- E Rental tenure
- F Stayed in bed to avoid heating
- G Household income less than required
- H Agree PPM restricts space heating
- I Observed breath indoors this winter
- J Primarily used electric space heating
- K House colder than preferred
- L Shivered indoors this winter
- M Cut back on groceries for electricity

The present research has suggested that using such indicators in the local setting may provide a means of identification of individual households that would benefit from policy intervention. This is particularly true in the absence of sufficient data about the energy requirements of the housing stock, for example the English House Condition Survey and Standard Assessment Procedure ratings that give measures of the thermal efficiency of the British housing stock (79). However, it should be noted that careful consideration and testing of any identification survey using subjective indicators and how these are phrased will be required. The overseas experience suggests that behavioural practices influencing self-rationing and heating regimes are difficult to predict, and self-reported thermal comfort and fuel poverty indicators have not always been found to have a high correlation with those identified as fuel poor, using either a *needs to spend*, or *actual* expenditure based definition (80, 91). On the other hand, using property and household characteristics to identify homes with cold indoor temperatures has also found insufficient rates of correlation for policy targeting, with behavioural practices identified as a complicating factor when using identification methods based on these objective measurements (325). The available evidence suggests that using a combination of objective and subjective measures to target fuel poor households can provide the best opportunities for successful policy outcomes (80).

Prepayment meter users across the spectrum held positive views about prepayment metering, despite the problems and risks that they also identified. The survey and interview data suggest that these households appreciate the feedback provided by prepayment metering and use this to make choices about how energy is used as well as how much energy is used in their homes. Arguably, for fuel poor households, these choices should not have to be made, and the current prepayment metering systems and governance model in the local setting are providing insufficient protections for these households to fully benefit from the potential advantages of using prepayment metering. The above estimates indicate that a significant proportion of prepayment meter users are experiencing fuel poverty, and would fall into the categories of energy deprived or severely energy deprived in the scale above. However, households that would be classified as energy sufficient or oversufficient and are currently less likely to be using prepayment metering could benefit from prepayment metering to increase consumer awareness of energy use within the home.

Suggestions towards such an approach for local definition and measurement have been made here, though significant further research and development of this scale is required, and debate on the components used for calculating fuel poverty welcomed. However, measuring the proportion of households within the four categories of the suggested household energy affordability scale will provide better information than if hinged on a binary measurement of fuel poor/not fuel poor. This will enable more accurate adjustment of percentage points of household income required for achieving the desired level of household energy services affordability when targeting policy solutions at the low income end of the spectrum. Having a dual quantitative/qualitative identification strategy for household energy services sufficiency will also allow for targeted policy solutions to reduce energy overconsumption, particularly at the high income end of the spectrum.

### 9.3 Conclusions

This chapter has used integration of the mixed method research phases, through further analysis and synthesis of data, results and conclusions, to extend the value of the individual research phases and contribute to the theoretical development of defining and measuring fuel poverty in New Zealand.

This integration has confirmed that households using prepayment metering to pay for electricity are more likely than other households in New Zealand to experience fuel poverty, supporting policy recommendations of the research phases to strengthen regulation of the prepayment metering industry and improve consumer protections to reduce fuel poverty. It supports the assumption that under the current model of use and in the absence of other measures, prepayment metering is a useful proxy for identifying households experiencing, or at risk of, fuel poverty in New Zealand communities. It has also produced suggestions for an evidence-based approach to defining and measuring fuel poverty in New Zealand, which will allow for further policy development, targeting, implementation, and evaluation, to reduce fuel poverty in the local setting.





## Chapter Ten:

### Discussion

#### 10.1 Outline

This thesis has outlined an investigation into aspects of fuel poverty in New Zealand by progressively investigating the outcomes for consumers who use prepayment metering for electricity, through a multiphase mixed methods research programme. It has specifically sought to clarify the advantages and disadvantages of prepayment metering, a market-based strategy for debt management in the electricity sector, and its effects on access to electricity services.

Fuel poverty has most commonly been defined using the Boardman definition, that a household is fuel poor if it *needs to spend* more than 10% of its income on energy (6, 7), which includes adequate heating consistent with World Health Organization guidelines, although there is current academic and policy debate on the definition of fuel poverty both overseas (8, 61, 63, 72, 80, 82) and in the local setting (11, 93). Fuel poverty is an issue separate from general income poverty, with different causes and outcomes, and requires a coordinated policy approach for successful reduction of the problem (7, 63, 72).

This thesis aimed to explore in depth the experiences over time for New Zealand households using prepayment metering, and examine whether they are at increased risk of fuel poverty. Specifically, the objectives of the thesis were to explore in depth the experiences over time for New Zealand households using prepayment metering, and examine whether they are at increased risk of fuel poverty. I also set out to use a multiphase mixed methods research approach to provide a broad range of evidence, with data from the research phases integrated

to increase the value and function of the findings. I intended to use my research evidence, in light of international best practice to provide evidence-based policy recommendations. I used publications arising from the thesis to translate the research to suggest best practice policies for the reduction of fuel poverty and improvement of public health, acting through the pathway of the social determinants of health. Finally, this thesis sought to use the knowledge I gained from undertaking this thesis to suggest an approach to defining and measuring fuel poverty in New Zealand.

I achieved my aim and objectives through undertaking a multiphase mixed methods research programme. I initially analysed secondary data in order to compare pricing between prepayment and standard billing plans. This analysis was followed by a quantitative national postal survey (including some qualitative components), a subsequent follow-up quantitative postal survey (also including some qualitative components), and a qualitative interview study undertaken as part of a larger project outside the thesis. Integrative analysis of data and conclusions of the individual research phases enabled me to explore the outcomes of prepayment metering for children, as well as confirming that prepayment consumers are at greater risk of fuel poverty than the general population. This data integration contributed to theory development by indicating conceptual issues that needed to be considered when defining and measuring fuel poverty in New Zealand. I have provided evidence-based policy recommendations throughout the thesis, which are collated and further discussed below.

This Chapter concludes the thesis. It revisits the framings of fuel poverty put forward in the introductory chapter, initially locating the research within these frames. The findings and implications of the discrete research phases described in Chapters Five to Eight are then summarised and integrated, before returning to the broader issue of fuel poverty in New Zealand. A suggested approach for policy formulation with a focus on fuel poverty and policies which could be used to

address fuel poverty, even in the absence of a focused fuel poverty policy programme, are described. Finally, some concluding remarks highlight key messages of the thesis.

## 10.2 Framing fuel poverty

As posited in the introduction chapter, the multi-faceted nature of fuel poverty makes it at once a (de)regulatory issue, a social justice issue, and a public health issue (see sections 1.3-1.5).

Vital to reducing fuel poverty, this research supports previous evidence that inadequate regulation and government oversight, particularly in the electricity and building and housing sectors, contribute to fuel poverty in New Zealand (9, 10). As this research illustrates, the cost of electricity is a particularly important driver of fuel poverty in New Zealand due to the highly deregulated nature of the market. Moreover, there is a dearth of government policy on the use of prepayment meters, which is problematic given the number of people currently using prepayment, as well as the potential for prepayment meter use to become more common with the installation of advanced metering technologies. The evidence of fuel poverty in New Zealand, strengthened by the findings of the research here indicates, that as in other jurisdictions facing problems with fuel poverty (81, 82, 84), another key area for specific fuel poverty remediation will be the improvement of household energy efficiency, both in increasing building standards and energy efficiency of heating, lighting and appliances.

There is growing concern about the levels of social and income inequalities observable in New Zealand (185). Fuel poverty is a social justice issue that reflects unequal distribution of resources and opportunities, as well as unequal recognition and influence for different societal groups (43). Through confirming that those

using prepayment metering are at greater risk of fuel poverty than the general population, this research has shown that there are inequalities in the New Zealand electricity market between residential consumers. This is in addition to the inequalities evident between industrial, commercial and residential classes of consumers by divergent pricing. Fuel poverty remediation in New Zealand must also include efforts to reduce these as the suggested policies to address problems with prepayment metering in its current form (discussed further below) argue.

Fuel poverty has both direct and indirect health effects, and the research presented here especially supports the premise that the social determinants of health are negatively affected by fuel poverty. The crucial public health implications of fuel poverty have been highlighted by the studies (discussed in detail below). These also caution that definitional debates should not preclude preventive multi-sectoral action, particularly in the face of the present limited political will to acknowledge and address fuel poverty.

### **10.3 Summation and integration of the research findings**

The overseas literature describing the nature of fuel poverty and its outcomes, as outlined in the introductory chapters of the thesis, together with the local evidence that fuel poverty is a significant, though largely ignored, public health and policy problem in New Zealand, precipitated the investigation undertaken here. Similarly, the previously undertaken local qualitative research indicating that prepayment metering posed specific problems for fuel poor households (2), supported by overseas evidence of problems associated with prepayment in other settings (see Chapter Three), triggered the initial exploration of prepayment metering as a means of investigating the outcomes of fuel poverty among a specific and easily identifiable group.

The following diagram illustrates the research aims and findings across the study phases within the overall research programme, consistent with the overall thesis objectives (Figure 9.1). The four studies are depicted in blue, while the integrative analysis of the survey data described in Chapter Seven appears in green.

**Overall thesis research programme aim:**

To explore in depth the experiences over time for New Zealand households using prepayment metering (PPM), and examine whether they are at increased risk of fuel poverty.

**Study 1**

Price Comparison Analysis

**Research Aim**

To investigate whether PPM is a more expensive payment option in NZ.

**Findings**

PPM is more expensive. Further examination of the use of PPM in New Zealand is warranted when considering fuel poverty.

**Study 2**

Nationwide cross-sectional postal survey

**Research Aim**

To investigate the advantages and disadvantages of PPM for consumers.

**Findings**

PPM consumers are highly satisfied with the payment method. Self-disconnection is an extreme outcome of fuel poverty, experienced by 53% of respondents in the past year. Self-disconnection is problematic, lasting 12 or more hours for 38%, and occurring  $\geq 6$  times in the past year for 17% of those who self-disconnected.

**Study 3**

Follow-up Postal Survey

**Research Aim**

To investigate self-disconnection, heating, and self-reported thermal comfort among PPM users.

**Findings**

Self-disconnection remained problematic over time. PPM encourages restriction of space heating in already cold homes. 57% of respondents reported restricting space heating, 68% experienced shivering and 57% seeing their breath condensing in their homes during the winter months on at least one occasion.

**Integrative Analysis**

Examining PPM survey outcomes for children

**Analysis Aim**

To investigate whether outcomes of using PPM differ between households with and without children.

**Findings**

Households with children experience greater financial hardship, and were significantly more likely to cut back on grocery spending, than childless households and report seeing their breath condensing indoors on at least one occasion during the winter.

**Study 4**

Qualitative interview study

**Research Aim**

To qualitatively explore PPM outcomes, and effects on household electricity use and budgeting.

**Findings**

Households report sociotechnical interactions with PPMs that influence household budgeting and management of electricity use. The findings of advantages and disadvantages reflect and support those identified through the surveys.

**Overall research programme key findings:**

Despite high user satisfaction, prepayment metering in its current form contributes to fuel poverty and poor thermal comfort in New Zealand. Prepayment metering is used by households that are at greater risk of fuel poverty than the general population in New Zealand. Negative outcomes of using prepayment metering for vulnerable households and households with children are particularly concerning. Prepayment metering can provide increased feedback to consumers and encourage reductions in electricity consumption. Government policies and regulation could minimise negative outcomes and capture the benefits of prepayment metering. Further development of a fuel poverty definition and measurement strategy will enable policy targeting, implementation, and evaluation.

Figure 10.1: Research aims and findings of study phases within the overall multiphase mixed methods research programme

### 10.3.1 Implications

The findings of the research programme outlined have direct implications for both public health and policy, which are discussed here in turn.

#### *Public health implications*

The findings have confirmed that using prepayment metering in its current form in New Zealand has some negative effects on the social determinants of health for a significant number of households (and even greater numbers of individuals). Prepayment metering is used by around 3% of households nationwide (256). These consumers have been shown here to experience marked financial and material hardship compared to the general population (305). Among those using prepayment metering, home ownership rates and household incomes are low; while tenants of social housing, and both Māori and Pasifika peoples are over-represented. Responses to questions indicating the extent to which households economise on some basic items to afford others found that for four of the indicators, rates of “enforced lacks” of basic items, including staying in bed to keep warm, were at least double those reported in the general population (306).

Although the results suggest that the most current data collected by the regulatory body on the number of households using prepayment may now be outdated, no further collection of data has been reported. Assuming representativeness of the survey samples and using the 2008 figure of 52,664 households using prepayment metering nationally (256), extrapolation indicates broader implications, suggesting that in 2011 around 27,700 (53%) households experienced self-disconnection (305), compared to the figure of 30,000 disconnections for non-payment on standard post-payment billing (160). If households that frequently self-disconnected, defined as 6 or more self-disconnections in the past 12 months, were counted only once, the national rate of disconnection would be increased by 16% (305). Self-disconnection remained problematic over time, as evidenced by the follow-up survey findings and

qualitative data from households that had experienced pervasive difficulty affording electricity over long periods of prepayment meter use.

Self-rationing of electricity, sometimes to extremes that included extensive restriction of hot water, appliance use, lighting, and space heating, was reported during interviews and indicated by the surveys. Prepayment metering was found to encourage the restriction of space heating in already cold homes, with 57.0% (approximating 30,000 households using prepayment metering nationwide) agreeing that using prepayment metering made them cut back on using their heaters. Despite this, 69.0% (36,000) reported homes colder than they preferred, 67.6% (35,000) reported shivering indoors, and 57.2% (30,000) observed their breath condensing indoors, at least once in the past winter.

Among those using prepayment metering, around 54% (28,000 of these households) had children living at the address. Households with children were significantly more likely to report cutting back on grocery expenditure to afford electricity (56.8%) than those without children (41.2%) (119), an outcome of the *“heat or eat”* problem of fuel poverty which has particularly negative effects on child health and development (51, 52, 92, 319). Using the same national figure of prepayment metering above, approximately 16,100 households with children could be expected to experience at least one self-disconnection in the past 12 months, while restricting grocery spending was an outcome that could be expected for approximately 15,900 households with children.

Using different techniques for estimating rates of fuel poverty with the data and conclusions obtained through the empirical research phases found that households using prepayment metering are, as hypothesised, more likely than the general population to experience fuel poverty.



As climate change is arguably the most pressing and important public health problem, any public health investigation needs to consider the broader implications of climate change and related policies (326). Households in or at risk of fuel poverty are in a particularly vulnerable position as they will be less likely to afford adaptive technologies to protect them from anticipated increases in climate variability (143, 144). Without countervailing Government regulations, they may also face increased energy prices as companies pass on the costs of carbon emissions trading to consumers (145, 146). However, the key methods of reducing fuel poverty, which largely focus on increasing the energy efficiency of the housing stock, have few disadvantages and a broad range of co-benefits, including reducing emissions as is urgently required for climate change mitigation (79, 96, 139, 141, 327). The findings of the studies here have also confirmed that through the use of prepayment metering technologies there is the potential for households to make more informed choices about their household energy use, which could have significant advantages for managing energy consumption from an environmental perspective. This practice may also bring risk for vulnerable households to further reduce space heating and restrict indoor temperatures below a healthy range, and increases stress for some households already experiencing significant hardship. However, the argument that the sense of control that this offers may be beneficial, even for some vulnerable households (88, 225), is also supported by the findings.

Local research suggests that significant uptake of prepayment metering by consumers in mid- to high-income households is not presently achievable, largely because prepayment metering in its current form is stigmatised and does not present great enough incentives for higher income groups (239). However, increased uptake of prepayment metering by higher income households is one means of reducing energy consumption from the demand side, through the increased feedback that is provided by prepayment metering technologies (111). This should be considered as part of a broad suite of measures to reduce carbon emissions. Both the survey and

interview data found that the majority prepayment meter users had positive views of prepayment metering, particularly with regards to increased awareness and control of energy use within the home made available through increased feedback.

The results here caution that not all the prepayment metering technologies used locally provide detailed enough information to enhance feedback (305), and support calls for market regulation of metering technologies to ensure that these potential benefits can be harnessed (207, 208). In contrast, the situation in Northern Ireland has shown that prepayment metering can be part of the fuel poverty solution in the presence of a strong regulator (7, 81). In that setting, prepayment metering tariffs are 2% cheaper than standard credit payments, and a technology which overcomes many of the historic difficulties of purchasing credit that disadvantaged prepayment metering consumers, while also providing increased feedback that has resulted in average consumption reductions of 4%. This has achieved market transformation, with prepayment metering now used by around 30% of the population (81, 214).

### *Policy recommendations*

The following policy recommendations relating to fuel poverty, and focussing on prepayment metering directly arise from the research findings (Table 9.1).

**Table 10.1: Prepayment metering policy recommendations directly related to the research findings, indicating studies providing supporting evidence**

| <b>Policy recommendations</b>                                                                                                                                                                                          | <b>Study 1</b> | <b>Study 2</b> | <b>Study 3</b> | <b>Study 4</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|
| That prepayment pricing be required to be at least as cheap (if not a set percentage rate cheaper) as the cheapest possible post-payment plan offered by the same company in the same geographical area.               | ✓              |                |                | ✓              |
| That mandatory reporting of self-disconnection is introduced, and rates are monitored and published in the same way in which disconnection for late or non-payment of post-payment customers statistics are published. |                | ✓              | ✓              |                |
| That hours of possible self-disconnection are restricted to business hours, and that crediting facilities be available at all times when self-disconnection can occur.                                                 |                | ✓              | ✓              | ✓              |
| That minimum credit amounts be lowered.                                                                                                                                                                                |                | ✓              | ✓              | ✓              |
| That additional fees for obtaining a credit balance be curtailed.                                                                                                                                                      |                | ✓              | ✓              |                |
| That minimum informational standards for prepayment metering devices be set.                                                                                                                                           |                | ✓              | ✓              | ✓              |
| That credit purchasing facilities be made more widely available, through increasing numbers of outlet stores, accepting credit card, debit card, telephone, and online payments.                                       |                | ✓              | ✓              | ✓              |
| That inappropriately positioned prepayment meters be relocated, and consideration of functionality and health and safety issues be taken into account in future installations of metering devices.                     |                | ✓              | ✓              | ✓              |

Prepayment metering consumers, who typically experience hardship, are further disadvantaged by pricing structures resulting in their paying more for the same amount of electricity than consumers using other payment methods. The justification for the continued pricing premium is growing increasingly questionable given the advances in available technologies making prepayment metering less expensive to administer (111, 214). These technological advances should also make the mandatory reporting of self-disconnection statistics possible, and rates of self-disconnection, along with frequency and duration of self-disconnection events should be regularly published and monitored.

The inappropriate location of prepayment meters for several households (for example, too high, or in home display units attached to meter boxes outside the

home), particularly highlighted through the interviews and reported in the qualitative answers naming disadvantages in the surveys, is an issue that could be easily remedied (255). It may also reduce self-disconnection events and increase feedback to consumers by removing a barrier to interaction with prepayment meters by households.

Because prepayment metering in New Zealand is almost completely unregulated and is highly market-driven, the current situation is one with significant variation in the services offered to consumers by different companies. While the following recommendations are being met by some companies, it seems that none of these currently represents what could be considered a 'gold standard' prepayment metering service, and all could be improved by the uptake of one or more of the fairly self-explanatory recommendations that: hours of possible self-disconnection are restricted to business hours, and that crediting facilities be available at all times when self-disconnection can occur; minimum credit amounts be lowered; and credit purchasing facilities be made more widely available, through increasing numbers of outlet stores, accepting credit card, debit card, telephone, and online payments.

While the argument that those using prepayment metering should not be purchasing credit via credit cards in order to limit other problem debt is perhaps rational, it is also a judgment that is inconsistent with the other current free-market principles that dominate the area, particularly when other payment methods do not preclude consumers from paying with credit cards over the telephone, for example. It also restricts the access of a potential crediting facility, and excludes the possibility of consumers using a debit card which operates in a similar fashion to a credit card, with the difference being that the card is essentially prepaid. Some additional fees, for example, for applying credit to meters, are perhaps justified, though arguably should be removed to encourage wider use of prepayment and in recognition of the hardship faced by the typical consumer group. Others, such as those currently

charged by one company for obtaining a credit balance, reduce benefits of prepayment metering, in this case through increased feedback, from being obtained. The complete removal of these types of “*junk fees*” is argued for by fuel poverty advocates in the United States of America (215). Similarly, as discussed in Chapter Five, the current services vary in the feedback that is available to consumers, with some providing less information than that of current standard billing invoices, and therefore, it is recommended that minimum informational standards for prepayment metering devices be set.

Further consideration needs to be given to the availability and means for accessing emergency credit, which currently varies by company. Although the survey and interview findings suggest that emergency credit creates unaffordable debt for some households that experience severe hardship, they also indicate that many short duration self-disconnection events – particularly when a household has forgotten to check their meter or has self-disconnected before opening hours of purchasing outlets – may be avoided if a small amount of emergency credit was available and able to be activated at the meter by consumers, as in the United Kingdom (255).

The policy recommendations outlined above focus on prepayment metering policy as one area in which fuel poverty remediation can immediately begin, following the confirmation from the research here that prepayment metering consumers in New Zealand are largely comprised of the fuel poor. While these recommendations fit within the policy area of electricity market governance and regulations, this is only one area of the broader policy arena in which fuel poverty policy is located. Although not directly investigated, broader policy recommendations that support the reduction of fuel poverty are also supported by the research above, as this will benefit the population that has been examined in detail here. For example, the key recommendation arising from the integrative analysis investigating the outcomes of prepayment metering for households with children supports the prioritisation of this

group when targeting fuel poverty policy. The research here has highlighted that the outcomes of fuel poverty on households have crucial flow-on effects on health and wellbeing. For example, the reduction of space heating use in homes that are reported by occupants to be too cold to protect and promote health and the restriction of other spending on necessary items such as groceries.

#### **10.4 Future focus on fuel poverty**

This thesis has been dominated by a narrowed focus on prepayment metering as the chosen identification tool to find households in or at risk of fuel poverty in New Zealand. I now broaden the scope to suggest strategies for future policy and research engagement with the issue of fuel poverty in the local setting. While there are several broad policy areas where existing policy work streams could be strengthened and targeted to mitigate fuel poverty (depicted in blue in Figure 9.2), a specific work stream that focuses on fuel poverty remains a significant policy void (depicted in purple in Figure 9.2). I now turn to discussion of these two approaches to fuel poverty policy development.

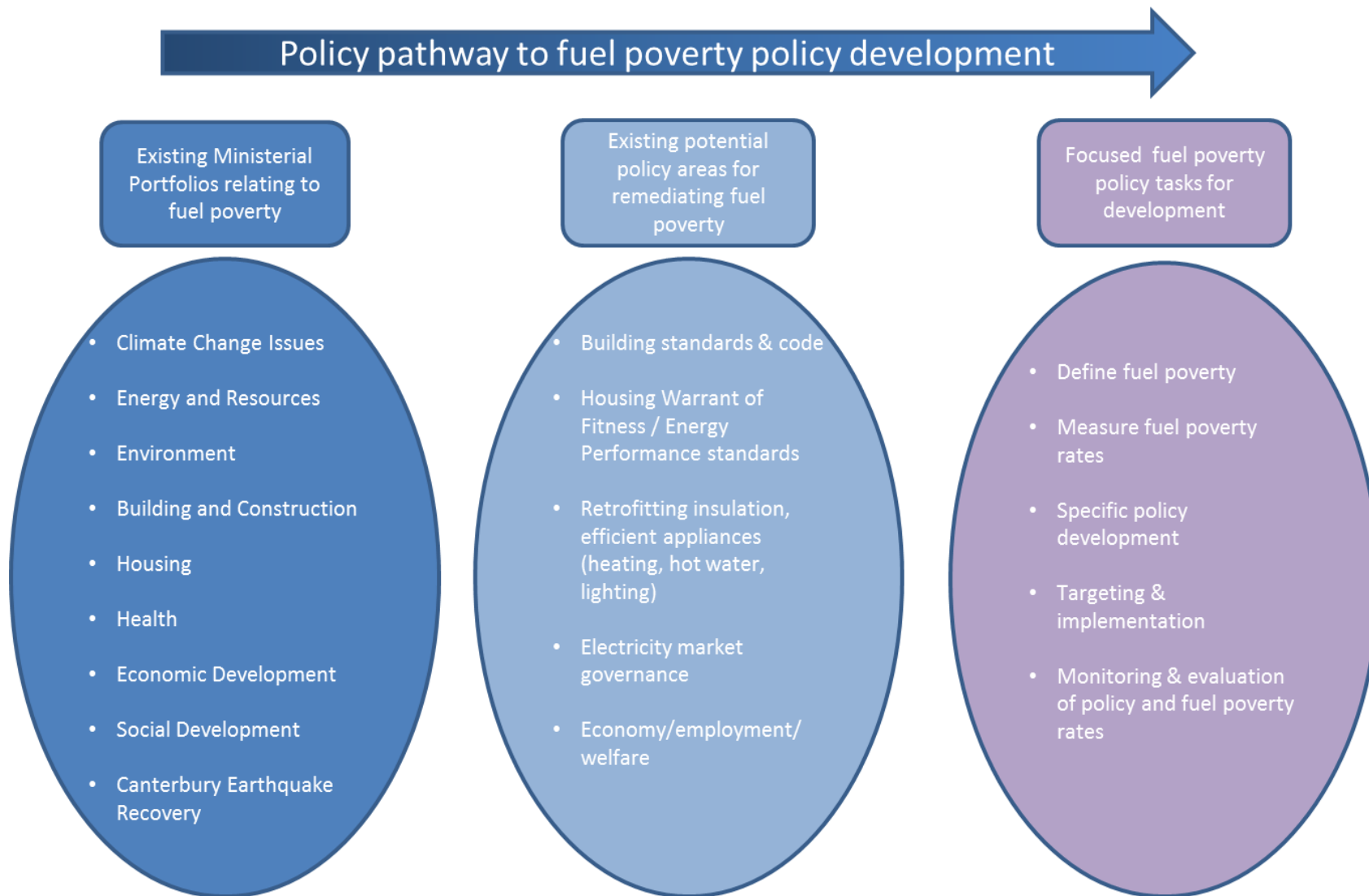


Figure 10.2 Policy map locating fuel poverty

#### **10.4.1 Focused fuel poverty policy development**

As the policy map suggests, one policy option to address fuel poverty, that has been favoured in the United Kingdom and is being developed in Europe, is to advance fuel poverty policies within a specifically focused and coordinated policy work stream. This approach has some advantages in that it acknowledges that fuel poverty is a distinct problem with causes and outcomes separate from other related policy problems such as general income poverty and food insecurity. The use of this approach will require a definition and measurement strategy to be developed for the local setting, such as that suggested in Chapter Nine in order to monitor fuel poverty rates and evaluate any policies introduced that aim to reduce fuel poverty. However, focused fuel poverty policy development seems unlikely within the current political landscape, and it is therefore fitting to explore in depth other policy changes which may be advocated for to reduce fuel poverty.

#### **10.4.2 Existing policy areas for incorporating remedial fuel poverty policies**

If a focused policy approach to addressing fuel poverty is not taken, a more universal approach that incorporates measures to mitigate fuel poverty into existing policy portfolios (highlighted in Figure 9.2 above) could also be beneficial. There are existing policies which could immediately be adjusted to better address fuel poverty, such as extension and targeting of the present Government-funded household energy efficiency scheme towards households at risk of fuel poverty, for example, those using prepayment metering, and of that group, households with children.

In that broader policy sense, Boardman's most recent work has continued her strong argument for vastly improving the energy efficiency of buildings and appliances, with the dual focus of reducing fuel poverty while also reducing future emissions. While in 2005, Boardman and colleagues provided a strategy for reducing residential carbon emissions in the United Kingdom by 60% in 2050 (328), an even more ambitious, though achievable, goal of transformation of all buildings



in the United Kingdom to a zero carbon emissions in 2050 is envisaged through the policy framework outlined in Boardman's January 2012 publication (79). This kind of policy vision is required to transform New Zealand's historically poor housing stock to one that will provide a future in which fuel poverty is curtailed.

The present energy efficiency standards for retrofitting programmes, while an improvement, will not come close to achieving this goal (37) and will potentially "lock-in" a commitment to higher carbon emissions, and fuel poverty, over the lifetime of the building stock (96, 196). They risk following the mistakes of United Kingdom policies where insulation standards increased in several stages that were expensive to administer, and continue to focus on intervention in steps rather than taking a "whole-house" approach to energy efficiency improvements that would "fuel-poverty proof" the dwelling (81). Similarly, the improved insulation standards of the Building Code for new buildings which were introduced in 2007 (37, 196), require regular updating with a sinking lid approach used, not just for insulation and thermal performance, but for the broader energy efficiency of buildings. Barring a lack of political will to regulate, there is no good reason why new build homes today should not at least aim for the *passivhaus* standard, with no active heating or cooling requirements (79). A unique opportunity exists to significantly reduce fuel poverty in the Canterbury region during the extensive rebuilding required following the damaging earthquakes of 2010 and 2011. This area could be a showcase for *passivhaus* dwellings in New Zealand, which would provide future occupants with healthy indoor temperatures and low energy costs, in a city that experiences climate extremes.

Adoption of a mandatory housing 'warrant of fitness' as suggested by the Office of the Children's Commissioner's Expert Advisory Group on Child Poverty (185), among others (141, 186, 187), with a requirement for the display of Energy Performance Certificates at point of sale or rental, and minimum required energy efficiency standards based on these as in the United Kingdom (79), is strongly

recommended as a means of reducing fuel poverty among those in private rental housing. Such a tool would provide data that could feed into the calculations of required energy expenditure for the household energy affordability scale and enable identification of potentially fuel poor households.

Vastly improving the energy performance of the residential building stock will have the co-benefit of reducing pressure on the electricity system through decreasing electricity consumption, which has seen increasing demand in the residential sector, requiring expensive new build generation to maintain future supply. It will also mean that the remaining key driver of fuel poverty in New Zealand will be the price of domestic energy services, in particular electricity, which will require regulation to remedy. The experiment with deregulation and privatisation as a method to control electricity prices has proven this (32, 145, 195), along with the research presented in this thesis.

In that vein, along with the policy recommendations to protect prepayment metering consumers, significantly reducing fuel poverty in New Zealand is likely to require regulation of the domestic electricity market to better protect low income consumers. The qualitative interviews highlighted that the unfortunate case of Mrs Muliaga is still a relevant example for those suffering fuel poverty. However, the introduction of guidelines to protect financially vulnerable and consumers medically dependent on electricity from disconnection, which were subsequently restricted to preventing the disconnection of only medically dependent consumers (329), illustrates the extent to which electricity is no longer considered an essential service and fuel poverty is portrayed as a tragic exception to the rule rather than a public health issue (3). Another example of inadequate regulation is found with the Electricity (Low Fixed Charge Tariff Option for Domestic Consumers) Regulations 2004 (SR 2004/272) legislation<sup>43</sup>, which requires that the fixed tariffs for

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<sup>43</sup> The legislation states that:

households using below 8000kWh (and 9000kWh in Southern areas) be offered at around one third of the price of regular fixed tariffs. However, the variable tariff is often adjusted upwards for low fixed tariff plans, nullifying the effect of the regulation. As noted in Chapter Three, at the time of the price comparison analysis, it appeared that the required Low Fixed Tariff option was not being offered to prepayment metering consumers by three of the (then four) major companies retailing prepayment plans (172). It is unclear whether a required exemption from the Minister of Energy had been obtained, or whether retailers were operating outside of the regulations that were not being adequately enforced. Other measures that may be required include alternative tariff structures, for example progressive pricing (Boardman, 2010) and implementing minimum requirements for smart-metering technologies (Wright, Hendy et al. 2009; International Energy Agency 2011).

Further opportunities for incorporating policies that reduce fuel poverty may be available within other existing Ministerial Portfolio policy areas including Youth Affairs, Senior Citizens, and Pacific Island Affairs, for example. However, this will require some consideration as to which, if any, of these groups are given priority when it comes to targeting fuel poverty policy. Policy in the United Kingdom to date has prioritised the elderly as a group especially vulnerable to the ill-health effects of adverse indoor temperatures (7). However, it has been shown that there may in fact be more children experiencing fuel poverty than older people in the United Kingdom (although this is dependent on the definition and measurement strategy used) (61, 81). The present analysis supports the argument for the

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**Electricity retailers to make low fixed charge tariff options available**

(1) For each of the delivered electricity packages that an electricity retailer supplies to homes in its supply areas, the electricity retailer must make at least 1 low fixed charge tariff option available. (2) To avoid doubt, the obligation in subclause (1) applies with respect to all homes, whether or not they have prepayment meters and irrespective of the degree of load control that the domestic consumer has. <http://www.legislation.govt.nz/regulation/public/2004/0272/latest/viewpdf.aspx> - last accessed 25 November 2012

prioritisation of children in fuel poverty policy targeting (119), along with previous research (although limited in volume), which has demonstrated negative health and wellbeing outcomes of fuel poverty among children (53, 77, 78).

Whichever policy approach is favoured – specific fuel poverty policy development, or universal policy amendment to incorporate fuel poverty policy – the research presented here argues for immediate targeting and implementation of policy to reduce fuel poverty, as a pressing, local public health and social policy problem.

### **10.5 Strengths and limitations**

The multiphase mixed methods research approach used in this thesis has enabled varied approaches to data collection and analyses to examine in detail the advantages and disadvantages of prepayment metering as a means for exploring some of the broad effects of fuel poverty on a sub-group of the population. This design was employed as the very limited knowledge of the consumer experience of using prepayment metering in New Zealand required both exploration and explanation. It facilitated the use of both quantitative and qualitative techniques to enhance the policy-relevance of the research. It also allowed reflectivity and flexibility in the research process. This enabled me to respond to opportunities for including new study phases over the course of the thesis research programme, which further explored findings from previous study phases. It provided a means of triangulating the data, combining and contrasting different research methods and findings (274), which enabled better understanding of the issues for prepayment metering consumers and how fuel poverty is manifested and influenced through the use of prepayment metering in its' present form locally. The successful triangulation of the data increased the rigour of the research, and added strength to the findings (268, 274).

A particular strength of the multiphase mixed methods approach is the ability for researchers to engage in publication and dissemination of the individual phases of research in stages during the research programme (291), in keeping with the dual academic and advocacy roles of public health research (25). This attribute of multiphase mixed methods research design is valuable both for public health research, which places a strong emphasis on the importance of timely dissemination of research in order to enhance opportunities for the translation of research to policy, as well as PhD research, as having publications on completion of the research programme is useful for transitioning to future positions. I have endeavoured to make use of this advantage by submitting papers for publication in academic journals, and disseminating these to policy contacts and responding to media interest during my thesis. Further research dissemination and publications are envisaged.

Although it is difficult to judge the outcomes, it appears that the dissemination of results of the studies outlined here during the course of the thesis may have had some positive effect. *Consumer New Zealand* magazine ran a story on fuel poverty and prepayment metering in May 2012, informed by the earlier price comparison analysis published, and with preliminary results of the surveys made available (47). Further media interest and coverage stemmed from the use of the research and papers provided to the Children's Commissioners' Expert Advisory Group on Solutions to Child Poverty in their Working Paper on Housing Issues (48, 49). I have also subsequently sent copies of the published paper detailing the initial postal survey to the Electricity Authority, who at the outset of the research suggested that it would usefully complement the surveys they had undertaken with retailers, and they have indicated their interest in the findings (although it is unfortunately no longer within the scope of their mandate, so is unlikely to result in translation to policy).

The most significant limitation of this thesis is that I have chosen to focus on one subset of the population likely to experience fuel poverty, those using prepayment metering, and have (with the exception of the inclusion of two of the participants of the qualitative study) not investigated other groups. For several reasons, I believe that the benefits of doing this outweighed the shortcomings. As noted, fuel poverty has not been picked up by the Government as a policy priority, and this was a major influence in my decisions to focus my research efforts on consumers using prepayment metering. I felt that highlighting where the disadvantages of a market-based approach lie and suggesting practical policy options for reducing these, seemed a more likely route for achieving some policy change than, for example, attempting to define and measure fuel poverty in New Zealand, which was unlikely to be politically palatable and adopted by the Government at this stage. Without an official definition of fuel poverty, it is impossible to identify 'officially' fuel poor households, so any research would be based on a fit-for-purpose definition of fuel poverty; in this case I have focussed on those using prepayment as a subset likely to have a larger proportion that would be defined as fuel poor, or at risk of fuel poverty. This approach also enabled the exploration of using self-reported thermal comfort indicators in this population, which identified that many households using prepayment metering in New Zealand employ the coping strategies typical of those in, or at risk of, fuel poverty and, or, cold homes. It did not preclude evidence to highlight the negative effects of fuel poverty on households or to support policy strategies to ameliorate fuel poverty from being gathered, which could be used to contribute to increasing the profile of fuel poverty as an important policy issue.

Other limitations include those of the individual studies that I have outlined in the preceding chapters. These main limitations were the potential for bias in the postal surveys and the recruitment issues of the interview study; the latter preventing the intended aim of thoroughly investigating the experiences of those

experiencing, or at risk of, fuel poverty who had sought budgeting advice but had not previously been using prepayment metering to pay for electricity. This would have enabled better contrasting of how those households budget for electricity without the reported engagement with prepayment metering technologies.

## 10.6 Future fuel poverty research

As has been described in Chapter Nine, significant research is required to further develop a definition of fuel poverty and suitable measurement scales and identification tools to be used in policy implementation and evaluation in the local setting.

The research described here has shown that the majority of electricity consumers using prepayment metering report that they have practical benefits, including increased control and awareness of household electricity consumption, due to the increased feedback that prepayment metering can provide where sufficient information is given through in home display units. However, the extreme outcome of self-disconnection is a particularly punitive incentive, and alternatives to prepayment metering, such as the use of informative billing and in home display devices which could provide some of the benefits of increased consumer information and control of home energy use without the risk of self-disconnection, should also be further explored (10). These may be especially beneficial to vulnerable households for whom the outcomes of self-disconnection are likely to be problematic and present health risks.

The research undertaken here has also highlighted that the effects of fuel poverty may be particularly detrimental for children, and that households with children, that use prepayment metering for electricity, are more vulnerable to experiencing fuel poverty. Yet very little research has been undertaken specifically investigating

the effects and outcomes of fuel poverty among children (53, 99, 118, 119). Even less research has been undertaken *with* children to explore their experiences of fuel poverty. A rare exception from Wales describes children's experiences of and coping strategies for fuel poverty (53). Recent innovative New Zealand research undertaken on the perspectives of children on neighbourhood walkability included methodological designs that privileged children's knowledge and found them capable collaborators as well as research participants (330, 331). These methods could be usefully adapted to provide local information on the experiences and outcomes of fuel poverty among children.

## 10.7 Conclusion

Fuel poverty is a pervasive public health and policy problem that typifies inequalities. Despite this, there is a continued lack of public health framing of the problem locally, where the consequences are portrayed as tragic exceptions, rather than an outcome of broad policy failure. Fuel poverty is separated from general poverty by differing causes, outcomes, and policies for remediation, all three of which largely hinge on the energy efficiency of housing and appliances. In New Zealand, more than in other jurisdictions, fuel poverty is driven by electricity prices and exacerbated by inequalities within the residential electricity market, as well as inequalities between prices for industrial, commercial and residential consumer classes. Recent discussions of the most appropriate definitions and measurement strategies of fuel poverty in academic and policy settings are on-going; however, this should not prevent the introduction of measures to tackle this important problem. Lessons can be taken from the overseas experience, particularly from the United Kingdom, where policies to address fuel poverty have been implemented with varying success.



In the absence of robust information on fuel poverty in New Zealand, the situation for prepayment meter consumers, who are at greater risk of experiencing fuel poverty than the general population, has been progressively investigated here, finding that these consumers would benefit from new forms of Government intervention. Prepayment metering is currently a more expensive method for residential consumers to purchase electricity. Prepayment metering consumers are typically those in households facing financial and material hardship, and the use of this payment method unjustifiably contributes further to their difficulties. This research supports the assumption that under the current model of use and without other practical measures, prepayment metering is a useful proxy for identifying households experiencing, or at risk of, fuel poverty in New Zealand communities. Negative outcomes that present clear health threats result from the currently marketed prepayment metering schemes available locally.

The situation in Northern Ireland, where market transformation to high rates of prepayment meter use has been influenced by a more stringent regulatory environment, is a model example of using prepayment metering as an empowering tool to contribute to the reduction of fuel poverty. By comparison, the local situation illustrated by these studies can be viewed as an unfortunate lesson from a liberalised market of how prepayment metering can exacerbate fuel poverty. Individually, these studies indicate that disadvantages of prepayment metering increase fuel poverty in New Zealand, and that Government intervention could reduce these negative effects, thus enabling prepayment metering to enhance household budgeting and reduce electricity consumption, while having the important co-benefit of also reducing carbon emissions. Collectively, these studies provide a volume of evidence that warrant immediate and effective Government intervention to address serious market failure in the prepayment metering sector and protect the most vulnerable consumers using prepayment metering.

The qualitative data presented here corroborates the evidence found by the surveys that, for the group of consumers experiencing severe fuel poverty, the use of prepayment metering serves only to hide their difficulties. It forces them to take extreme measures to restrict their electricity use to levels well below those most people would accept enable normal modern living, including persistently experiencing unhealthily cold indoor temperatures and, or, to suffer frequent, and sometimes extended, periods of self-disconnection. Despite this, prepayment metering was viewed positively, as it is a useful budgetary tool even for those in this situation; although they would prefer to be able to use more electricity if it was affordable, they appreciate the increased control that using prepayment metering has provided as it enables them to better make choices about the prioritisation of electricity end uses in their homes.

The question remains, to what extent we, as a community, believe these choices should have to be made? If we agree that electricity is indeed an essential service required to participate fully in modern society, a rights-based arguments to electricity supply applies to some extent. It is time to reflect on the evidence provided by these and other studies, that the current governance model of the New Zealand electricity market is not achieving, nor will it achieve, acceptable outcomes for residential consumers. Continued encouragement for consumers to engage with the market is clearly not going to address the market failure currently occurring, particularly for prepayment metering consumers for whom there is very little market competition. As demonstrated in this thesis, further privatisation of the electricity sector cannot be expected to replace the need for regulations to protect residential consumers nor improve electricity affordability, particularly for those using prepayment metering. Until the issue of fuel poverty overcomes a lack of political will and achieves strategic policy focus in New Zealand it is evident that implementing the recommendations suggested regarding the prepayment sector of

the electricity market would go some way towards eliminating one local driver of fuel poverty.

Fuel poverty is a complex and challenging, though not insurmountable, problem. The key policy solution to fuel poverty lies in procuring rapid and vast improvements to household energy efficiency that we now have the knowledge and technology to achieve. The remaining challenge will be to implement the bold policy vision and strong regulatory frameworks required to ensure that these technologies are made available across the entire current and future housing stock, taking care to ensure that further inequalities are not produced. The clear health benefits and environmental co-benefits of such policy will transform New Zealand's housing stock, which has historically provided little protection from the elements, to modern, sustainable, housing, which frees occupants from avoidable fuel poverty and its ill-health effects.



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## Appendix One: Survey 2010 Mail Contents and Protocol

This appendix includes copies of the documents (excluding envelopes) outlined in the order detailed in the mailing protocol set out in Table 5.1, first appearing in Chapter Five. Where letters differ by electricity company, all three have been included, however only one information sheet has been included as an example, as these were identical apart from the having the different electricity companies identified in the contents. Letters from electricity companies were sent on their letterhead stationery, letters from me were sent on Department of Public Health, University of Otago, Wellington letterhead.

**Table 9.1: Mailing Protocol - Electricity Prepayment Meter Users Survey 2010**

| <b>Mail-out</b> | <b>Company 1, 2, and 3 mail-out dates</b>       | <b>Contents</b>                                                                                                                                                                                                                                                                                        | <b>Sent to</b> |
|-----------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Mail 1          | 1. 14/09/2010<br>2. 22/09/2010<br>3. 28/09/2010 | Pre-notification letter from Electricity Company<br>Standard sized Electricity Company envelope                                                                                                                                                                                                        | All 768 sample |
| Mail 2          | 1. 21/09/2010<br>2. 01/10/2010<br>3. 05/10/2010 | Cover letter from Electricity Company<br>A4 sized Electricity Company envelope<br>Letter from University of Otago<br>Information sheet from University of Otago<br>Consent form from University of Otago<br>Questionnaire from University of Otago<br>Return prepaid envelope from University of Otago | All 768 sample |
| Mail 3          | 1. 06/10/2010<br>2. 20/10/2010<br>3. 15/10/2010 | Reminder postcard (co-branded with Electricity Company and University of Otago)                                                                                                                                                                                                                        | Non-responders |
| Mail 4          | 1. Not sent<br>2. 04/11/2010<br>3. 03/11/2010   | Cover letter from Electricity Company<br>A4 sized Electricity Company envelope<br>Letter from University of Otago<br>Information sheet from University of Otago<br>Consent form from University of Otago<br>Questionnaire from University of Otago<br>Return prepaid envelope from University of Otago | Non-responders |
| Mail 5          | 1. 10/11/2010<br>2. 23/11/2010<br>3. 24/11/2010 | Cover letter from Electricity Company<br>A4 sized Electricity Company envelope<br>Letter from University of Otago<br>Information sheet from University of Otago<br>Consent form from University of Otago<br>Questionnaire from University of Otago<br>Return prepaid envelope from University of Otago | Non-responders |

14 September 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Customer Care Team  
Private Bag 3131  
Waikato Mail Centre  
Hamilton 3240  
T. 0800 300 400  
F. 0800 110 999  
E. [info@genesisenergy.co.nz](mailto:info@genesisenergy.co.nz)  
W. [genesisenergy.co.nz](http://genesisenergy.co.nz)  
Genesis Power Limited  
Trading as Genesis Energy

Dear Householder

We are writing to ask for your help with a study being undertaken by Kimberley O'Sullivan at the University of Otago. Kimberley's study aims to understand the advantages and disadvantages of using prepayment meters to pay for electricity.

In the next few days you will receive a request to participate in a postal survey about using your prepayment meter to pay for electricity.

Genesis Energy is supporting this study as it will help us to better understand the needs and views of our customers who use prepayment meters. The survey will take approximately 20 minutes of your time. We hope you will assist us by participating in this survey.

We'd like to assure you that we have not given your personal details to the University of Otago. It will be your choice if you wish to provide your personal details when you complete the survey. Genesis Energy will not see your completed survey however the University of Otago will supply Genesis Energy with anonymised overall results.

On completion of the survey being returned, the University of Otago will send you a \$20 supermarket voucher to thank you for your time. Please make sure that you write your name and address on the back of the survey form in the space provided so that the voucher can be sent out to you and the research team can contact you if necessary about the study.

We hope that you enjoy completing the survey and the opportunity to voice your thoughts and opinions on using prepayment meters to pay for electricity.

Once again we thank you for your time and support in this independent research.

Regards

SIGNATURE

NAME  
Sales & Marketing Manager

22 September 2010

Address 1  
Address 2  
Address 3  
Address 4 Postcode

Dear PrePower customer

**University of Otago survey about prepayment electricity meters**

As a Contact Energy PrePower customer, the University of Otago would like your assistance to answer a survey. A study is being undertaken to understand the advantages and disadvantages of using prepayment meters to pay for electricity, and the University is keen to hear your views.

**Next step**

In the next few days, you will receive a survey to complete about using prepayment meters to pay for electricity. It will take approximately 20 minutes to complete. If you choose to participate, the University of Otago will send you a \$20 supermarket voucher as a thank you gift. (Just remember to write your name and address on the back of the survey).

**All your details are confidential**

We'd like to assure you that all your personal details remain confidential to Contact and we are sending all correspondence on the University of Otago's behalf. Contact will not see your individual answers, but we will be supplied with overall results.

Contact supports the study as it will help us to better understand the needs and views of our PrePower customers. We hope you enjoy the opportunity to voice your thoughts and opinions.

If you have any questions, please call the University of Otago on 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz)

Kind regards

SIGNATURE

NAME  
Manager Customer Marketing

28 September 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Dear Householder

We are writing to ask for your help with an important study being undertaken by Kimberley O'Sullivan at the University of Otago that will help to understand the advantages and disadvantages of using prepayment meters to pay for electricity.

In the next few days, you will receive a request to participate in a postal survey about using your prepayment meter to pay for electricity.

Mercury Energy supports the University of Otago's study as it will help us to better understand the needs and views of our customers who use prepayment meters. The survey will take approximately 20 minutes of your time. We hope you will assist us by participating in this survey.

We'd like to assure you that we have not given your personal details to the University of Otago. It will be your choice if you wish to provide your personal details to the University of Otago when you complete the survey. Mercury Energy will not see your completed survey however the University of Otago will supply Mercury Energy with overall anonymised results.

On completion of the survey being returned, the University of Otago will send you a \$20 supermarket voucher to thank you for your time. Please make sure that you write your name and address on the back of the survey form in the space provided so that the voucher can be sent out to you.

We hope that you enjoy completing the survey and the opportunity to voice your thoughts and opinions on using prepayment meters to pay for electricity.

Once again we thank you for your time and support in this independent research.

Regards

SIGNATURE

NAME

Community Relations



21 September 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Customer Care Team  
Private Bag 3131  
Waikato Mail Centre  
Hamilton 3240  
T. 0800 300 400  
F. 0800 110 999  
E. [info@genesisenergy.co.nz](mailto:info@genesisenergy.co.nz)  
W. [genesisenergy.co.nz](http://genesisenergy.co.nz)  
Genesis Power Limited  
Trading as Genesis Energy

Dear Householder

We recently wrote to you advising you we are helping Kimberley O'Sullivan at the University of Otago with a study to find out what the advantages and disadvantages are of using prepayment meters to pay for electricity.

Enclosed is a letter from Kimberley O'Sullivan, along with:

1. an information sheet explaining the study;
2. a consent form for you to sign and return;
3. the survey questionnaire; and
4. a reply paid envelope to return the completed survey and consent form to the University of Otago.

The survey will take approximately 20 minutes of your time.

We'd like to assure you again that we have not given your personal details to the University of Otago. It will be your choice if you wish to provide your personal details when you complete the survey. Genesis Energy will not see your completed survey however the University of Otago will supply Genesis Energy with anonymised overall results.

Genesis Energy supports this study as it will help us to better understand the needs and views of our customers who use prepayment meters.

If you do not wish to be involved with this study please call the study helpline on 0800 100 884 and give the study team the unique ID code that you will find on the front of the survey form so you can be removed from the mailing list. This ID code enables you to remain anonymous to the study team.

We hope you will assist us by participating in this survey with the University of Otago.

Regards

SIGNATURE

NAME  
Sales & Marketing Manager

21 September 2010

Dear Householder

I am currently completing a research project through the University of Otago, to help understand the advantages and disadvantages of using prepayment meters to pay for electricity in New Zealand. As part of this research I am asking people who use prepayment meters to share their thoughts and opinions.

Your address was one of a small number that was randomly selected from pool of households who use prepayment meters for electricity with Genesis Energy. Any household member who can tell us about using the prepayment meter at this address and who is over 18 years old may complete the survey.

Your views are really important to us. Please help us with our research by completing the enclosed survey questionnaire and posting it back in the reply paid envelope. The questionnaire will only take around 20 minutes to complete.

Your participation is voluntary. We ask that you complete every question where possible. The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. Your name and address will only be used to contact you about the study, and will only be seen by members of the research team. We will never show Genesis Energy your survey form. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

I appreciate your time to participate in this study. As a token of our appreciation for taking the time to complete and return the survey, you'll receive a \$20 supermarket voucher. Genesis Energy have not given me your personal details, so to receive the voucher and to enable us to contact you if necessary, please fill out your name and address in the space provided on the back of the survey.

If you decide to participate, please read and sign the enclosed consent form, and post it back to me, together with your completed questionnaire.

If you do not wish to be involved with this study please call the study helpline on 0800 100 884 and give the study team the unique ID code that you will find on the front of the survey so you can be removed from the mailing list. This ID code enables you to remain anonymous to the study team. Not taking part in the study will not affect your electricity supply or disadvantage you in any way.

You'll find an information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz) under *Electricity Prepayment Meter Users Study*.

If you have any questions, please don't hesitate to contact me. You can either call our toll free number 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

I hope that you enjoy completing the survey and the opportunity to voice your thoughts and opinions on using prepayment meters to pay for electricity. I look forward to receiving your survey response.

Yours sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study

30 September 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Dear Sir/Madam

**University of Otago survey about prepayment electricity meters  
– survey enclosed**

We recently wrote to you about a survey the University of Otago is doing to understand the advantages and disadvantages of using prepayment meters to pay for electricity. Contact supports the study as it will help us better understand the needs of PrePower customers.

**Completing the survey**

It would be great if you could assist the study by completing the enclosed survey. Don't forget, if you choose to participate, the University of Otago will send you a \$20 supermarket voucher as a thank you gift. (Just remember to write your name and address on the back of the survey).

Enclosed is an introductory letter from Kimberly O'Sullivan of the University, along with:

1. an information sheet explaining the study;
2. a consent form for you to sign and return;
3. the survey questionnaire; and
4. a reply paid envelope to return the completed survey and consent form to the University of Otago.

**All your details are confidential**

We'd like to reassure you again you that all your personal details remain confidential to Contact and we are sending all correspondence on the University of Otago's behalf. You can answer the survey anonymously if you wish. Contact will not see your individual answers, but we will be supplied with overall results.

**If you do not wish to complete the survey**

If you do not wish to be involved with this study, please call the University of Otago helpline on 0800 100 884 so we can remove your details from the mailing list. The study team will need your survey unique ID code, which you will find on the front of the survey. This ID code enables you to remain anonymous to the study team. If you choose not to take part, this will not affect your electricity supply or disadvantage you in any way.

Thanks for your help.

Kind regards

SIGNATURE

NAME  
Manager Customer Marketing

30 September 2010

Dear Householder

I am Kimberley O'Sullivan, and am leading a University of Otago research team to understand the advantages and disadvantages of using prepayment meters to pay for electricity in New Zealand. Your address is one of a small number that has been randomly selected from a pool of Contact PrePower customers.

By completing the enclosed survey, you will be helping us with our research and also helping Contact to better understand your needs.

### **Completing the survey**

Any household member who can tell us about using the prepayment meter at this address, and is over 18 years of age may fill in the survey. It will take approximately 20 minutes to complete. Please try and complete every question. Once you have finished it, just pop it in the reply paid envelope along with the signed consent form.

Don't forget, we will send you a \$20 supermarket voucher as a thank you gift if you complete the survey. (Just remember to write your name and address on the back of the survey).

### **All answers are confidential**

The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. The name and address you supply for the supermarket voucher will only be seen by members of the research team. We will never show Contact your survey form. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

### **If you do not wish to complete the survey**

If you do not wish to be involved with this study, please call the University of Otago helpline on 0800 100 884 so we can remove your details from the mailing list. The study team will need your survey unique ID code, which you will find on the front of the survey. This ID code enables you to remain anonymous to the study team. If you choose not to take part, this will not affect your electricity supply or disadvantage you in any way.

### **Need more information?**

Please read the information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on the website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz). Just search under *Electricity Prepayment Meter Users Study*. The Housing and Health Research Programme (Healthy Housing) is part of the University of Otago.

If you have any questions, please don't hesitate to contact me. You can call 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

I hope that you enjoy completing the survey and the opportunity to voice your thoughts and opinions on using prepayment meters to pay for electricity. Thank you for your time.

Yours sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study

5 October 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Dear Householder

We recently wrote to you advising you that Mercury Energy is helping Kimberley O'Sullivan at the University of Otago with a study to find out what the advantages and disadvantages are of using prepayment meters to pay for electricity.

Enclosed is a letter from Kimberly O'Sullivan, along with:

1. an information sheet explaining the study;
2. a consent form for you to sign and return;
3. the survey questionnaire; and
4. a reply paid envelope to return the completed survey and consent form to the University of Otago.

The survey will take approximately 20 minutes of your time

We'd like to assure you again that we have not given your personal details to the University of Otago. It will be your choice if you wish to provide your personal details to the University of Otago when you complete the survey. Mercury Energy will not see your completed survey however the University of Otago will supply Mercury Energy with anonymised overall results.

Mercury Energy supports the University of Otago's study as it will help us to better understand the needs and views of our customers who use prepayment meters.

On completion of the survey being returned, the University of Otago will send you a \$20 supermarket voucher to thank you for your time. Please make sure that you write your name and address on the back of the survey form in the space provided so that the voucher can be sent out to you.

If you do not wish to be involved with this study please call the study helpline on 0800 100 884 and give the study team the unique ID code that you will find on the front of the survey form so you can be removed from the mailing list. This ID code enables you to remain anonymous to the study team..

We hope you will assist us by participating in this survey with the University of Otago.

Regards

SIGNATURE

NAME  
Community Liaison

5 October 2010

Dear Householder

I am currently completing a research project through the University of Otago, to help understand the advantages and disadvantages of using prepayment meters to pay for electricity in New Zealand. As part of this research I am asking people who use prepayment meters to share their thoughts and opinions.

Your address was one of a small number that was randomly selected from pool of households who use prepayment meters for electricity with Mercury Energy. Any household member who can tell us about using the prepayment meter at this address and who is over 18 years old may complete the survey.

Your views are really important to us. Please help us with our research by completing the enclosed survey questionnaire and posting it back in the reply paid envelope. The questionnaire will only take around 20 minutes to complete.

Your participation is voluntary. We ask that you complete every question where possible. The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. Your name and address will only be used to contact you about the study, and will only be seen by members of the research team. We will never show Mercury Energy your survey form. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

I appreciate your time to participate in this study. As a token of our appreciation for taking the time to complete and return the survey, you'll receive a \$20 supermarket voucher. Mercury Energy have not given me your personal details, so to receive the voucher and to enable us to contact you if necessary, please fill out your name and address in the space provided on the back of the survey.

If you decide to participate, please read and sign the enclosed consent form, and post it back to me, together with your completed questionnaire.

If you do not wish to be involved with this study please call the study helpline on 0800 100 884 and give the study team the unique ID code that you will find on the front of the survey so you can be removed from the mailing list. This ID code enables you to remain anonymous to the study team. Not taking part in the study will not affect your electricity supply or disadvantage you in any way.

You'll find an information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz) under *Electricity Prepayment Meter Users Study*.

If you have any questions, please don't hesitate to contact me. You can either call our toll free number 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

I hope that you enjoy completing the survey and the opportunity to voice your thoughts and opinions on using prepayment meters to pay for electricity. I look forward to receiving your survey response.

Yours sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study

## **Electricity Prepayment Meter Users Survey Participant Information Sheet August 2010**

You are invited to take part in the Electricity Prepayment Meter Users Survey being carried out by the University of Otago, Wellington together with three electricity companies across New Zealand, including Genesis Energy. Any household member who can tell us about using the prepayment meter at this address and who is over 18 may fill in the survey.

We want to find out what people think about using prepayment meters to pay for electricity. What are the advantages and disadvantages of prepayment meters? This information is really important because electricity is essential for our everyday living, and it can be hard to pay for it. We want to know if prepayment meters are a useful way for people to pay for electricity.

You will find enclosed a questionnaire for you to fill in, that will help us to understand more about what people think about using prepayment meters for electricity. We will add your results with answers given by other people to get a better picture of what people across New Zealand think about prepayment meters for electricity.

### **Why is the study being done?**

Electricity services can be expensive, but everyone knows that we all need electricity for our everyday living. Some people have trouble paying for electricity and can get disconnected from electricity. Prepayment meters are one way which people can budget and pay for their electricity. The Electricity Prepayment Meter Users Survey is being done so that we can get a better picture of what people think about using prepayment meters for electricity. The study is being completed by Kimberley O'Sullivan as part of her doctorate study at the University of Otago.

### **Where is the study being done?**

The study is being done with randomly selected households across New Zealand.

### **When is the Study going to take place?**

The first survey is happening between September and December 2010. A second postal survey may happen next year.

### **What will I have to do if I participate?**

Fill out the enclosed questionnaire and send it back to Kimberley O'Sullivan at the University of Otago in the return envelope provided. Kimberley will then take your survey forms, and add your answers in with the surveys from other people in the study. Every effort will be made to make sure that your identity is protected, and you will not be named in any results of the study. The questionnaire should take about twenty minutes of your time to fill out.

Because we know that it takes time to participate in the research, we will send you a \$20 supermarket voucher as a token of our appreciation of your participation. You will need to provide us with your name and address so that we can post the voucher, as Genesis Energy is helping us with this research by posting the survey to you, and they have not given us your personal details.

The survey has questions about prepayment electricity meters, and some questions about the people that live in your house. If you become uncomfortable with the question(s) you can choose not to answer that question(s), without any disadvantage to yourself of any kind. If you choose not to answer more than five questions, we won't be able to use your questionnaire answers, and will not be able to send you the voucher.

If you agree you may be sent another questionnaire form next year. It will ask mostly the same questions as the first survey. It is important to take part in the follow-up survey as it will show us whether things have changed for people using prepayment meters over time. If you are willing, we may also contact you next year and ask you to meet with the researchers face-to-face to share your thoughts on using prepayment metering to pay for electricity.

#### **What information will be collected and what use will be made of it?**

The information collected will come from survey questionnaires that you fill out. Once you send us your questionnaires, we will join your survey answers with the answers from the other participants so that we have a better picture of what people think about using prepayment meters for electricity.

The kinds of questions we will be asking are (for example):

How long have you been using your prepayment meter for electricity?

What was the reason for starting to use your prepayment meter for electricity?

The only people to see the survey forms will be Kimberley O'Sullivan, and people on the research team at the University of Otago. Your electricity company will never see your survey form. The results of the survey will all be added together for the final reports, and your name will not appear anywhere in the written reports. The results of the project may be published and will be available in the library and online, but no one will be able to identify you from the data. At the end of the project any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in a locked storage unit for five years, after which it will be destroyed. Any information stored electronically will be accessible only to the researchers on a password protected computer.

#### **Can I find out the results of the Electricity Prepayment Meter Users Survey?**

Yes. Although there will be some time between the surveys and the results being known, a summary of the results will be made available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz).



**What if I have questions?**

If you would like to discuss any part of this research, or your participation in it, please feel free to speak with either:

*Research Project Manager*

Kimberley O'Sullivan (04) 918 5611  
or email: [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz)

You can also call the study helpline 0800 100 884, and if Kimberley can't talk to you immediately, she will phone you back.

*Supervisors*

Professor Philippa Howden-Chapman (04 3855541 extension 6047) or  
Geoff Fougere (04 3855541 extension 6046)

This proposal has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

# Electricity Prepayment Meter Users Survey Consent Form

**Participants Name** \_\_\_\_\_

**Address and Phone Number** \_\_\_\_\_

\_\_\_\_\_

I have read and understand the information sheet about the Electricity Prepayment Meter Users Survey (dated August 2010) for people agreeing to take part in the study to understand more about how people use prepayment metering. I understand that I am free to request further information at any stage.

I understand that:

1. Taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without any disadvantage. My electricity supply will not be affected in any way.
2. I may choose not to answer every question in the survey.
3. My electricity company will never be shown my survey form.
4. The survey forms will be kept in locked storage for five years, and then destroyed.
5. The results of the project may be published and available in the library and online but every attempt will be made to keep my identity confidential. My name and personal details will not be used except to contact me about the study.
6. When I post my questionnaire back to the University of Otago, I will be sent a \$20 supermarket voucher if I give my name and address, to compensate me for my time and thank me for participating.
7. If I give my permission I may be contacted next year and asked to participate in a follow-up survey, or give face-to-face feedback about using prepayment metering unless I indicate that I do not wish to participate.

I have had the opportunity read about this study and am satisfied with the information provided. I consent to take part in this study.

|                            |  |
|----------------------------|--|
| Participant's<br>Signature |  |
| Name                       |  |
| Date                       |  |

**University of Otago**

# **Electricity Prepayment Meter Users Survey**

An effort to understand the advantages and disadvantages of using  
prepayment meters to pay for electricity

## **Questionnaire**

**August 2010**

*To be completed by an adult (age 18 and over) who uses prepayment metering  
to pay for electricity.*

*Please answer every question by ticking the most appropriate box or writing an  
answer in the space provided. Even if you are unsure about how to answer a  
question, please give the best answer you can. All of the information that you  
provide will be kept confidential, and you will remain anonymous. Please note  
that unless you write your name and address at the end of the questionnaire we  
will not be able to post the voucher to you.*

Individual ID: \_\_\_\_\_

Department of Public Health  
University of Otago, Wellington  
PO Box 7343  
Wellington 6242



1. Do you use a prepayment meter to pay for electricity?
  - No – thank you, unfortunately you are ineligible for the study, but please post the questionnaire back to us in the return envelope.
  - Yes – please continue to answer this questionnaire
  
2. How many people live in this house?
  - \_\_\_\_\_ People 18 and over live here
  - \_\_\_\_\_ People under 18 live here
  
3. How would you describe the condition of this house?
  - Excellent – No immediate repair and maintenance needed
  - Good – Minor maintenance needed
  - Average – Some repair and maintenance needed
  - Poor – Immediate repairs and maintenance needed
  - Very poor – Needs immediate extensive repair and maintenance
  
4. Do you own or rent it?
  - I or my family trust owns it
  - I rent it from family or a landlord
  - I rent it from Housing New Zealand
  - I rent it from someone else (eg the city council or a church or charitable group)
  
5. How is the hot water in your house heated?
  - Electricity
  - Gas
  - Other, please describe: \_\_\_\_\_
  
6. What do you use for cooking?
  - Electricity only
  - Gas only
  - Electricity and Gas
  - Other, please describe: \_\_\_\_\_

**These questions are about using prepayment electricity in this house**

7. How satisfied are you with using prepayment metering? (*tick one*)

- Very satisfied with prepayment metering
- Fairly satisfied with prepayment metering
- Neutral
- Dissatisfied with prepayment metering
- Very dissatisfied with prepayment metering

8. How satisfied are you with your electricity company? (*tick one*)

- Very satisfied with my electricity company
- Fairly satisfied with my electricity company
- Neutral
- Dissatisfied with my electricity company
- Very dissatisfied with my electricity company

9. What are the two best things about using your prepayment meter to pay for electricity?

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

10. What are the two worst things about using your prepayment meter to pay for electricity?

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

11. How long have you been using your prepayment meter for electricity?

\_\_\_\_\_ years \_\_\_\_\_ months

12. Why did you start to use your prepayment meter for electricity?
- Because debt had built up on the electricity account
  - The meter was already here when we moved into the house
  - We had a prepayment meter in our old house and wanted one when we shifted here
  - We transferred from an old coin meter
  - Our landlord wanted us to use a prepayment meter
  - Our electricity company wanted us to use a prepayment meter
  - Other, please describe: \_\_\_\_\_
- 
- 

13. How did you first find out about prepayment meters for electricity?
- Friends or family used one
  - Our electricity company told us about prepayment meters
  - WINZ, a budgeting service, or another community group such as your Church told you about prepayment metering
  - Advertising
  - Other, please describe: \_\_\_\_\_

14. Some people like the ability to budget with prepayment meters and say the benefits outweigh the risk of running out of credit. Do you: (*tick one*)
- Strongly agree
  - Agree
  - Disagree
  - Strongly disagree

Sometimes people go onto prepayment metering for electricity because debt has built up on their account, and it is useful for us to know the reasons that debt builds up.

15. If you had debt on your electricity account before you started using the prepayment meter, why did the debt build up?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

I did not have electricity debt

16. **In the year before** you started using your prepayment meter, had the electricity to your house ever been cut off? (*tick all that apply*)

Yes, for planned maintenance

Yes, because of accident or the weather

Yes, for late or non-payment (electricity debt)

    └─> How many times? \_\_\_\_\_

Yes, for other reasons

    └─> what reasons? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

No

17. Before you started using your prepayment meter for electricity how did you pay your electricity bill?

Direct debit from bank account each month

Automatic payment of a set amount (smooth pay or easy pay)

Internet banking or telephone banking

Posting a cheque or paying in person (at the post office)

I've always used prepayment meters to pay for electricity

I've never paid for electricity before

18. Thinking about when you use the prepayment meter to pay for electricity compared to before you used the prepayment meter, complete these statements: (*Circle either 'MORE' 'THE SAME' or 'LESS' for each sentence*)

The electricity costs **MORE** / **THE SAME** / **LESS** when paying with the prepayment meter.

I use **MORE** / **THE SAME** / **LESS** electricity when paying with the prepayment meter.

I spend **MORE** / **THE SAME** / **LESS** on electricity when paying with the prepayment meter.

I think about how much electricity I use **MORE** / **THE SAME** / **LESS** when paying with the prepayment meter.

19. How often do you usually top up the credit on your prepayment meter?

- Every few days
- Once a week
- Once a fortnight
- Once a month
- Less than once a month

20. How much do you spend on electricity?

\$\_\_\_\_\_ per month

Many people who use prepayment meters run out of credit sometimes. We want to understand the reasons why people might run out of credit, and how long they have no credit for.

21. Have you ever run out of credit for your prepayment meter?

- No
- Yes, more than a year ago
- Yes, in the last year

↳ How many times? \_\_\_\_\_

↓  
**Last time** you ran out of credit, how long did you have no credit for? \_\_\_\_\_

↓  
**Last time** you ran out of credit, what was the reason you ran out? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

↓  
**Last time** you ran out of credit, what was the worst thing about running out? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



22. Have you ever turned off all the electricity to the house at the mains switch to save the credit on your prepayment meter. (*tick all that apply*)

No

Yes, more than a year ago

Yes, in the last year

    ↳ How many times? \_\_\_\_\_

23. Have you had outside help to pay your electricity bill in the last year? (*tick all that apply*)

Yes, a grant from a government agency or department

Yes, a loan from a government agency or department

Yes, a grant or loan from a church or social agency

Yes a grant or loan from family or friends

No

**These questions are about other household bills and expenses:**

24. This is a list of other household bills that you might have. Please tick one answer for each row. (*each row should have one tick*)

|                              | Yes –<br>Have it         | No –<br>because I<br>don't want<br>it | No –<br>because of<br>the cost | No – for<br>some other<br>reason |
|------------------------------|--------------------------|---------------------------------------|--------------------------------|----------------------------------|
| a) A telephone<br>(landline) | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |
| b) Cellphone on<br>a plan    | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |
| c) Cellphone on<br>prepay    | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |
| d) Home<br>internet          | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |

25. In the last year, have you been unable to pay any of your telephone, gas, or water bills by the due date because of a lack of money?

Yes

No

Not applicable – I don't have any of these bills

26. If you needed \$500 for a family emergency in the next week, could you: *(tick all that apply)*

- pay it yourself
- get it from family or friends
- get it from WINZ
- get it from a church or other social agency
- get it from a bank
- get it from a moneylender
- get it from someone else
- I couldn't get it

27. Some people do these things to help keep costs down. Please tick if you have done the things in each row 'not at all', 'a little', or 'a lot'. *(each row should have one tick)*

|                                                                                                 | Have not done at all     | Have done a little       | Have done a lot          |
|-------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| a) gone without fresh fruit and vegetables to help keep down costs                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| b) continued wearing clothing that was worn out because you couldn't afford a replacement       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| c) put off buying clothing for as long as possible to help keep down costs                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| d) stayed in bed longer to save on heating costs                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| e) postponed or put off visits to the doctor to help keep down costs                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| f) NOT picked up a prescription to help keep down costs                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| g) spent less time on hobbies than you would like to help keep down costs                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| h) done without or cut back on trips to the shops or other local places to help keep down costs | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Please tell us some information about yourself:**

28. Are you?

Male

Female

29. What year were you born?

\_\_\_\_\_ (eg. 1965)

30. Are you in paid employment?

Yes – full-time

Yes – part-time

No

31. Which of the following do you receive? (*tick all that apply*)

Working for families

Unemployment benefit

Domestic purposes benefit

Sickness benefit

Invalids benefit

New Zealand superannuation

Accommodation supplement

Disability allowance

Student allowance

I don't receive any of these

32. What was your household's income before tax in the last year?

\$0 - \$20,000

\$20,001 - \$40,000

\$40,001 - \$60,000

\$60,001 - \$80,000

\$80,001 - \$100,000

\$100,001 and above

Don't know

33. Which ethnic group do you belong to? (*tick all that apply*)

- NZ European
- Maori – Iwi: \_\_\_\_\_
- Samoan
- Cook Island Maori
- Tongan
- Niuean
- Chinese
- Indian
- Other (such as *DUTCH, JAPANESE, TOKELAUAN*). Please state:  
\_\_\_\_\_

**Thank you for completing this questionnaire.**

We know that it takes time and effort to help us with our research, and would like to thank you by sending you a \$20 supermarket voucher. Please write your name and address below so that we can post the voucher to you. This information will be kept confidential and will be used only post the voucher and information about this study:

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\_\_\_\_\_

PHONE: \_\_\_\_\_

We are interested hearing more of your opinions about using prepayment metering for electricity, but will only contact you with your permission. If you are asked to participate you will compensated for your time.

May we post you another survey next year?      YES / NO

May we ask to talk to you in person?      YES / NO

**Thank you. Please send your questionnaire and consent form back to us using the return envelope provided. If you have any questions, please contact Kimberley O’Sullivan on 0800 100 884**

## Electricity Prepayment Meter Users Study



5 October 2010

Dear Householder

We recently sent you a survey questionnaire about using prepayment meters to pay for electricity.

As at 5 October 2010 your completed survey hasn't been received. Please help us with our research by completing the questionnaire and sending it back to the University of Otago using the reply paid envelope provided as soon as you can.

We appreciate your time in participating in this important research. If you have already sent your survey, thank you.

If you have misplaced the questionnaire or did not receive one, please call 0800 100 884 and a new one will be sent out to you.

Thank you for your time and support.

Kimberley O'Sullivan  
Research Project Manager

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Research Project Manager

**Kimberley O'Sullivan**  
Department of Public Health  
University of Otago, Wellington  
PO Box 7343  
Wellington 6242



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Address Line 2  
Address Line 3  
Address Line 4 Postcode

ID:

**Kimberley O'Sullivan**  
Department of Public Health  
University of Otago, Wellington  
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PLACE  
STAMP  
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## Claim your free \$20 supermarket voucher!

### Dear Householder

Recently we sent you a survey from the University of Chicago about electricity prices in our homes. To say thank you for completing the survey, Chicago is offering you a free \$20 supermarket voucher. All you have to do is complete the survey, write your name and address on the back, and return it to Chicago by the mail paid envelope by 15 November.

### Misplaced the survey?

If you've misplaced it, we've got you covered. If you're not sure, please call us on 0800 100 884.

### Do not wish to be involved?

If you'd like us to remove your details from our database, please call the University of Chicago helpline on 0800 100 884.

### Already responded?

If you've already responded, thank you for participating. Your voucher will be mailed to you free by.

Kind regards

*A. S. B.*

Andrew van Buren  
Manager, Academic Research



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2 November 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Dear Sir/Madam

**University of Otago survey about prepayment electricity meters  
– still time to collect your \$20 supermarket voucher!**

We recently sent you a survey on behalf of the University of Otago about the advantages and disadvantages of using prepayment meters to pay for electricity. The University's records show that you haven't responded yet, and while the survey is voluntary, the researchers are very keen to hear your views.

This letter is a reminder that there is still time. If you do choose to participate and return your survey by **15 November 2010**, the University of Otago will send you a \$20 supermarket voucher as a thank you gift. (Just remember to write your name and address on the back of the survey.)

**The survey**

We've enclosed the survey and reply paid envelope again, plus other information to have a read through. The survey will take approximately 20 minutes to complete.

**All your details are confidential**

We'd like to reassure you again that all your personal details remain confidential to Contact and we are sending all correspondence on the University of Otago's behalf. You can answer the survey anonymously if you wish. Contact will not see your individual answers, but we will be supplied with overall results.

**If you do not wish to complete the survey**

If you do not wish to be involved with this study, please call the University of Otago helpline on 0800 100 884 so they can remove your details from the mailing list. The study team will need your survey unique ID code, which you will find on the front of the survey. This ID code enables you to remain anonymous to the study team. If you choose not to take part, this will not affect your electricity supply or disadvantage you in any way.

Thanks for your help.

Kind regards

SIGNATURE

NAME  
Manager Customer Marketing

2 November 2010

Dear Householder

Last month, I sent a letter asking you to complete a survey questionnaire about using prepayment meters to pay for electricity. I haven't heard back from you and am writing again because of the importance your questionnaire has for helping get accurate results. (Don't forget, you can opt out if you want to, just call the University of Otago helpline on 0800 100 884).

**Why should you answer the survey?**

It is only by hearing from all customers that we can be sure the results truly tell us what it is like to use prepayment meters to pay for electricity. So, it would be great if you could get your survey back to me as soon as possible – don't forget, you will receive a \$20 supermarket voucher for helping me out. Any household member who can tell us about using the prepayment meter at this address and who is over 18 years old may complete the survey.

**Completing the survey**

Any household member who can tell us about using the prepayment meter at this address, and is over 18 years of age, may fill in the survey. It will take approximately 20 minutes to complete. Please try and complete every question. Once you have finished it, just pop it in the reply paid envelope along with the signed consent form.

Don't forget, we will send you a \$20 supermarket voucher as a thank you gift if you complete the survey. (Just remember to write your name and address on the back of the survey).

**All answers are confidential**

The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. The name and address you supply for the supermarket voucher will only be seen by the research team. We will never show Contact your survey form. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

**If you do not wish to complete the survey**

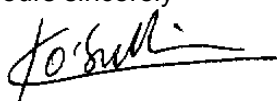
If you do not wish to be involved with this study, please call the University of Otago helpline on 0800 100 884 so we can remove your details from the mailing list. The study team will need your survey unique ID code, which you will find on the front of the survey. This ID code enables you to remain anonymous to the study team. If you choose not to take part, this will not affect your electricity supply or disadvantage you in any way.

**Need more information?**

Please read the information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on the website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz). Just search under *Electricity Prepayment Meter Users Study*. The Housing and Health Research Programme (Healthy Housing) is part of the University of Otago. If you have any questions, please don't hesitate to contact me. You can call 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

Thank you for your time.

Yours sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study

2 November 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Dear Householder

Last month we sent you a survey questionnaire for a study on the advantages and disadvantages of using prepayment meters to pay for electricity. Kimberley O'Sullivan at the University of Otago is conducting this independent study.

The University of Otago have not yet received your response to this survey and we are hoping you would like to take this opportunity to share your views on prepayment meters. Your response to the survey assists in ensuring the results are accurate.

In case you have mislaid our earlier letter, we've enclosed again the following information for you:

- a letter from Kimberley O'Sullivan who is conducting this study;
- an information sheet explaining the study;
- a consent form for you to sign and return;
- the survey questionnaire; and
- a reply paid envelope to return the completed survey and consent form to the University of Otago.

The survey will take approximately 20 minutes of your time.

Once again we'd like to assure you again that we have not given your personal details to the University of Otago. It will be your choice if you wish to provide your personal details to the University of Otago when you complete the survey. Mercury Energy will not see your completed survey however the University of Otago will supply Mercury Energy with anonymised overall results.

Mercury Energy supports the University of Otago's study as it will help us to better understand the needs and views of our customers who use prepayment meters.

On completion of the survey being returned, the University of Otago will send you a \$20 supermarket voucher to thank you for your time. Please make sure that you write your name and address on the back of the survey form in the space provided so that the voucher can be sent out to you.

If you do not wish to be involved with this study please call the study helpline on 0800 100 884 and give the study team the unique ID code that you will find on the front of the survey form so you can be removed from the mailing list. This ID code enables you to remain anonymous to the study team.

We hope you will assist us by participating in this survey with the University of Otago.

Regards

SIGNATURE

NAME  
Community Relations

2 November 2010

Dear Householder

Last month I sent you a letter asking you to complete a survey questionnaire about using prepayment meters to pay for electricity. To date it has not been returned to me.

I am writing again because of the importance that your questionnaire has for helping to get accurate results. It is only by hearing from nearly everyone that we sent a survey to that we can be sure that the results truly tell us what it is like to use prepayment meters to pay for electricity. So I hope that you will be able to fill out the survey soon. Any household member who can tell us about using the prepayment meter at this address and who is over 18 years old may complete the survey.

Your views are really important to us. Please help us with our research by completing the enclosed survey questionnaire and posting it back to me in the reply paid envelope. The questionnaire will only take around 20 minutes to complete.

Your participation is voluntary. We ask that you complete every question where possible. The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. Your name and address will only be used to contact you about the study, and will only be seen by members of the research team. We will never show Mercury Energy your survey form. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

As a token of appreciation for your time, I will send you a \$20 supermarket voucher to thank you. Mercury Energy have not given me your personal details, so to receive the voucher, please fill out your name and address in the space provided on the back of the survey questionnaire so that your voucher can be sent out to you.

If you decide to participate, please read and sign the enclosed consent form, and post it back to me, together with your completed questionnaire.

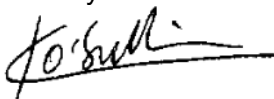
If you do not wish to be involved with this study please call the study helpline on 0800 100 884 and give the study team the unique ID code that you will find on the front of the survey form so you can be removed from the mailing list. This ID code enables you to remain anonymous to the study team. Not taking part in the study will not affect your electricity supply or disadvantage you in any way.

You'll find an information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz) under *Electricity Prepayment Meter Users Study*.

If you have any questions, please don't hesitate to contact me. You can either call our toll free number 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

Thank you once again for your time. I look forward to receiving your survey response.

Sincerely



Kimberley O'Sullivan

Research Project Manager, Electricity Prepayment Meter Users Study

10 November 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Customer Care Team  
Private Bag 3131  
Waikato Mail Centre  
Hamilton 3240  
T. 0800 300 400  
F. 0800 110 999  
E. info@genesisenergy.co.nz  
W. genesisenergy.co.nz  
Genesis Power Limited  
Trading as Genesis Energy

Dear Householder

In September we sent you a survey questionnaire for a study on the advantages and disadvantages of using prepayment meters to pay for electricity. Kimberley O'Sullivan at the University of Otago is conducting this independent study. We understand the Otago University have not yet received your response to this survey.

Genesis Energy supports the University of Otago's study as it will help us to better understand the needs and views of our customers who use prepayment meters.

We are hoping that you take this final opportunity to have your say. Your response to the survey assists in ensuring the study reflects what it is like to use prepayment metering in New Zealand.

You will find enclosed documents regarding the survey and also the survey questionnaire to complete and return to the University of Otago in the envelope provided. The survey will take approximately 20 minutes of your time.

We'd like to assure you again Genesis Energy will not see your completed survey however the University of Otago will supply Genesis Energy with anonymised overall results.

If you wish to participate in the survey, please mail your completed questionnaire and your consent form back to the University of Otago **by 6 December 2010**.

If you have any questions about the research, please call the study helpline on 0800 100 884 to speak to Kimberley O'Sullivan at the University of Otago.

Once again we thank you for your time and participation.

Regards

SIGNATURE

NAME  
Sales & Marketing Manager

10 November 2010

Dear Householder

In September I sent you a letter asking you to complete a survey questionnaire about using prepayment meters to pay for electricity. To date it has not been returned to me.

I am writing again because of the importance that your questionnaire has for helping to get accurate results. Your views are important to us. I am hoping you will take this final opportunity to complete and return the questionnaire to me.

Any household member who can tell us about using the prepayment meter at this address and who is over 18 years old may complete the survey. The questionnaire will only take around 20 minutes to complete.

Your participation is voluntary. We ask that you complete every question where possible. The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. We will never show Genesis Energy your survey form. Your name and address will only be used to contact you about the study, and will only be seen by members of the research team. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

As a token of appreciation for taking the time to complete and return the survey, you'll receive a \$20 supermarket voucher. Genesis Energy have not given me your personal details, so to receive the voucher and enable us to contact you if necessary, please fill out your name and address in the space provided on the back of the survey questionnaire.

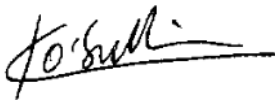
You'll find an information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz) under *Electricity Prepayment Meter Users Study*.

If you wish to participate in the survey, please mail your completed questionnaire and your consent form back to the University of Otago **by 6 December 2010**.

If you have any questions, please don't hesitate to contact me. You can either call me on our toll free number 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

Once again thank you for your time and participation.

Yours sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study



23 November 2010

The Householder  
Address 1  
Address 2  
Address 3  
Address 4 Postcode

Dear Sir/Madam

**University of Otago survey about prepayment electricity meters  
– time extended to collect your \$20 supermarket voucher!**

In September, we sent you a survey on behalf of the University of Otago about the advantages and disadvantages of using prepayment meters to pay for electricity. The University has not had a response from you, and has extended the final response date. While the survey is voluntary, your response would be really appreciated as it helps the researchers at the University to ensure they correctly understand the needs of prepay users.

This letter is a reminder that there is still time. If you do choose to participate and return your survey by **6 December 2010**, the University of Otago will send you a \$20 supermarket voucher as a thank you gift. (Just remember to write your name and address on the back of the survey.)

**The survey**

We've enclosed the survey and reply paid envelope again, plus other information to have a read through. The survey will take approximately 20 minutes to complete

**All your details are confidential**

We'd like to reassure you again that all your personal details remain confidential to Contact and we are sending all correspondence on the University of Otago's behalf. You can answer the survey anonymously if you wish. Contact will not see your individual answers, but we will be supplied with overall results.

Thanks for your help.

Kind regards

SIGNATURE

NAME  
Manager Customer Marketing

23 November 2010

Dear Householder

In September, I sent a letter asking you to complete a survey questionnaire about using prepayment meters to pay for electricity, and have also sent a couple of reminders. I haven't heard back from you and am writing because of the importance your questionnaire has for helping get accurate results. University protocol requires me to follow up with customers who haven't responded three times, so this is the last communication you will get from me. (Don't forget, you can opt out if you want to, just call the University of Otago helpline on 0800 100 884).

### **Why should you answer the survey?**

It is only by hearing from all customers that we can be sure the results truly tell us what it is like to use prepayment meters to pay for electricity. So, it would be great if you could get your survey back to me as soon as possible – don't forget, you will receive a \$20 supermarket voucher for helping me out. Any household member who can tell us about using the prepayment meter at this address and who is over 18 years old may complete the survey. This is the last time I will contact you about this survey.

### **Completing the survey**

Any household member who can tell us about using the prepayment meter at this address, and is over 18 years of age may fill in the survey. It will take approximately 20 minutes to complete. Please try and complete every question. Once you have finished it, just pop it in the reply paid envelope along with the signed consent form. Don't forget, we will send you a \$20 supermarket voucher as a thank you gift if you complete the survey. (Just remember to write your name and address on the back of the survey).

### **All answers are confidential**

The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. The name and address you supply for the supermarket voucher will only be seen by the research team. We will never show Contact your survey form. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

### **If you do not wish to complete the survey**

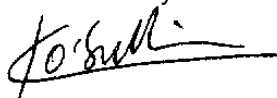
If you do not wish to be involved with this study, please call the University of Otago helpline on 0800 100 884 so we can remove your details from the mailing list. The study team will need your survey unique ID code, which you will find on the front of the survey. This ID code enables you to remain anonymous to the study team. If you choose not to take part, this will not affect your electricity supply or disadvantage you in any way.

### **Need more information?**

Please read the information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on the website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz). Just search under *Electricity Prepayment Meter Users Study*. The Housing and Health Research Programme (Healthy Housing) is part of the University of Otago. If you have any questions, please don't hesitate to contact me. You can call 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

Thank you for your time.

Yours sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study

23 November 2010

Dear Householder

In September we sent you a survey questionnaire for a study on the advantages and disadvantages of using prepayment meters to pay for electricity. Kimberley O'Sullivan at the University of Otago is conducting this independent study. We understand the Otago University have not yet received your response to this survey.

Mercury Energy supports the University of Otago's study as it will help us to better understand the needs and views of our customers who use prepayment meters.

We are hoping that you take this final opportunity to have your say. Your response to the survey assists in ensuring the study reflects what it is like to use prepayment metering in New Zealand.

You will find enclosed documents regarding the survey and also the survey questionnaire to complete and return to the University of Otago in the envelope provided. The survey will take approximately 20 minutes of your time.

We'd like to assure you again Mercury Energy will not see your completed survey however the University of Otago will supply Mercury Energy with anonymised overall results.

On completion of the survey being returned, the University of Otago will send you a \$20 supermarket voucher to thank you for your time.

If you wish to participate in the survey, please mail your completed questionnaire and your consent form back to the University of Otago **by 6 December 2010**.

If you have any questions about the research, please call the study helpline on 0800 100 884 to speak to Kimberley O'Sullivan at the University of Otago.

Once again we thank you for your time and participation.

Regards

SIGNATURE

NAME  
Community Relations

23 November 2010

Dear Householder

In September I sent you a letter from me asking you to complete a survey questionnaire about using prepayment meters to pay for electricity. To date it has not been returned to me.

I am writing again because of the importance that your questionnaire has for helping to get accurate results. Your views are important to us. It is only by hearing from nearly everyone that we sent a survey to that we can be sure that the results truly tell us what it is like to use prepayment meters to pay for electricity. I am hoping you will take this final opportunity to complete and return the questionnaire to me.

Any household member who can tell us about using the prepayment meter at this address and who is over 18 years old may complete the survey. The questionnaire will only take around 20 minutes to complete, and I'll send you back a \$20 supermarket voucher to say thanks.

Your participation is voluntary. We ask that you complete every question where possible. The answers that you provide will be kept strictly confidential and any results from the study will be presented anonymously. We will never show Mercury Energy your survey form. Your name and address will only be used to contact you about the study, and will only be seen by members of the research team. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

As a token of appreciation for taking the time to complete and return the survey, you'll receive a \$20 supermarket voucher. Mercury Energy have not given me your personal details, so to receive the voucher and enable us to contact you if necessary, please fill out your name and address in the space provided on the back of the survey questionnaire.

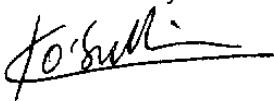
You'll find an information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz) under *Electricity Prepayment Meter Users Study*.

If you wish to participate in the survey, please mail your completed questionnaire and your consent form back to the University of Otago **by 6 December 2010**.

If you have any questions, please don't hesitate to contact me. You can either call me on our toll free number 0800 100 884 or email [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

Once again thank you for your time and participation.

Yours sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study

## Appendix Two: Follow-up survey mail contents and protocol

This appendix includes copies of the following documents sent to the sample of the follow-up postal survey detailed in Chapter 6:

- pre-notification letter;
- cover-letter; information sheet;
- questionnaire (including consent form on the back page); and
- reminder postcard.

29 August 2011

FIRSTNAME LASTNAME  
ADDRESS 1  
ADDRESS 2  
ADDRESS 3 POSTCODE

Dear FIRSTNAME LASTNAME

Last year you helped us with our research by completing and returning the Electricity Prepayment Meter Users Survey 2010. When you filled out the survey, you indicated that we could contact you again this year to ask you to fill in a follow-up survey. I am writing to ask for your help with an important follow-up survey that will help us understand any changes in prepayment meter use over time.

Like last year, the survey will tell us what the advantages and disadvantages of using prepayment meters to pay for electricity are for New Zealand households. In the next few days, you will receive a request to participate in this project by answering questions about using your prepayment meter to pay for electricity. If you have changed and are no longer using a prepayment meter we would still like to hear from you.

We would like to do everything we can to make it easy and enjoyable for you to participate in the study. I am writing in advance because many people like to know ahead of time that they will be asked to fill out a questionnaire. This research can only be successful with the generous help of people like you.

To say thanks, we would like to offer you a token of appreciation. When you send your completed questionnaire back to us, we will send you a \$20 supermarket voucher to thank you for your help with our research.

I hope that you will take 20 minutes of your time to help us. Most of all, I hope that you enjoy the questionnaire, and the opportunity to voice your thoughts and opinions about using prepayment meters to pay for electricity.

Best wishes,

(Hand signed)

Kimberley O'Sullivan  
Electricity Prepayment Meter Users Study  
Research Project Manager

7 September 2011

FIRSTNAME LASTNAME  
ADDRESS 1  
ADDRESS 2  
ADDRESS 3 POSTCODE

Dear FIRSTNAME LASTNAME

I am writing to ask for your help in understanding what the advantages and disadvantages of using prepayment meters to pay for electricity are for New Zealand households, and how prepayment meter use changes over time. The best way we have of learning about this is to ask people who use prepayment meters to pay for electricity to share their thoughts and opinions. Last year you indicated that we could contact you again this year and ask if you would help us with our follow-up survey.

Your views are really important to us. Your participation this year will help us discover important changes in the way people use prepayment meters over time. If you have changed and are no longer using a prepayment meter we would still like to hear from you. Please help us with our research by filling out the enclosed questionnaire and posting it back to us in the provided return envelope.

We know that it takes time and effort to participate in the research, and so we would like to offer a token of appreciation. When you send your completed questionnaire back to us, we will send you a \$20 supermarket voucher to say thanks for helping us with our research.

The questions will only take around 20 minutes to complete. Your participation is voluntary, and although we ask that you complete every question, you may choose not to answer a particular question. The answers that you provide will be kept strictly confidential, and any results from the study will be presented anonymously. This study has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

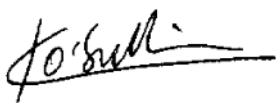
If you decide to participate, please fill out the questionnaire, read and sign the consent form on the back of the questionnaire, and post it back to me in the enclosed return envelope. If you decide that you do not want to take part, and do not wish to be contacted again about the research, please contact us on 0800 100884 and provide us with the unique ID code that can be found on the front of your survey form and you will be removed from the research mailing list. Not taking part in the study will not affect your electricity supply or disadvantage you in any way.

We do hope that you will decide to participate in this important research.

You'll find an information sheet enclosed. Further details and a summary of the anonymous results of the study will be available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz) under *Electricity Prepayment Meter Users Study*. If you have any questions, please don't hesitate to contact me. You can either call me on our toll free number 0800100884. Or, you can email me: [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz).

Thank you for your time, I look forward to receiving your survey response.

Sincerely



Kimberley O'Sullivan  
Research Project Manager, Electricity Prepayment Meter Users Study

# **Electricity Prepayment Meter Users Follow-up Survey Participant Information Sheet August 2011**

You are invited to take part in the Electricity Prepayment Meter Users Follow-up Survey being carried out by the University of Otago.

Last year you helped us with our first Electricity Prepayment Meter Users Survey and indicated that we could contact you again this year to fill in a follow-up postal survey. This information is really important because electricity is essential for our everyday living, and it can be hard to pay for it. We want to know if prepayment meters are a useful way for people to pay for electricity, and whether there are changes over time. We don't work for the electricity companies, our research is independent, and we use the results to make policy recommendations. If you have changed and are no longer using a prepayment meter we would still like to hear from you.

You will find enclosed a questionnaire for you to fill in, that will help us to understand more about what people think about using prepayment meters for electricity and how this changes over time. We will add your results with answers given by other people to get a better picture of what people across New Zealand think about prepayment meters for electricity.

## **Why is the study being done?**

Electricity services can be expensive, but everyone knows that we all need electricity for our everyday living. Some people have trouble paying for electricity and can get disconnected from electricity. Prepayment meters are one way which people can budget and pay for their electricity. The Electricity Prepayment Meter Users Survey is being done so that we can get a better picture of what people think about using prepayment meters for electricity. The study is being completed by Kimberley O'Sullivan as part of her doctorate study at the University of Otago.

## **Where is the study being done?**

The study is being done with randomly selected households across New Zealand that indicated we could contact them again this year.

## **When is the Study going to take place?**

The first survey took place last year, this final survey is happening between August and October 2011.

## **What will I have to do if I participate?**

Fill out the enclosed questionnaire and send it back to Kimberley O'Sullivan at the University of Otago in the return envelope provided. Kimberley will then take your



survey forms, and add your answers in with the surveys from other people in the study. Every effort will be made to make sure that your identity is protected, and you will not be named in any results of the study. The questionnaire should take about twenty minutes of your time to fill out.

Because we know that it takes time to participate in the research, we will send you a \$20 supermarket voucher as a token of our appreciation of your participation.

The survey has questions about prepayment electricity meters, and some questions about the people that live in your house. While many of the questions are the same as the questions last year, it is important for the research that you provide answers again this year. We've also included some new questions about prepayment, and also about home heating. If you become uncomfortable with the question(s) you can choose not to answer that question(s), without any disadvantage to yourself of any kind. If you choose not to answer more than five questions, we won't be able to use your questionnaire answers, and will not be able to send you the voucher.

**What information will be collected and what use will be made of it?**

The information collected will come from survey questionnaires that you fill out. Once you send us your questionnaire, we will join your survey answers with answers from the other participants so that we have a better picture of what people think about using prepayment meters for electricity, and any changes this year.

The only people to see the survey forms will be Kimberley O'Sullivan, and people on the research team at the University of Otago. Your electricity company will never see your survey form. The results of the survey will all be added together for the final reports, and your name will not appear anywhere in the written reports. The results of the project may be published and will be available in the library and online, but no one will be able to identify you from the data. At the end of the project any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in a locked storage unit for five years, after which it will be destroyed. Any information stored electronically will be accessible only to the researchers on a password protected computer.

**Can I find out the results of the Electricity Prepayment Meter Users Survey?**

Yes. Although there will be some time between the surveys and the results being known, a summary of the results will be made available on our website [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz).

**What if I have questions?**

If you would like to discuss any part of this research, or your participation in it, please feel free to speak with either:

*Research Project Manager*

Kimberley O'Sullivan      0800 100 884  
or email:                    [kimberley.osullivan@otago.ac.nz](mailto:kimberley.osullivan@otago.ac.nz)

You can call the study helpline 0800 100 884, and if Kimberley can't talk to you immediately, she will phone you back.

*Supervisors*

Professor Philippa Howden-Chapman      (04 3855541 extension 6047) or  
Geoff Fougere                                      (04 3855541 extension 6046)

This proposal has been reviewed and approved by the Department of Public Health, University of Otago, Wellington.

University of Otago

# Electricity Prepayment Meter Users Survey – Follow-up Study

An effort to understand the advantages and disadvantages of using prepayment meters to pay for electricity

## Questionnaire

August 2011

*To be completed by an adult (age 18 and over) who uses prepayment metering to pay for electricity.*

*Please answer every question by ticking the most appropriate box or writing an answer in the space provided. Even if you are unsure about how to answer a question, please give the best answer you can. All of the information that you provide will be kept confidential, and you will remain anonymous. By filling in and returning this survey you consent to take part in this study.*

**Thank you. Please send this survey form back to us in the enclosed return envelope, and we'll post a \$20 supermarket voucher to you. If you have any questions, please contact Kimberley O'Sullivan on 0800 100 884.**

Please indicate which supermarket you would like a \$20 voucher from:

- New World
- Countdown/Foodtown/Woolworths
- Pak N Save

Individual ID: \_\_\_\_\_

Department of Public Health  
University of Otago, Wellington  
PO Box 7343  
Wellington 6242



1. Do you use a prepayment meter to pay for electricity?
- Yes – please continue to answer all questions.
  - No, I've changed since I did the survey last year. Please tell us why? \_\_\_\_\_

---

Please answer all questions **except** questions **7-16 (pages 3-5)**.

2. How many people live in this house?

\_\_\_\_\_ People 18 and over live here

\_\_\_\_\_ People under 18 live here

3. How would you describe the condition of this house?

- Excellent – No immediate repair and maintenance needed
- Good – Minor maintenance needed
- Average – Some repair and maintenance needed
- Poor – Immediate repairs and maintenance needed
- Very poor – Needs immediate extensive repair and maintenance

4. Do you own or rent it?

- I or my family trust owns it
- I rent it from family or a landlord
- I rent it from Housing New Zealand
- I rent it from someone else (eg the city council or a church or charitable group)

5. How is the hot water in your house heated?

- Electricity
- Gas
- Other, please describe: \_\_\_\_\_

6. What do you use for cooking?

- Electricity only
- Gas only
- Electricity and Gas
- Other, please describe: \_\_\_\_\_

**These questions are about using prepayment electricity in this house**

7. How satisfied are you with using prepayment metering? (*tick one*)

- Very satisfied with prepayment metering
- Fairly satisfied with prepayment metering
- Neutral
- Dissatisfied with prepayment metering
- Very dissatisfied with prepayment metering

8. How satisfied are you with your electricity company? (*tick one*)

- Very satisfied with my electricity company
- Fairly satisfied with my electricity company
- Neutral
- Dissatisfied with my electricity company
- Very dissatisfied with my electricity company

9. What are the two best things about using your prepayment meter to pay for electricity?

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

10. What are the two worst things about using your prepayment meter to pay for electricity?

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

11. Do you agree with the following statements about using your prepayment meter (each row should have one tick)?

|                                                                           | Agree                    | Neutral                  | Disagree                 |
|---------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| My prepayment meter helps me budget                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| My prepayment meter makes me cut back on using my heaters                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| My prepayment meter is convenient                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| My prepayment meter means I never worry about the cost of electricity     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| My prepayment meter means I don't have a big bill at the end of the month | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| My prepayment meter makes me worry about having no electricity            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| My prepayment meter shows me how much electricity each appliance uses     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

12. Some people like the ability to budget with prepayment meters and say the benefits outweigh the risk of running out of credit. Do you:

- Strongly agree
- Agree
- Disagree
- Strongly disagree

13. Thinking about when you use the prepayment meter to pay for electricity compared to paying a bill, complete these statements: (*Circle either 'MORE' 'THE SAME' or 'LESS' for each sentence*)

The electricity costs **MORE** / **THE SAME** / **LESS** when paying with the prepayment meter.

I use **MORE** / **THE SAME** / **LESS** electricity when paying with the prepayment meter.

I spend **MORE** / **THE SAME** / **LESS** on electricity when paying with the prepayment meter.

I think about how much electricity I use **MORE** / **THE SAME** / **LESS** when paying with the prepayment meter.

14. How often do you usually top up the credit on your prepayment meter?
- Every few days
  - Once a week
  - Once a fortnight
  - Once a month
  - Less than once a month

15. How much do you spend on electricity?  
\$\_\_\_\_\_ per month

Many people who use prepayment meters run out of credit sometimes. We want to understand the reasons why people might run out of credit, and how long they have no credit for.

16. Have you ever run out of credit for your prepayment meter?
- No
  - Yes, more than a year ago
  - Yes, in the last year
- └─> How many times? \_\_\_\_\_

↓

**Last time** you ran out of credit, how long did you have no credit for? \_\_\_\_\_

↓

**Last time** you ran out of credit, what was the reason you ran out? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

↓

**Last time** you ran out of credit, what was the worst thing about running out? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

17. Have you ever turned off all the electricity to the house at the mains switch to save the credit on your prepayment meter. (*tick all that apply*)

No

Yes, more than a year ago

Yes, in the last year

    └─→ How many times? \_\_\_\_\_

18. Have you had outside help to pay your electricity bill in the last year? (*tick all that apply*)

Yes, a grant from a government agency or department

Yes, a loan from a government agency or department

Yes, a grant or loan from a church or social agency

Yes a grant or loan from family or friends

No

19. Do you ever cut back on food costs to pay for electricity?

Yes, always

Yes, often

Yes, sometimes

No

**These questions are about using heating in this house**

20. Do you feel your house has been cold so far this winter?

Yes, always

Yes, often

Yes, sometimes

No

21. Did you use heating when it was cold so far this winter?

Yes, always

Yes, often

Yes, sometimes

No



22. What kinds of heaters do you have and have you used in your house so far this winter? (each row should have one tick)

| Heater type                                                                                        | I use this heater        | Have but don't use       | I don't have it          |
|----------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| Open fire (no glass in front of flames)                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Enclosed fire / woodburner / multiburner                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Wood pellet burner                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Flued gas heater (has chimney or flue, AND uses gas that comes from wall/floor outlet or a bottle) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Unflued gas heater (NOT attached to chimney or flue, uses gas from wall/floor outlet or bottle)    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Heatpump                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Electric fixed heater (eg. wall mounted, or night store heater, NOT heatpump)                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Portable electric heater which you plug in (eg. fan heater, oil-filled column heater)              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Central heating                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other (please specify): _____                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

23. Of all the types of heaters you used, which would you say your MAIN heater is?

\_\_\_\_\_

24. Why do you use this as your main form of heating? (*tick all the reasons important to you that you think are true for this heating*)

- It's cheap
- It's easy to budget with
- It's convenient
- I like the way it looks
- I can move it from room to room
- It heats the whole house
- It gives 'instant heat'
- I have no other choice
- Other, please specify: \_\_\_\_\_

\_\_\_\_\_

25. Did you ever have the house colder than you would have liked so far this winter?

- Yes, always
- Yes, often
- Yes, sometimes
- No

26. What were the reasons for having the house colder than you would like?*(tick all that apply)*

- Not Applicable – my house was never colder than I liked
- Trying to keep cost of heating down
- Any heat just disappears
- Like to have windows open
- I think it is healthy to keep your body cooler
- Other household members like it cooler
- There is a heater in only one room
- Other,

↳ Please specify \_\_\_\_\_  
\_\_\_\_\_

27. So far this winter (June/July/August) how many times was your house cold enough that you shivered inside?

- Four or more day/nights
- Two or three day/nights
- One day/night
- Never

28. So far this winter (June/July/August) how many times did you ‘see your breath’ (“dragon-breath”) inside when it was cold?

- Four or more day/nights
- Two or three day/nights
- One day/night
- Never

**These questions are about other household bills and expenses:**

29. This is a list of other household bills that you might have. Please tick one answer for each row. (*each row should have one tick*)

|                              | Yes –<br>Have it         | No –<br>because I<br>don't want<br>it | No –<br>because of<br>the cost | No – for<br>some other<br>reason |
|------------------------------|--------------------------|---------------------------------------|--------------------------------|----------------------------------|
| a) A telephone<br>(landline) | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |
| b) Cellphone on<br>a plan    | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |
| c) Cellphone on<br>prepay    | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |
| d) Home<br>internet          | <input type="checkbox"/> | <input type="checkbox"/>              | <input type="checkbox"/>       | <input type="checkbox"/>         |

30. How do you pay for your water?

- In my rates or rent
- In a separate bill – not dependent on how much I use
- In a separate bill – I pay more if I use more water (meter read)

31. In the last year, have you been unable to pay any of your telephone, gas, or water bills by the due date because of a lack of money?

- Yes
- No
- Not applicable – I don't have any of these bills

32. If you needed \$500 for a family emergency in the next week, could you: (*tick all that apply*)

- pay it yourself
- get it from family or friends
- get it from WINZ
- get it from a church or other social agency
- get it from a bank
- get it from a moneylender
- get it from someone else
- I couldn't get it

33. Some people do these things to help keep costs down. Please tick if you have done the things in each row 'not at all', 'a little', or 'a lot'.  
(each row should have one tick)

|                                                                                                 | Have not done at all     | Have done a little       | Have done a lot          |
|-------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| a) gone without fresh fruit and vegetables to help keep down costs                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| b) continued wearing clothing that was worn out because you couldn't afford a replacement       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| c) put off buying clothing for as long as possible to help keep down costs                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| d) stayed in bed longer to save on heating costs                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| e) postponed or put off visits to the doctor to help keep down costs                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| f) NOT picked up a prescription to help keep down costs                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| g) spent less time on hobbies than you would like to help keep down costs                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| h) done without or cut back on trips to the shops or other local places to help keep down costs | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Please tell us some information about yourself:**

34. Are you?

Male

Female

35. What year were you born?

\_\_\_\_\_ (eg. 1965)

36. Are you in paid employment?

Yes – full-time

Yes – part-time

No

37. Which of the following do you receive? (*tick all that apply*)
- Working for families
  - Unemployment benefit
  - Domestic purposes benefit
  - Sickness benefit
  - Invalids benefit
  - New Zealand superannuation
  - Accommodation supplement
  - Disability allowance
  - Student allowance
  - I don't receive any of these
38. What was your household's income before tax in the last year?
- \$0 - \$20,000
  - \$20,001 - \$40,000
  - \$40,001 - \$60,000
  - \$60,001 - \$80,000
  - \$80,001 - \$100,000
  - \$100,001 and above
  - Don't know
39. Which ethnic group do you belong to? (*tick all that apply*)
- NZ European
  - Maori – Iwi: \_\_\_\_\_
  - Samoan
  - Cook Island Maori
  - Tongan
  - Niuean
  - Chinese
  - Indian
  - Other (such as *DUTCH, JAPANESE, TOKELAUAN*). Please state: \_\_\_\_\_

**Thank you for completing this questionnaire. Please send this survey form back to us in the enclosed return envelope, and we'll post a \$20 supermarket voucher to you.**

# Electricity Prepayment Meter Users Survey 2011 Consent Form

**Participants Name** \_\_\_\_\_

**Address and Phone Number** \_\_\_\_\_

\_\_\_\_\_

I have read and understand the information sheet about the Electricity Prepayment Meter Users Survey (dated August 2011) for people agreeing to take part in the study to understand more about how people use prepayment metering. I understand that I am free to request further information at any stage.

I understand that:

- Taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without any disadvantage. My electricity supply will not be affected in any way.
- I may choose not to answer every question in the survey.
- My electricity company will never be shown my survey form.
- The survey forms will be kept in locked storage for five years, and then destroyed.
- The results of the project may be published and available in the library and online but every attempt will be made to keep my identity confidential. My name and personal details will not be used except to contact me about the study.
- When I post my questionnaire back to the University of Otago, I will be sent a \$20 supermarket voucher to compensate me for my time and thank me for participating.

**I have had the opportunity read about this study and am satisfied with the information provided. I consent to take part in this study.**

|                                    |  |
|------------------------------------|--|
| <b>Participant's<br/>Signature</b> |  |
| <b>Name</b>                        |  |
| <b>Date</b>                        |  |

## Appendix Three: Additional results from the 2011 follow-up survey.

This appendix reports additional results from the 2011 follow-up survey (Chapter Six) alongside those from the same questions asked in 2010 that were reported and discussed in Chapter Five.

The age range of respondents (21-79 years) was smaller in 2011 as shown in Table 1, with an average age of 47. The proportion of those in retirement was 8.8% (65 years and over). The 2011 respondents had a significantly younger median age than the 2010 respondents.

### Demographics and housing characteristics

**Table 1: Age of respondents**

| Age range | 2011 Follow-up Results |           | 2010 Results |           | NZ Adult (over 20) Population |
|-----------|------------------------|-----------|--------------|-----------|-------------------------------|
|           | % Reported             | 95% CI    | % Reported   | 95% CI    |                               |
| 80+       | 0                      |           | 0.3          | 0.0-1.8   | 4.5%                          |
| 65-79     | 9.1                    | 5.4-14.2  | 8.4          | 6.0-12.2  | 12.8%                         |
| 55-64     | 21.4                   | 15.7-28.0 | 15.6         | 12.4-20.4 | 14.4%                         |
| 45-54     | 25.1                   | 19.1-32.0 | 19.2         | 15.8-24.4 | 19.1%                         |
| 35-44     | 24.1                   | 18.1-30.8 | 25.9         | 22.1-31.7 | 21.5%                         |
| 25-34     | 16.0                   | 11.1-22.1 | 18.1         | 14.8-23.2 | 18.1%                         |
| 20-24     | 4.3                    | 1.9-8.3   | 9.2          | 6.7-13.1  | 9.5%                          |
| 18-19     | 0                      |           | 0.6          | 0.1-2.3   |                               |

The reported ethnicities were spread as shown in Table 2, with high rates of Maori and Pacific participants, but fewer Asian participants as compared to the general population according to the 2006 Census (308). A higher proportion of respondents were of New Zealand European ethnicity than in the 2010 survey, while there were fewer Maori and Pacific respondents to the follow-up survey.

**Table 2: Self-reported (total responses) ethnicities of respondents compared with NZ population**

| Ethnicity                              | 2010 Results          |           | 2011 Follow-up Results |           | NZ Population % |
|----------------------------------------|-----------------------|-----------|------------------------|-----------|-----------------|
|                                        | % Reporting Ethnicity | 95% CI    | % Reporting Ethnicity  | 95% CI    |                 |
| Maori                                  | 35.4                  | 30.5-40.6 | 32.5                   | 25.9-39.6 | 14.6            |
| Pacific Peoples                        | 23.1                  | 18.9-27.9 | 15.5                   | 10.7-21.3 | 6.9             |
| Asian                                  | 2.5                   | 1.2-4.9   | 3.6                    | 1.5-7.3   | 9.2             |
| European/NZ European/<br>New Zealander | 52.1                  | 46.8-57.3 | 59.8                   | 52.5-66.8 | 78.7            |
| MELAA                                  | 0.3                   | 0.0-1.8   | 0.5                    | 0.0-2.8   | 0.9             |
| Other Ethnicity                        | 0.3                   | 0.0-1.8   | 0                      |           | 0.04            |

Although the number who did not know their household income was lower in 2011, this is still a relatively large proportion of the respondents (Table 3). When those who did not know their income were excluded and only the spread of valid responses across the six income brackets is examined, the results show that those using prepayment metering are an even more disadvantaged group, than those in 2010 with at 66.1% having a household income less than \$40,000 in 2011, and 83.3% with a household income less than \$60,000.

**Table 3: Household Income of Respondents**

| Household Income   | 2011 Follow-up Results |           |                             | 2010 Results |           |                             |
|--------------------|------------------------|-----------|-----------------------------|--------------|-----------|-----------------------------|
|                    | % Reported             | 95% CI    | % Spread of valid responses | % Reported   | 95% CI    | % Spread of valid responses |
| \$0-\$20,000       | 26.8                   | 20.7-33.6 | 32.1                        | 22.9         | 18.7-27.7 | 29.8                        |
| \$20,001-\$40,000  | 28.4                   | 22.1-35.2 | 34.0                        | 27.7         | 23.1-32.7 | 36.0                        |
| \$40,001-\$60,000  | 14.4                   | 9.8-20.2  | 17.2                        | 15.6         | 12.1-19.9 | 20.3                        |
| \$60,001-\$80,000  | 9.3                    | 5.6-14.3  | 11.1                        | 5.6          | 3.5-8.6   | 7.3                         |
| \$80,001-\$100,000 | 3.6                    | 1.5-7.3   | 4.3                         | 3.4          | 1.8-5.9   | 4.4                         |
| \$100,001 or more  | 1.0                    | 0.1-3.7   | 1.2                         | 1.7          | 0.7-3.8   | 2.2                         |
| Don't know         | 12.9                   | 8.5-18.4  |                             | 20.1         | 16.2-24.7 |                             |



Table 4 shows that self-rated housing conditions were similar across both survey years.

**Table 4: Self-rated housing conditions**

| Self-rated housing conditions                                | 2011 Results |             | 2010 Results |             |
|--------------------------------------------------------------|--------------|-------------|--------------|-------------|
|                                                              | %            | 95% CI      | %            | 95% CI      |
| Excellent (no immediate repair and maintenance needed)       | 22.7         | 17.0 - 29.3 | 19.8         | 15.9 - 24.4 |
| Good (minor maintenance needed)                              | 37.1         | 30.3 - 44.3 | 35.2         | 30.3 - 40.4 |
| Average (with some repair and maintenance needed)            | 31.4         | 25.0 - 38.5 | 35.8         | 30.8 - 41.0 |
| Poor (immediate repairs and maintenance needed)              | 6.2          | 3.2 - 10.6  | 4.7          | 2.9 - 7.6   |
| Very Poor (needs immediate extensive repair and maintenance) | 0.5          | 0.0 - 2.8   | 2.0          | 0.9 - 4.2   |

Electricity was the main form of hot water heating used, and was also the main method of cooking for respondents, as found in the 2010 survey, with only slightly more respondents using gas in the follow-up survey.

### **Satisfaction with prepayment metering**

As with the 2011 survey, a high level of general satisfaction with prepayment metering (Table 5) and their electricity company (Table 6) were indicated by the respondents. The tables below show 2011 and 2010 survey results, reporting 95% confidence intervals.

**Table 5: General Level of Satisfaction with Prepayment Metering**

| Level of Satisfaction with PPM | 2011 Follow-up Survey Results | 2010 Survey Results |
|--------------------------------|-------------------------------|---------------------|
| Very Satisfied                 | 45.6%, CI 38.4-52.9           | 48.5%, CI 43.2-53.8 |
| Fairly Satisfied               | 33.7%, CI 27.1-40.8           | 27.6%, CI 23.1-32.6 |
| Neutral                        | 9.3%, CI 5.6-14.3             | 15.3%, CI 11.8-19.6 |
| Dissatisfied                   | 2.6%, CI 0.9-6.0              | 4.5% CI 2.7-7.3     |
| Very Dissatisfied              | 1.6%, CI 0.3-4.5              | 3.3%, CI 1.8-5.9    |

**Table 6: General Level of Satisfaction with Electricity Company**

| Level of Satisfaction with Electricity Company | 2011 Follow-up Survey Results | 2010 Survey Results |
|------------------------------------------------|-------------------------------|---------------------|
| Very Satisfied                                 | 41.7%, CI 34.6-49.0           | 37.0%, CI 32.1-42.3 |
| Fairly Satisfied                               | 30.2%, CI 23.8-37.2           | 32.6%, CI 27.8-37.7 |
| Neutral                                        | 14.6%, CI 9.9-20.4            | 21.2%, CI 17.1-25.8 |
| Dissatisfied                                   | 5.2%, CI 2.5-9.4              | 5.3%, CI 3.3-8.3    |
| Very Dissatisfied                              | 0.5%, CI 0.0-2.9              | 2.8%, CI 1.4-5.2    |

Respondents were asked two open questions: “what are the two best things about using your prepayment meter to pay for electricity?”; and “what are the two worst things about using your prepayment meter to pay for electricity?”. The qualitative answers were thematically coded to give the frequencies provided below, and where several answers were given by a respondent, all were included in the analysis rather than only the first two. Frequencies are given as a percentage of those who responded to the questions, i.e. those who did not answer the question have been excluded from this analysis. Advantages named by 91.8% of respondents to the follow-up survey aligned with the responses given in 2010 (Table 7). Disadvantages were also similar (Table 8), and were given by 76.3% of respondents. One disadvantage remaining problematic is dissatisfaction with the Globug brand of prepayment meter used by one company as found in the 2010 survey. In 2011 47.2% of consumers using a Globug meter who named disadvantages made specific negative comments, (similar to the figure of 45.5% in 2010) and the total response rate to the survey from that electricity company’s customers dropped slightly to 33.5% in 2011, from 38.9% in 2010.

**Table 7: Advantages of prepayment metering**

| Advantages of Prepayment Metering                  | 2011 Results (%) | 2010 Results (%) |
|----------------------------------------------------|------------------|------------------|
| No bills                                           | 52.8             | 45.8             |
| Budgeting easier                                   | 44.4             | 34.9             |
| Prepaying/pay as use                               | 14.0             | 10.7             |
| Payment frequency                                  | 5.1              | 8.1              |
| Monitor usage of electricity                       | 50.0             | 44.1             |
| Control/conserve electricity                       | 18.0             | 18.2             |
| Easy to top up/credit                              | 5.1              | 8.9              |
| Store to purchase is convenient/close/more options | 2.8              | 4.6              |
| Availability of emergency credit                   | 3.9              | 2.6              |
| Cheaper than on a bill/lower rate                  | 6.2              | 4.3              |
| No disconnection/reconnection fees                 | 1.1              | 2.0              |
| No meter readers                                   | 1.1              | 0.9              |

**Table 8: Disadvantages of prepayment metering**

| Disadvantages of Prepayment Metering                                                                      | 2011 Results (%) | 2010 Results (%) |
|-----------------------------------------------------------------------------------------------------------|------------------|------------------|
| Self-disconnection (running out of credit)                                                                | 30.4             | 28.1             |
| Forgetting to top-up/purchase credit                                                                      | 6.1              | 11.1             |
| Having no money for credit                                                                                | 12.2             | 8.0              |
| \$20 minimum top-up too expensive                                                                         | 9.5              | 5.9              |
| No emergency credit/not enough emergency credit available                                                 | 4.7              | 0.7              |
| Having to use emergency/used up emergency credit                                                          | 2.7              | 2.1              |
| More expensive/extra charges                                                                              | 13.5             | 12.5             |
| Having to go to an outlet to purchase credit                                                              | 16.9             | 12.8             |
| Outlets too far away/too few outlets to purchase credit                                                   | 15.5             | 18.1             |
| Hours of outlets inconvenient                                                                             | 12.8             | 11.1             |
| Payment method limited (no online/phone/credit card payments)                                             | 4.7              | 4.2              |
| Ringling to reconnect/top-up credit                                                                       | 5.4              | 5.6              |
| Keying in code                                                                                            | 2.0              | 2.1              |
| Meter in an inconvenient location in the house                                                            | 4.7              | 2.1              |
| Having to monitor meter                                                                                   | 4.1              | 5.2              |
| Having to limit consumption (heating, cooking, entertainment)                                             | 4.1              | 1.0              |
| Unexpected high consumption of electricity (eg having visitors, cold snaps, meter jumps to lower balance) | 7.4              | 2.4              |
| Stigma associated with prepayment                                                                         | 1.4              | 0                |

Four questions were asked to discover how the respondents compared using prepayment metering to their previous method of payment, with answers remaining broadly consistent in 2011. Most respondents indicated that when they use prepayment metering: they believe electricity costs the same; they use less electricity; they spend less; and they think more about how much electricity they use.

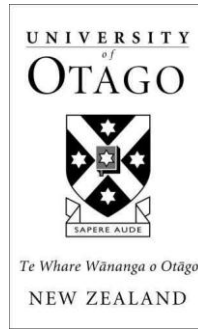
**Table 9: Comparing Prepayment Metering to Previous Payment Method (% and 95% CI)**

| Comparison statement                                                                              | Follow-up 2011 responses |                    |                    | 2010 Responses     |                    |                    |
|---------------------------------------------------------------------------------------------------|--------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                                                                                                   | More                     | The Same           | Less               | More               | The Same           | Less               |
| Electricity costs more/the same/less when paying with the prepayment meter                        | 24.9%<br>18.9-31.6       | 36.3%<br>29.5-43.5 | 29.0%<br>22.7-36.0 | 29.5%<br>24.9-34.6 | 32.9%<br>28.1-38.0 | 31.2%<br>26.5-36.3 |
| I use more/the same/less electricity when paying with the prepayment meter                        | 6.7%<br>3.6-11.2         | 41.5%<br>34.4-48.8 | 42.5%<br>35.4-49.8 | 10.9%<br>8.0-14.7  | 39.1%<br>34.1-44.4 | 44.1%<br>38.9-49.5 |
| I spend more/the same/less on electricity when paying with the prepayment meter                   | 18.3%<br>13.1-24.6       | 31.9%<br>25.4-39.1 | 40.3%<br>33.3-47.6 | 24.0%<br>19.8-28.9 | 30.2%<br>25.5-35.3 | 39.9%<br>34.9-45.2 |
| I think about how much electricity I use more/the same/less when paying with the prepayment meter | 43.8%<br>36.6-51.1       | 27.1%<br>20.9-34.0 | 21.4%<br>15.8-27.8 | 45.1%<br>39.9-50.4 | 27.9%<br>23.3-32.9 | 22.3%<br>18.2-27.0 |

The frequency that respondents credited their prepayment meter remained similar to the 2010 findings, with 13.5% (9.0-19.1) topping up every few days, 54.4% (47.1-61.6) once a week, and 18.1% (13.0-24.3) once a fortnight. Only 5.2% (2.5-9.3) reported topping up once a month, and just 2.0% (0.6-5.2) less than once a month. Reported expenditure was similar to the 2010 survey. The reported amount spent on electricity per month varied widely again in 2011, with the reported spread the same at \$10.00 through to \$800.00, with a mean amount of \$148.82 per month (s.d. \$85.72) up from \$141.66 in 2010 (s.d. \$83.51). The most commonly reported amount spent per month was again \$100.00 in 2011 and the median spend was \$122.50, (compared to \$120.00 in 2010). This is less than the national average household expenditure on electricity of \$148 reported in the Household Economic Survey for the year ended June 2010 (309).

## **Appendix Four: Qualitative interview schedules and in-home display device**

This appendix contains the information sheet, consent form, and the three qualitative interview schedules used in the Metered Out: Household Management of Electricity project to obtain the data that was analysed in Chapter Eight. It also contains information on the in-home display device given to participants of the study at the end second interview, which was theirs to keep.



## **Metered Out: Household Management of Electricity INFORMATION SHEET FOR POTENTIAL PARTICIPANTS**

Thank you for your interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

You are invited to apply for the *Metered Out Study* being carried out by He Kainga Oranga, / Housing and Health Research Programme, which is part of the University of Otago, located in Wellington. He Kainga Oranga carries out research exploring the relationship between housing and health. We have a commitment to doing research that is relevant to people and communities and that will make a difference to people's lives.

By the end of the study, every house still enrolled in the study will have been interviewed three times, and given one "cost-plug" to keep. After each interview, we will give participants a \$25 supermarket voucher for their time. So households that do the whole study will receive a total of \$75 per house and a cost-plug. It costs nothing to join the study.

### **Why is the Study being done?**

Many households in New Zealand houses use electricity to heat their houses, but over the past few years it has become increasingly expensive. We want to understand how people who are having difficulty paying for electricity decide when to use electricity, and what they know about what uses the most electricity. We also want to see if people having trouble paying for electricity manage to keep their houses warm enough to be comfortable and healthy.

### **Where is the study being done?**

The Study is taking place in the Greater Wellington area: Wellington, the Hutt Valley, and Porirua.

### **When is the Study taking place?**

The study will take place during 2011. We will enrol people in the autumn, and interview them three times, once each in the autumn, winter and spring.

### **Who can take part?**

We are looking for participants who are getting help through Family Budgeting Services for help managing their electricity bills (they may also be getting help for managing other bills). We would like people of a variety of ages and ethnicities.

Although we are interested in having participants who use all different types of electricity payment plans we are especially interested in people who have just decided to get a pre-payment electricity meter.

Because we are interviewing people over a year, we want participants who are planning to stay in the same house until spring 2011. We want people who are interested in taking part in research. We are looking for a total of twenty people/households.

### **What will I do, if I take part?**

If your household takes part, we would like to interview one person responsible for paying the electricity bill, three times in your home. You can have another support person/partner with you during the interview if you like. Each interview will take about an hour, and will usually be carried out by two people. The interviewers will ask your thoughts about what uses the most electricity, and what it's important to have in the home. If you do not like, or want to answer any of the questions you do not need to do so.

We will also ask to read the electricity meter during each interview, and see any mail that the electricity company has sent you over the past year.

During the first interview we will install two dataloggers in your home, they will measure the temperature and moisture in your home during the study (they do not measure anything else).

During the second interview we will give you a "cost-plug" and explain how to use it. It will be yours to keep.

During the third interview we will take down the dataloggers.

### **What will you do with the information?**

We will record your interview on a digital recorder. Some of your answers we will write on a questionnaire. We will transcribe your interview so we can analyse what you tell us. We will not tell anyone outside the study team that you took part in this study.

The research team will have access to your information, however no electricity company will be given access to your raw data. When the report/s are written some short direct quotations of what you have said may be used. Companies and others may read the report and know that \*someone\* said something about them, but they will not know that \*you\* said it. Although we will do our best to preserve your anonymity, if you tell people that you are taking part in this research, and they read the report they may be able to guess what you said.

The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand), and online, but every attempt will be made to preserve your anonymity.

The data collected will be securely stored in such a way that only the research team will be able to gain access to it. At the end of the project any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in secure storage for at least five years, after which it will be destroyed.

If you do not wish to take part you do not have to.

Further information and a copy of the research report will be made available on our website, [www.healthyhousing.org.nz](http://www.healthyhousing.org.nz), just look under "Metered Out". If you wish at the end of the study we will send you a summary of the results.

This project involves an open-questioning technique. The general line of questioning includes energy use, energy bills and how people choose different priorities. The precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops. Consequently, although the University of Otago Human Ethics Committee is aware of the general areas to be explored in the interview, the Committee has not been able to review the precise questions to be used.

In the event that the line of questioning does develop in such a way that you feel hesitant or uncomfortable you are reminded of your right to decline to answer any particular question(s) and also that you may withdraw from the project at any stage without any disadvantage to yourself of any kind.

### **Can Participants Change their Mind and Withdraw from the Project?**

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

### **What if Participants have any Questions?**

If you have any questions about our project, either now or in the future, please feel free to contact either:-

Kim O'Sullivan (3855999 x5611 ) or Helen Viggers (3855999 x 6847) Department of Public Health, University of Otago, Wellington

This study has been approved by the University of Otago, Department of Public Health, Ethics approval process



## Metered Out: Household Management of Electricity

### CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:-

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. Personal identifying information will be destroyed at the conclusion of the project but any raw data on which the results of the project depend, including digital recordings will be retained in secure storage for at least five years;
4. This project involves an open-questioning technique where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops and that in the event that the line of questioning develops in such a way that I feel hesitant or uncomfortable I may decline to answer any particular question(s) and/or may withdraw from the project without any disadvantage of any kind;
5. After every interview my household will be given a \$25 supermarket voucher for my time. At the second interview my household will be given a cost-plug to keep;
6. The results of the project may be published and available in the University of Otago Library (Dunedin, New Zealand), and online, but every attempt will be made to preserve my anonymity, and my name will never be used.

I agree to take part in this project.

.....  
(Signature of participant)

.....  
(Date)

## METERED OUT: HOUSEHOLD MANAGEMENT OF ELECTRICITY USE

### Qualitative interview schedule for first interview – August 2011.

#### Transition from quantitative short question interview section

This next part of the interview is a bit different; we'd like to ask you some questions so you can tell us more about using electricity and paying for electricity in your home. Everyone's answers are different, and there are no right or wrong answers, you can talk about whatever you like. We'd like to remind you that the questions for everyone's interviews will also be a bit different, and if there is anything you feel uncomfortable answering you can choose not to answer that question.

#### Electricity use in your home

We're interested in how people use electricity in their home and what they get out of using electricity, so we'd like to start by talking about this

**1 What do you use electricity for? What do you think uses most electricity in your home?**

**2 Do you do anything to try to save electricity in your home?**

Prompts for Q2

**If yes:** Can you describe those things you do to save electricity? What are the main reasons that you try to save electricity?

**If no:** Do you think that you could do anything to cut back on electricity use? What are the reasons that you don't? (Do you feel you can't save any electricity, or that you already use the minimum amount of electricity?)

## Paying for electricity

These next questions we'd like to ask you are more about paying for electricity.

**3 Have there been times when you have had to choose between paying for electricity and paying for other things?**

Prompts for Q3

How important is being able to use electricity in your home?

**4 Can you tell me about a time when your house felt colder than you would like?**

Prompts for Q4

Can you remember what month that was? (Was that in winter?)

Is that a situation that happens often for you?

**5 Can you talk a bit about your dealings with your electricity company/companies?**

Has the electricity company sent you anything recently?

Prompts for Q5

Have you ever been sent any late account notices?

Did you ever call your electricity company to talk about paying for your electricity?  
Or did they ever contact you? Was that about ways to pay for your electricity?

Have you ever received any disconnection notices? And what happened after that?

**6 Can you tell me about how you find (your method) as a way to pay for electricity?**

Prompts: What works well? What doesn't? What are the best and worst things about it.

(for those with prepayment meters -- running out of credit ? Why? Worst thing about running out?)

**7 Can you tell me about how you budget for electricity?**

Prompts for Q7

How does this work for you?

Did you use to do something else? How did you find that?

About how much did you spend on electricity (winter/summer)?

Have you ever had outside help to pay the actual bill? Who helped? How long ago?

Future planning for electricity

The last thing we'd like to ask about is what you plan to do between now and when we see you next time.

**8 Are there things you think you might do differently when it comes to using electricity?**

## Prompts for Q8

And what about paying for electricity? Do you have any plans to do that differently?

How about using electricity? (Appliances/hot water) Is there something that you are going to try to do differently?

## Closing the interview

Thank you, that is all of the questions that we had for today, this has been a really interesting talk. Do you have any other thoughts that you would like to add today?

## METERED OUT: HOUSEHOLD MANAGEMENT OF ELECTRICITY USE

### **Qualitative Interview Schedule for 2<sup>nd</sup> Interview – September 2011**

#### Transition from Short Interview Section

Again like last time, we'd like to ask you some more open questions and have a bit more of a chat about some things related to budgeting for electricity, and managing electricity in your home.

Firstly, is there anything that you thought about after we talked last time that you would like to share with us?

#### Healthy homes and electricity

Could you describe your ideas about what makes a healthy home?

How is that the same or different to this house?

Is there anything you use electricity for to make your home healthy?

Are there other things that you think you could use electricity for to make your home healthy? What are the reasons that you don't do this?

Have you always used electricity like this? What about in other houses you've lived in?

Some people have talked about how some people need to use more electricity to be healthy, what are your views about that? For instance do you think age affects how much electricity you need to use to keep healthy at home?

## Budgeting

Are there things like holidays, shiftwork, or illness that you take into consideration when you are budgeting for electricity? In what ways do these things change the way that you plan for your household bills?

Last time we talked about budgeting for electricity and how much different appliances use, I wondered if you were to get a new appliance, say a new fridge or oven, how would you work out whether it used more or less electricity than the one you have now?

INTRODUCE PARTICIPANT TO COST-PLUG, ENERGY EFFICIENCY ADVICE SHEET

## Closing the interview

Thank you, that is all of the questions that we had for today, this has been a really interesting talk again. Do you have any other thoughts that you would like to add today?

Thank you. We'd like to come and talk with you again in about four weeks' time for our last visit, and to find out about how you got on with the cost-plug and about your electricity use... shall we make a time?

## METERED OUT: HOUSEHOLD MANAGEMENT OF ELECTRICITY USE

### **Qualitative Interview Schedule for 3<sup>rd</sup> Interview – September 2011**

#### Transition from Short Interview Section

Again like last time, we'd like to ask you some more open questions and have a bit more of a chat, but this time we'd like to talk about how you found the cost-plug.

Before we get on to that, is there anything that you thought about after we talked last time that you would like to share with us?

#### Cost-plug

Did you use the cost-plug?

What were the reasons for not using it?

Was there something tricky about using it?

What did you use it for?

What did it tell you?

Was that what you expected it to tell you?

What did you like about using it?

Was there anything you didn't like about it?

What was tricky about it?

Would you recommend it to other people?



How does it compare to using the prepayment meter?

If somebody mentioned to you that they were having problems with their electricity what would you suggest?

What are the reasons for that?

What would you say to try next if they were still having trouble?

PPM/Costplug?

### More about prepayment meters

Who do you think prepayment meters are good for?

Is there anyone who should not use a prepayment meter?

### Closing the interview

Thank you, that is all of the questions that we had for today, this has been a really interesting talk again. Do you have any other thoughts that you would like to add today?

Thank you. That is our final interview, thank you so much for taking part in the study, we really appreciate your help with our research. Do you have any questions about what we do with the information we've collected? Thanks.

### In home display device Elto EMA-1 Meter

This meter was used as an alternative in home display device for the Metered Out study. It was selected because it was relatively inexpensive at NZ\$24.99, and we were able to purchase it from a *Dick Smith Electronics* store, a common chain store in New Zealand, which also provides free delivery of the device.

The Dick Smith Electronics webpage for this product provides the following general overview information<sup>44</sup>:

Model #: **EMA1** Cat#: **DSNZ\_M7319**

This Mains Power Meter measures an appliances power usage. Displays Voltage, Current, Power, Power used, & Cost.

The power meter plugs into a power point and turns it into a real-time power monitoring outlet. You can enter the local price of your electricity and the meter will tell you exactly how much the appliance is costing to run. In addition, the power meter tracks the power used and can display the voltage or current being drawn as well as the peak levels that have been drawn. The meter has backup batteries so it will not lose the stored data during a blackout or moving from point to point. Simple to install and a valuable tool for monitoring you power consumption.

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<sup>44</sup> <http://www.dicksmith.co.nz/product/M7319/mains-power-meter> - accessed 9 September 2012



This photo courtesy Helen Viggers, 2012.

The following available customer reviews of the product suggested that this was an acceptable in home display device:

Purchased this to assess how much power items were using around the house and it does a good job. You can use it to read the watt's used by items in various modes, e.g. for a laptop when using, when the screen is hibernating, and when the item goes into power-saver mode and virtually shuts down. If you enter in the cost per kWh from your power bill into the unit and leave it attached to a device for a whole month it will gradually increment the cost for you giving you a true picture of real life usage. It is a little tricky to setup initially as some of the text is very small and the info supplied is sparse. You will also want to go to a couple of energy saving web pages to understand the connection between the wattage, kWh, and how to turn these into a months costing without leaving the device plugged in for days at a time. Pros: good price, works well. Cons: hard to read screen, instructions sparse. I would recommend this to a friend!

This is a really neat and useful tool - I spent several weeks going through all the electrical appliances in the house. You can program it with the cost per watt, and

work out how much an appliance costs to run. The handiest thing is being able to detect how much power something is drawing even if it's switched "Off". Some appliances you wouldn't think of needing power when turned off still draw power (like our Bosch washing machine). One caveat is that it's not too accurate for items that draw very low current, like cellphone chargers. It's not as useful once everything in the house has been checked and catalogued, but always handy if you ever get a new toy and what to check what it costs to run. Pros: helps you check on your power consumption, great fun for a gadget nerd. Cons: doesn't give accurate results for low power items, loses appeal once you've checked everything. I would recommend this to a friend!

## Appendix Five: Publications arising from this thesis

The following papers appear in this Appendix in order of publication and the progressive phases of the thesis multiphase mixed methods research programme: The versions provided are the final copies provided by the authors to the journals.

**O'Sullivan, K.,** Howden-Chapman, P., and Fougere, G. (2011) Making the connection: the relationship between fuel poverty, electricity disconnection and prepayment metering. *Energy Policy*; 39: 733-741.

Full version available at:

<http://www.sciencedirect.com/science/article/pii/S0301421510007974>

**O'Sullivan, K.,** Howden-Chapman, P., Fougere, G, Hales, S., and Stanley, J. (2013) Empowered? Examining self-disconnection in a postal survey of electricity prepayment meter consumers in New Zealand. *Energy Policy*; 52: 277-287.

Full version available at:

<http://www.sciencedirect.com/science/article/pii/S0301421512007951>

**O'Sullivan, K.,** Howden-Chapman, P., Stanley, J., and Hales, S. (2013) Kids in the cold: Outcomes for households with children using prepayment metering. *New Zealand Medical Journal*, 126:1371, 71-81.

Full version available at: <http://journal.nzma.org.nz/journal/126-1371/5574/>

Two further papers arising from this thesis have been submitted for publication, which are not included here are:

**O'Sullivan, K.,** Howden-Chapman, P., Stanley, J., and Fougere, G. Dark and cold: A longitudinal postal survey of electricity prepayment meter users in New Zealand

examining self-disconnection over time, and heating practices. Submitted for publication, April 2013.

**O'Sullivan, K.**, Viggers, H., and Howden-Chapman, P. The influence of electricity prepayment meter use on household energy behaviour. Submitted for publication, April 2013.

A paper that I contributed to as a co-author drawing on this thesis is not included here, but has been published during the course of this thesis:

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*; 49: 134-142. Full version available at:

<http://www.sciencedirect.com/science/article/pii/S0301421511007336>

## TITLE

Making the connection: the relationship between fuel poverty, electricity disconnection and prepayment metering.

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ABSTRACT 178 words

Fuel poverty, or inability to afford adequate heating for a reasonable outlay of expenditure, is a significant and under-researched problem in New Zealand. The connection between fuel poverty, electricity disconnection or 'self-disconnection' is analysed for four cities using prepayment metering to pay for electricity. A price comparison analysis on a government-sponsored website showed that prepayment metering was more expensive than other payment options. This website analysis was supplemented by qualitative data from older people with chronic respiratory disease expressing their views about electricity disconnection and prepayment metering. We show that prepayment metering for electricity is more expensive than other payment methods in New Zealand and that older people's insights provide valuable context to these issues. Under the present payment schedule, the use of prepayment metering to pay for electricity is not a suitable policy instrument to address fuel poverty, which remains problematic. The deregulated electricity market continues to lead to increases in the real price of residential electricity and in the number of people in fuel poverty. We offer policy suggestions for reducing fuel poverty in New Zealand.

## KEYWORDS:

Fuel poverty, prepayment metering, 'self-disconnection'

## Introduction

Cold housing is a health risk and being able to afford to keep a house warm is clearly a factor (Strategic Review of Health Inequalities in England Post-2010 2010). Fuel poverty is an important social determinant of health in New Zealand, where relatively high rates of excess winter mortality (EWM), or deaths occurring in the winter months of June-September exceed deaths expected from non-winter rates, are observed. From 1980-2000 an average of 1,600 excess winter deaths occurred each year and mortality in this period

was estimated to be 18% higher than expected (Davie, Baker et al. 2007). This rate of EWM is greater than in some less temperate European countries (Healy 2003). The endurance of the high level of EWM over time is probably due to the slow progress in retrofitting insulation into existing houses and policies to remove inefficient wood burners in order to improve air polluting particulate matter (Melhuish, Shearer et al. 2005/6), which have led to a declining level of space heating (Howden-Chapman, Viggers et al. 2009). These factors, along with the rapidly rising cost of residential electricity means that for some households, disconnection from electricity services for non-payment of bills is a severe outcome of fuel poverty, which increases the strain on already stretched household budgets.

Prepayment metering is a payment method commonly offered to households who face disconnection as an alternative to post-paid plans (Electricity Commission 2008), and is often presented by companies as a useful tool to aid budgeting. In this paper, we firstly discuss fuel poverty and prepayment metering before analysing the household financial options to domestic electricity customers through a price comparison of different electricity payment plans, including prepayment meter options in four New Zealand cities. We show that prepayment metering options, recommended to those on low income with financial problems to lower their expenditure, are more expensive than the standard payment option. In order to understand the implications of the advice, in the second part of the paper we present qualitative data on the consequences of living with electricity disconnection and prepayment metering, for older people with an illness negatively affected by cold conditions, chronic obstructive pulmonary disease.

### Fuel poverty

Fuel poverty, or the inability to obtain household energy services, including heating, for less than 10% of household income (Boardman 1991), is a significant and under-researched public health problem in New Zealand (Lloyd 2006; O'Sullivan 2008). Fuel poverty is caused by energy inefficiency of the house, together with income poverty, which prevents the household from achieving adequate indoor temperatures (Clinch and Healy 1999). In New Zealand, electricity is the most common heating fuel and small, ineffective electrically-powered heaters are commonly used for space heating, which also contributes to fuel poverty (Howden-Chapman, Viggers et al. 2009). Unlike other jurisdictions, such as the United Kingdom, where fuel poverty has gained political recognition and the government has specific policies designed to eradicate fuel poverty by 2016 (Boardman 2010), New Zealand has been slow to recognise fuel poverty and it has not gained traction on the policy agenda.

The health effects of fuel poverty include, but are not limited to, respiratory distress (Collins 1993), exacerbation of respiratory conditions including asthma (Howden-Chapman, Matheson et al. 2007; Howden-Chapman, Pierce et al. 2008) and chronic obstructive pulmonary disease (COPD) (Collins 2000; Sherwood Burge 2006; Osman, Ayres et al. 2008), exacerbation of arthritic/rheumatic symptoms (Shortt and Rugkasa 2007), accidental



hypothermia particularly among older people (Pedley, Paterson et al. 2002; Roaf, Crichton et al. 2005; Critchley, Gilbertson et al. 2007), increased risk of accidents in the home (Roaf, Crichton et al. 2005), and increased risk of cardiovascular events caused by defence mechanisms triggered when the body is cold, which thicken the blood and increase blood pressure (Collins 1993; Lan Chang, Shipley et al. 2004; Howieson and Hogan 2005). In a narrative synthesis of five recent intervention studies examining specific effects of cold housing on health, Liddell and Morris (2010) conclude that broader health and wellbeing measures may better capture the full range of benefits that improved housing conditions and heating are likely to have on human health.

Fuel poverty also contributes to excess winter morbidity and mortality (Healy 2003; Rudge and Gilchrist 2005), or increased morbidity and mortality occurring in winter months compared to summer months. Those most at risk of fuel poverty include families with young children (Bhattacharya, DeLeire et al. 2003; Frank, Neault et al. 2006), older people (Morgan, Blair et al. 1996; Wright 2004; Burholt and Windle 2006; O'Neill, Jinks et al. 2006), people with disabilities or ill-health (Harrison 2004), and the unemployed (McAvoy 2007), as these groups spend most of their day at home so require heating for longer than people at work or school.

The price of electricity is an important driver of fuel poverty in New Zealand (O'Sullivan 2008; Howden-Chapman, Viggers et al. 2009). Following an extensive programme of deregulation, New Zealand's electricity market is one of the least regulated electricity markets in the OECD (Bertram 2001). The market, although small, is disaggregated into different sectors including generation, transmission, and retail, with some state-owned enterprises, which must act under a business model to return profits to the government shareholder, also participating in the market. In practice, vertical reintegration of the market through large companies operating in more than one sector has occurred in New Zealand, as in other parts of the world such as the United Kingdom, and deregulation has not delivered either the increased market competition or efficiency that was promised to drive down prices (Beder 2003; Bertram and Twaddle 2005; Poletti 2009). The price of electricity has risen steeply in real terms since the 1990s, with residential electricity prices increasing 71% between 1990 and 2008, while industrial prices increased only 18% and commercial prices actually decreased 21% (Ministry of Economic Development 2010). This price escalation of residential electricity intensified after 2000 (Bertram and Twaddle 2005; Ministry of Economic Development 2008), and continues to be the subject of inquiry (Commerce Commission 2009; Layton, Dean et al. 2009; Nils-Henrik 2009; Wolak 2009). Despite this, even after a recent Ministerial Review of Electricity Market Performance (Layton, Dean et al. 2009), regulation of the domestic market continues to be light-handed and favours voluntary guidelines rather than state intervention.

New Zealand studies have found that meeting the cost of electricity and other utilities bills is a significant problem (Kearns, Smith et al. 1991; Waldegrave, King et al. 2004). The most recent New Zealand Living Standards Report identified that 10% of Pakehā (New Zealanders of European descent) families, and 25% of Māori (indigenous) families could

not keep up with electricity, gas, or water bills (Jensen, Krishnan et al. 2006). Based on a modelling study, Lloyd (2006) estimated that between 10-14% of the population of New Zealand may be living in fuel poverty, using the United Kingdom threshold of required spending of household income of 10%. Lloyd (2006) also found a strong regional effect, with rates of fuel poverty in Dunedin, the southernmost city included in the modelling, estimated at 26-32%, compared with 6-8% for the northernmost city Auckland. However, this study used 2001 income and electricity price data. A revised estimate calculated using 2008 electricity prices and income data from the 2006 Census put the level of fuel poverty at 23% nationally (Lloyd, 2008, personal communication). The only way in which the Government has intervened to achieve lower electricity prices is by requiring a low user tariff for those using under 8000kWh per annum or 9000kWh per annum in the south of the South Island: this must be offered at around one third of the price of regular fixed daily charges.

### Prepayment Metering

There are a range of payment options for electricity users in New Zealand, including direct debit options, which often have prompt payment discounts attached to them, and prepayment meters. Prepayment metering is a payment method where the consumer credits a special meter installed at the house, before the electricity is consumed. Prepayment metering is used by utility companies to provide service in instances where the consumer is considered a credit risk, or the consumer requests this method of payment (Speak 2000). Prepayment meters can be used to collect payment of debt while continuing the supply of electricity (Electricity Commission 2007), and are often portrayed by retailers and perceived by consumers as a useful budgetary tool (Boardman and Fawcett 2002; Sharam 2003). Costs for prepayment meters vary considerably, and retailers reported in July 2008 that fixed daily charges for prepayment meters ranged between NZ\$0.21 and NZ\$0.68 (Electricity Commission 2008).

Coutard and Guy (2007) argue that the advantages of prepayment metering, and the appreciation that prepayment meter users have for them are often overlooked. Prepayment metering increases awareness of energy use, and a recent review of 12 pilot studies that investigate the effect of in home displays showing electricity use on consumer behaviour found that the direct feedback provided encourages energy conservation (Faruqui, Sergici et al. 2010). Consumers who actively use in home displays reduce electricity consumption on average 7%, and when a prepayment meter is used in addition to an in home display consumption is reduced by about 14% (Faruqui, Sergici et al. 2010). While reduced consumption may be beneficial from an environmental perspective, or in a purely economic sense, low income households tend to have less discretionary energy consumption and therefore less opportunities for reducing consumption (Colton 2001). This may be of particular concern in New Zealand where electric space heating is commonly used, and use of central heating is rare, as cutting back on electric heating to reduce electricity consumption will often mean that the house is then underheated. However, using prepayment metering provides greater budgetary control, and avoids the accrual of debt, in

addition to disconnection and reconnection fees often applied to post-payment customer accounts where disconnection cannot be avoided. Prepayment metering may also empower low income consumers to choose when unavoidable disconnection may occur, and remove the need for embarrassing or stressful interactions with their electricity company about debt and disconnection (Sharam 2003; Coutard and Guy 2007).

Several articles have discussed the effect of prepayment metering on low income domestic consumers in the United Kingdom (Graham and Marvin 1994; Drakeford 1997; Graham 1997; Speak and Graham 1999; Speak 2000; Graham 2006). Grey literature produced by community organisations also discusses fuel poverty and the use of prepayment meters<sup>1</sup> (Sharam 2003). These authors all highlight the higher prices generally paid by consumers using prepayment meters, along with the essential nature of electricity services, as growing concerns which can lead to social exclusion of low income consumers.

Using prepayment meters for electricity acts to “shift the burden of disconnection from the public to the private sphere” (Drakeford, 1997, p120). This household disconnection is misleadingly termed ‘self-disconnection’ given that the electricity company is not disabling the connection to the electricity grid: rather, the consumer is ‘choosing’ not to re-credit their prepayment meter, and is thereby ‘self-disconnecting’ their household from electricity services (or other services that may be supplied through prepayment metering). Because of this, official statistics on disconnection rates with prepayment meters are not collected (Graham 2006). Cosmo Graham (2006) cites figures from Ofgem, the regulatory body for the electricity and gas markets in the United Kingdom, suggesting around one quarter of consumers using prepayment meters experienced self-disconnection in the third quarter of 2005, a period of relative prosperity. Doble (2000), in his survey of gas prepayment meter users, found higher disconnection rates of around 30%. The Electricity Commission (2008, p86) compared New Zealand’s much higher rate of disconnection with that of Victoria, Australia and the United Kingdom, and commented that while “prepayment meters have been used extensively in the United Kingdom, and this may be reducing the apparent rate of disconnection for non-payment”, prepayment meters are not used in Victoria. British information suggests a clear correlation between reduced official electricity disconnection figures, and increased in prepayment meter use (Drakeford 1997; Graham 2006). Sharam (2003) points out that low income people prefer the discretion and privacy that prepayment metering offers, rather than face negotiating with electricity companies, reconnection fees, and uncertainty about when they will be disconnected. However, prepayment metering may contribute to poor health, by increasing cold and damp through lack of heating (Speak and Graham 1999).

Stephen Graham (1994, 1997), describes the shifting low income consumers to prepayment metering as “social dumping”; enabling companies to reduce the costs and negative publicity of household disconnection. Despite this, many consumers using prepayment meters express a high level of satisfaction with them, and state that they would be reluctant to switch to a different payment plan, a switch which often involves considerable transaction costs.<sup>2,3</sup> If debt has built up on the account prior to moving to prepayment and

the consumer is using prepayment to pay off debt while continuing to access electricity services, switching to a different plan may not be possible (Boardman and Fawcett 2002). In addition, there are limits to the benefits prepayment meter users may gain from switching companies, due to limited competition between prepayment meter plans, if the consumer wishes to remain on prepayment, and costs associated with switching (Boardman and Fawcett 2002).

Switching between companies is encouraged by the government as a means for households to exercise consumer choice, and government support for Powerswitch, the website tool for consumers to compare prices between companies described below evidences continued belief in the market. This ability to choose between companies is an essential part of neo-liberal economic theory which provided the rationale for the government to deregulate the electricity market in the 1990s. While the neo-liberal policy was based on the purported benefits of competition, residential consumers have been shown to display a preference for less choice and are reluctant to participate in the market as expected (Brennan 2007).

According to the Electricity Commission's Prepayment Meter Survey Results (2008), there were a total of 52,664 prepayment meters installed in New Zealand in 2008; the number of prepayment meters in use had not increased over the previous five years (Electricity Commission 2008). This figure corresponds to around 3% of the total number of households in New Zealand in 2008 according to Government Statistics.<sup>4</sup> Following a high profile death of a woman in 2007, which was partly attributed to the disconnection of electricity carried out by the retailer for non-payment of bills (Matenga 2008; O'Sullivan, Howden-Chapman et al. 2010), disconnection rates fell rapidly in 2007-2008. During this time electricity retailers put a halt to disconnection for non-payment, while the *Guideline on arrangements to assist low income and vulnerable consumers* set out by the Electricity Commission was reviewed. Companies have since complained that there are instances of consumers 'gaming the system' and called for a relaxation of the Guidelines to protect only those with certification of a critical electronic medical device.

The Guidelines have now been revised and split into two distinct Guidelines, one that deals with 'vulnerable' consumers, and one with 'medically dependent' consumers (Electricity Commission 2010; Electricity Commission 2010). The new Guidelines prevent disconnection for reasons of non-payment from electricity services for those consumers who are certified medically dependent on 'critical electronic medical equipment', for example dialysis or oxygen concentration machines, but not for those who are vulnerable due to low income. Both Guidelines state that prepayment metering must be offered as an alternative payment method, though medically dependent consumers may be advised against their use and must be fully informed of the risk of 'self-disconnection'.

The most recent statistics collated by the Electricity Commission show that the number of disconnections for non-payment are increasing again, although they have not yet reached the high levels seen in early 2007 (Electricity Commission 2010). Because the disconnection statistics were affected by the incident described above, and due to a lack of

recent statistics on the number of prepayment meters currently in use, it is difficult to assess whether ‘self-disconnection’ associated with prepayment meters is now masking an increase in total disconnection rates. This complicated situation is in contrast to the British example, where a clear correlation between the reduction of official electricity disconnections and increased prepayment meter use was shown (Drakeford 1997; Graham 2006). In a yearly survey of electricity retailers regarding prepayment meters undertaken in March 2007 by the Electricity Commission, one retailer “noted that it did not believe that prepayment meters were an effective solution for low income consumers” and that “prepayment meters ‘hide’ the difficulties of low income consumers” (Electricity Commission 2007). This calls into question the ethics of promoting prepayment meters as a budgeting tool for those who are consistently having difficulty paying their electricity bills, as the Electricity Commission (2010c, p4) also “considers electricity to be an essential service for domestic consumers – it is a necessity for individuals and household groups to maintain health and wellbeing, and to sustain a reasonable standard of living”.

#### Price comparison study

Concerns have been raised in other countries about disparities caused by retailers charging more for electricity purchased using prepayment metering than other payment plans (Drakeford 1997; Boardman and Fawcett 2002). To investigate whether prepayment pricing plans are more expensive than other payment plans in New Zealand, we undertook a price comparison analysis. As part of their initiatives to encourage competition in the electricity retail market, the government sponsors a website run by Consumer New Zealand, that displays price comparisons, [www.powerswitch.org.nz](http://www.powerswitch.org.nz). Price comparisons were obtained for four city areas of New Zealand; Auckland Central and Manukau City, and Wellington in the North Island, Christchurch City, and Dunedin City in the South Island. Price comparisons were run in September 2009, and again in February 2010 with similar results, and only the latest results are presented below. Comparisons were run using the following variables that can be entered into the site: 1-2, 3-4, and 5 or more person households; someone at home during the day; electric hot water cylinder; plug-in electric heating with additional heating provided by a portable unflued LPG heater; electric oven and stove. Estimated annual electricity usage was generated by the website calculator, and prices over two plan types were compared: controlled hot water, which allows the electricity retailer to restrict hot water heating at times of peak demand; and uncontrolled hot water. Direct debit payment prices were compared with prepayment metering prices for both plan types. The cheapest possible prices across all retailers are shown in the results below.

The costs between each region cannot be directly compared, as the estimated annual usage of electricity increases with each southern geographical shift due to the changes in climate which lead to increased need for heating. There are also geographical differences in electricity prices due to the differences in generation, transmission, and retail in the different areas.

The majority of electricity plans available in New Zealand include a fixed daily tariff charge, and a per kWh charge for the actual amount of electricity used. One retailer is now offering only single rate tariffs, where consumers are only charged a per kWh charge, and any other costs are bundled into that single charge. These single rate plans are shown in the graphs in yellow, and are in most situations slightly cheaper than direct debit.

Comparing the estimated costs for a 3-4 person household, Fig 1 shows that prepayment metering is more expensive than direct debit payment in every case. Dunedin, the most southern and coldest city, has the most disparity between the direct debit and prepayment plans, with the cheapest prepayment metering price for a controlled hot water plan being \$2,523 compared to \$2,056 for a direct debit plan, a 22.7% increased cost. The difference in the prices of uncontrolled hot water plans is even more marked, with a 38.9% higher price for prepayment metering (\$2,918 compared with \$2,100 for direct debit payment). Prepayment is also more expensive than the single tariff rate offered by one retailer.

In the Wellington region, two retailers offer prepayment metering, and the retailer offering the cheapest plan, does not offer a controlled hot water plan, where the company has no ability to restrict electricity use in times of peak demand. This inability further limits the choice of those using prepayment metering, and increases their costs, as uncontrolled hot water plans are usually more expensive than controlled hot water plans. The uncontrolled plan in this case is more expensive than the controlled plan, but this is probably because the comparison is between two retailers; if the cheaper company offered a controlled plan it would probably be cheaper.

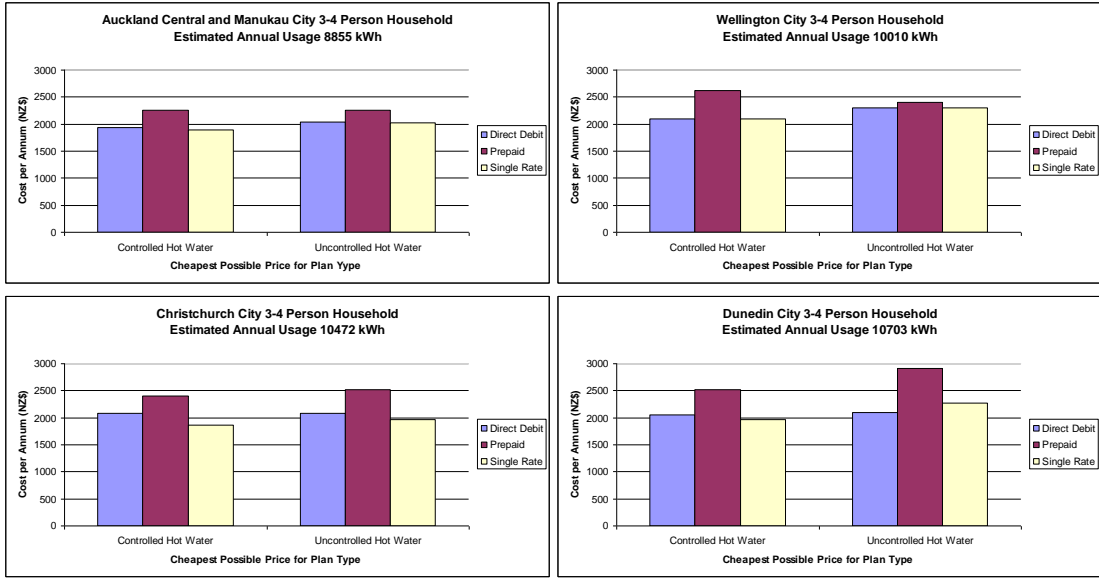


Fig. 1: Electricity price comparisons for 3-4 person households for Auckland, Wellington, Christchurch and Dunedin cities. Source of prices: [www.powerswitch.org.nz](http://www.powerswitch.org.nz) accessed 10 February 2010.

Comparing prices for households with five or more people shows the same pattern - prepayment metering is the most expensive payment plan. The greatest disparity between prepayment and direct debit payment is again in Dunedin.

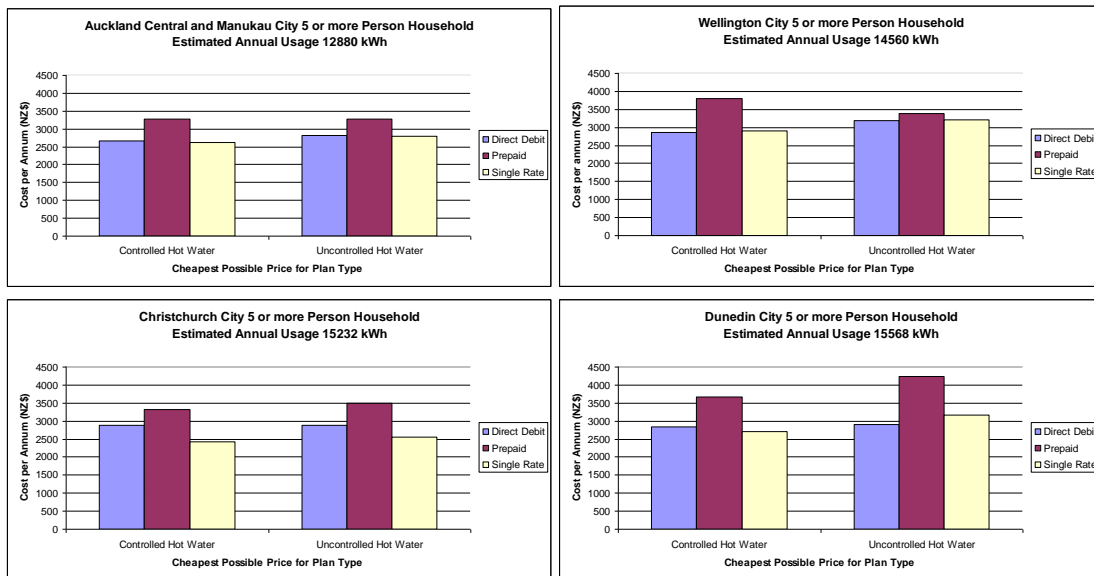


Fig. 2: Electricity price comparisons for 5 or more person households for Auckland, Wellington, Christchurch and Dunedin cities. Source of prices: [www.powerswitch.org.nz](http://www.powerswitch.org.nz) accessed 10 February 2010.

Turning now to price comparisons for 1-2 person households, the pattern is similar, although more complex, as these households are all eligible for a low daily fixed charge tariff option. Legislation stipulates that households using under 8000kWh annually for Auckland and Wellington, or 9000kWh in Christchurch and Dunedin in this study must be offered a low daily fixed charge that is around one third of the usual daily fixed charge. Retailers are free to set the per kWh charge, however, and therefore the price difference between a low user tariff plan and a regular plan is small, as the per kWh charge is higher.

The graphs below show that in the case of 1-2 person households, prepayment metering is again more expensive than direct debit payment plans, in the four regions studied.

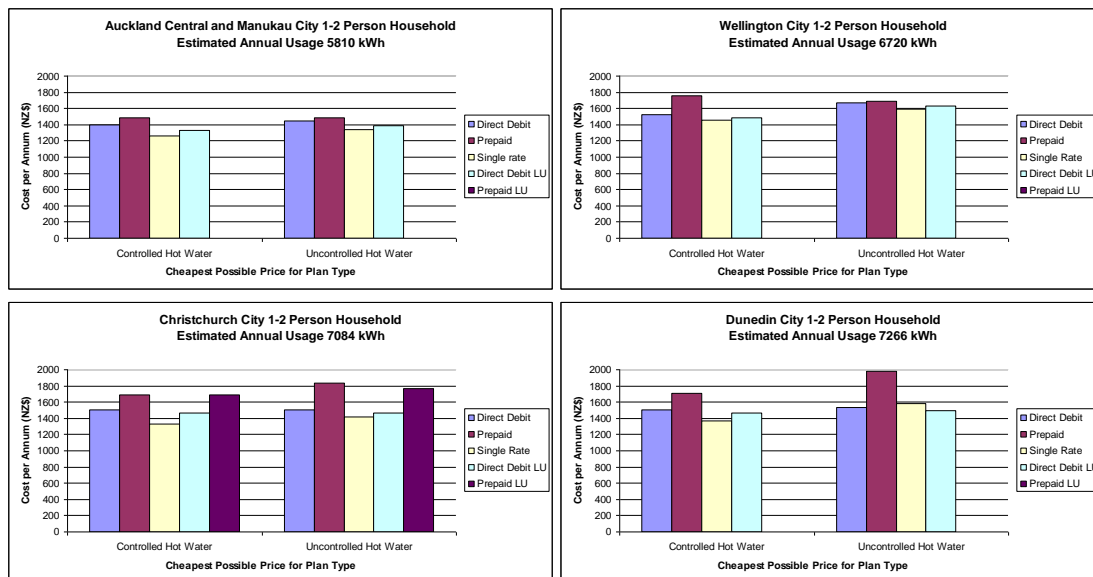


Fig. 3: Electricity price comparisons 1-2 person households for Auckland, Wellington, Christchurch and Dunedin cities. Source of prices: [www.powerswitch.org.nz](http://www.powerswitch.org.nz) accessed 10 February 2010.

Only one company, which retails prepayment metering in the Christchurch region, offers low fixed user tariffs to customers using prepayment metering. This indicates that the other companies may be operating outside the legal regulations.<sup>5</sup>

#### Disconnection and prepayment metering: Community insights

The following section outlines insights gained from the Qualitative Component of the Warm Homes for Elderly New Zealanders Pilot Study. This study piloted a randomised community trial of an electricity voucher, which aims to increase the indoor temperature in the homes of older people on low incomes with Chronic Obstructive Pulmonary Disease (COPD), a respiratory disease that is negatively affected by exposure to cold temperatures, and reduce winter morbidity (O'Sullivan 2008). An amount of NZ\$500 was directly credited into the participants' electricity accounts in order to enable them to heat their homes during the winter of 2007, and semi-structured interviews were undertaken following this. Structural narrative analysis (Labov 1997; Riessman 2008), was used in the analysis of the data. A full copy of the research report is available at <http://ourarchive.otago.ac.nz/handle/10523/367>, and a description of the community trial which is currently underway is available at <http://www.healthyhousing.org.nz>. The following anonymised quotes are taken from the qualitative interviews undertaken with four of the nine participants from the pilot study.

Most of the participants explained that they needed electricity for their nebuliser and/or oxygen machine, and therefore they would be considered 'medically dependent' on 'critical electronic medical equipment' under the Electricity Commission Guidelines and should not be disconnected from electricity services. Participants generally described a fear of being disconnected, or not being able to use their machines. Participants spontaneously made



references to the highly publicised death of a woman, who was medically reliant on an oxygen machine, after her electricity was disconnected for non-payment (O'Sullivan, Howden-Chapman et al. 2010), and to the resulting public advice that people who had medical requirements for electricity should have their doctors advise their electricity providers.

For example, Kiri mentioned *“that incident that happened with that lady”*, and described how she had spoken with her electricity retailer saying to them *“because I’m COPD... I’ll provide you with a letter from my doctor... please don’t cut us off”*. Ripeka talked about the need to *“stop them”* from *“cutting my power off”*, saying that her doctor had written to her electricity provider explaining her condition, and that she uses a nebuliser, *“and that under no circumstances must my power be turned off”*. Ripeka explained that, *“they take \$30 a week out of my [social welfare] benefit”*, adding, *“That’s just to stop them from ever cutting my power off”*.

When asked whether the cost of electricity worried her, Mabel’s first response was *“Yes it does. Because, without that electricity I can’t use my machine”*, saying that without *“the power for my nebuliser, I can panic”*. Mabel later described a particular incident where she had shifted into a new house where the previous tenants had not paid their electricity account, and she and her husband had had to argue forcefully with their electricity retailer to have the electricity connected despite them having paid up fully on their own account. Mabel suggested a solution to this problem, *“So that’s when I says ‘well why don’t you people put [prepayment meters] in places like this’.”* However, she did say when asked about this that she did not believe that prepayment metering would be suitable for older people as getting to the retail outlets to buy more prepaid cards may be difficult for those who are less mobile.

Kahu and Howard, using a prepayment meter, described a form of ‘self-disconnecting’, turning off the mains power supply at the fuse box during the day, as a method of rationing the electricity remaining before they would be able to afford more. Howard described this in detail, saying:

*“I’ve done it three times now... turning it off on a Tuesday morning... because I’ve only had say four or five dollars in there, and I turn it on at four o’clock... do a barbeque for the kids when I come home, so they got dinner, and then turn it on at night... we had a dollar fifty left in the morning, it would last until nine o’clock and I’d go down and buy some.”*

He explained that if the credit runs out, the electricity is not disconnected between 4pm and 8am, and that switching off the mains electricity during the day and then turning it on again later ensured that their meter would not disconnect the electricity. Evaluating their situation, Howard said, *“But ah no one likes to live like that! Every week. Yeah.”* Later in the interview, Howard described how Kahu, who also has COPD, had once been admitted to hospital because they had run out of electricity on a Monday and were not going to be paid until the Wednesday, which meant she would be without her nebuliser (critical

electronic medical device) for that time. The family were informed that an emergency loan was available from social welfare; however Howard commented *“I’ll stick to turning it off. Because you’ve gotta still pay that back... you don’t have to if I turn it off.”*. Using prepayment metering has given Howard a method of controlling their electricity usage, and ensuring that they remain out of debt, and in this sense he has agency to control their situation. However, this method also means that on the days where he has ‘self-disconnected’, he and Kahu will be at home on a winter’s day with no electricity, leaving the only available source of heating an unflued gas heater which negatively affects Kahu’s respiratory disease.

## Discussion

The data presented from the price comparison study shows that prepayment metering is a costly method of obtaining electricity services in New Zealand. While prepayment metering may be useful in some situations, the additional expense may negate its perceived usefulness in others, for example in low income households where it may be used as a budgeting aid. Further, this study does not include the transaction costs incurred in using prepayment metering, such as time and travel required to purchase credit, which increase the price differentials between using prepayment metering and other payment plans. It also takes time to correctly interpret the payment options and their relative costs, which are often difficult to interpret, even when using tools such as Powerswitch. The study also highlights geographical disparities in the difference between prepayment metering and other payment plans, with Dunedin City in the south of the South Island being the most expensive city location to use prepayment metering. This extra expense is the context of the higher rates of fuel poverty in Dunedin, partly due to increased heating requirements as compared to Auckland in the north (Lloyd 2006). Low fixed daily charge tariffs are legislated for, yet are not always made available to consumers using prepayment metering, which further increases disparity between the payment plans for smaller households.

Successive New Zealand Governments have continued to encourage consumer switching to reduce the prices paid for electricity services by consumers, instead of engaging in more regulation or radical restructuring of the electricity system or even enforcing the provision of low fixed daily tariffs. This has been highlighted by the support of the previous and current Government for the Powerswitch website used to compare prices in this study. However, it is difficult to see how much more successful consumer switching can be in reducing prices when New Zealand’s rate of consumer switching is high by comparison with other countries (Brennan 2007; Defeuilley 2009).

The interviews with older people with COPD illustrate the fear they have of disconnection. Older people with chronic respiratory illnesses, who rely on electronic medical equipment are particularly vulnerable to fuel poverty, which exposes them to cold indoor conditions (Sherwood Burge 2006) and their reliance on ‘self-disconnection’ as a method of rationing electricity is potentially fatal. Although households where one or more people are medically reliant on electricity are discouraged from using prepayment metering, the Electricity

Commission comments that it would be discriminatory to deny these households this option (Electricity Commission 2010). While the particular frailties of this group are not present in the general population, other households suffering fuel poverty are likely to experience similar difficulties with electricity disconnection and 'self-disconnection'. This is especially true for those households, who have a member with chronic illness, or include older people or young children, as these groups are at particular risk of cold indoor temperatures. In addition, electricity disconnection causes further hardship for already stretched households as the inconvenience of loss of food supplies due to refrigeration / freezer thawing, and lack of access to hot water for adequate hygiene, or cooking facilities is universal.

The comparison of pricing options in this paper has shown that the present retail supply arrangements structurally discriminate against low income consumers; only one company in New Zealand has taken steps to implement a more equitable policy. Further, it is not just prepayment metering customers who are disadvantaged; some companies penalise those who choose to pay in person, by cheque or credit card with additional administrative fees, which can only be avoided through paying by direct debit or internet banking (Fisher and Wood 2010). Ofgem, the British regulator has recently called into question the liberalised energy market (Office of Gas and Electricity Markets (Ofgem) 2010), which was followed by New Zealand, and has led to high residential energy prices. Moreover, in contrast to New Zealand, there has been increasing concern about the rise of fuel poverty in Britain and in response to this among other concerns, Ofgem has proposed a public body to control the market (Office of Gas and Electricity Markets (Ofgem) 2010). Successful policy for reducing fuel poverty in New Zealand will need to take into account the regulation of electricity prices particularly to low income households, and differential payment methods, as well as other contributing factors such as income, housing quality, and heating appliances.

This paper highlights that the use of prepayment metering alone is not an adequate policy to address fuel poverty in New Zealand. Use of prepayment metering in its current form by households struggling with fuel poverty is likely to cause greater hardship, electricity purchased is more expensive than other payment methods. Furthermore, New Zealand's culture of under-heating suggests that increased awareness of the cost of electric heating is likely to discourage fuel poor households using prepayment metering from using much needed heating. The only saving that is likely to be beneficial to fuel poor households using prepayment metering, is that if they cannot afford to pay and would otherwise face disconnection on a post-payment plan, they can avoid the disconnection and reconnection fees, which can be substantial and possibly lead to greater hardship to those struggling with electricity bills. At least those households using prepayment metering avoid these fees when disconnection is inevitable and have some control over 'self-disconnection'. Similar control can be exercised over electricity use, although as the qualitative research indicates this can lead to considerable stress and under-utilisation of electricity for example electric heating.

On the other hand, prepayment metering can provide the impetus to conserve energy by giving direct consumer feedback (Faruqui, Sergici et al. 2010), and encouraging for example switching off unnecessary lighting or appliances not in use. It is not the prepayment meter device itself that causes most of the problems identified in this paper, but the way in which prepayment meters are regulated, priced, and marketed in New Zealand that is currently problematic. With stronger controls in place to restrict electricity companies from charging more for electricity purchased through prepayment, prepayment metering could be useful to low income households living in fuel poverty. Northern Ireland provides a good example of how implementation of suitable policies can make prepayment part of the solution to the fuel poverty problem (Boardman 2010).

In order to address fuel poverty, New Zealand must first recognise fuel poverty as a specific policy problem, and encourage research into the number of households living in fuel poverty. While government departments had recently undertaken some cross-departmental research in this area as highlighted by the Electricity Commission (Electricity Commission 2008), no publications reporting the results of this work are available on government websites in July 2010. Use of a benchmark to assess the level of fuel poverty, such as the 10% income threshold used in the United Kingdom would be a good place to start, despite the shortcomings of the approach as highlighted recently by Boardman (2010). Only after the number of households in fuel poverty is identified can targets to reduce fuel poverty be set, and policies introduced to reduce fuel poverty be evaluated against the benchmarked targets to ensure a positive impact on fuel poverty is achieved.

Continuation of the current policy Warm Up New Zealand, which provides subsidies for insulation, and clean heating, should help to reduce fuel poverty. However, better targeting of the policy to ensure that it reaches those in fuel poverty may be necessary. Providing stricter controls on rental properties to improve thermal quality and access to efficient heating may also be necessary, as it is likely that a large proportion of households in fuel poverty in New Zealand are private rental tenants, due to diminishing home ownership and the significant private rental sector.

Although no recent Governments have considered reregulating the electricity market, in the absence of more redistributive tax and social policies, regulation is essential to reduce fuel poverty. The ongoing upward trend in the price of residential electricity is likely to be increasing the number of households in fuel poverty, particularly following impact of the global economic recession on household incomes. While there is legislation in New Zealand providing for low fixed daily tariffs for those households using under the average annual amount of electricity, this is currently balanced by increased per unit charges, which reduces the effectiveness of this policy. As highlighted by the price comparison analysis it seems that these rules are not being adhered to, or adequately enforced, as only one company appears to be offering the low fixed daily tariff to prepayment customers. Restricting electricity price increases will reduce Government revenue given that three of the largest electricity companies are State Owned Enterprises, however the health and social costs of fuel poverty are currently difficult to estimate and unaccounted for. There is a

growing body of research that identifies some of these costs, for example recent New Zealand research showing that improving heating in the homes of asthmatic children reduces the number of days absent from school (Free, Howden-Chapman et al. 2010). We support Liddell and Morris' (2010) call for further research that better estimates these indirect effects of fuel poverty.

## Conclusion

This paper has made the connection between fuel poverty, electricity disconnection, and the use of prepayment metering, and provided insights on the impact of these problems on vulnerable older people. The price comparison study has shown that the use of prepayment metering is a more expensive payment method than others such as direct debit in New Zealand. The comments on disconnection and prepayment metering arising from qualitative evidence from the Warm Homes for Elderly New Zealanders Study highlight some of the difficulties faced by older, low income people with chronic obstructive pulmonary disease. Although this is a select group of people, these observations bring some social context to the hidden problems of fuel poverty.

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Footnotes

<sup>1</sup> [http://www.cab.org.nz/issues/policy/Electricity\\_Governance\\_submission.htm](http://www.cab.org.nz/issues/policy/Electricity_Governance_submission.htm)

<sup>2</sup> <http://www.ccp.uea.ac.uk/publicfiles/publications/Prepayment%20Meters%20-20Boon%20or%20Bane.pdf>

<sup>3</sup> [http://www.nea.org.uk/Policy\\_&\\_Research/Policy\\_Briefings/Prepayment\\_Meters](http://www.nea.org.uk/Policy_&_Research/Policy_Briefings/Prepayment_Meters)

<sup>4</sup> [http://www.population.govt.nz/sitecore/content/statistics/Home/browse\\_for\\_stats/population/estimates\\_and\\_projections/dwelling-and-household-estimates.aspx](http://www.population.govt.nz/sitecore/content/statistics/Home/browse_for_stats/population/estimates_and_projections/dwelling-and-household-estimates.aspx)

<sup>5</sup> **Electricity retailers to make low fixed charge tariff options available**

(1) For each of the delivered electricity packages that an electricity retailer supplies to homes in its supply areas, the electricity retailer must make at least 1 low fixed charge tariff option available. (2) To avoid doubt, the obligation in subclause (1) applies with respect to all homes, whether or not they have prepayment meters and irrespective of the degree of load control that the domestic consumer has.

<http://www.legislation.govt.nz/regulation/public/2004/0272/latest/viewpdf.aspx>



**Title:**

Empowered? Examining self-disconnection in a postal survey of electricity prepayment meter consumers in New Zealand.

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**Abstract 181 words:**

Prepayment metering is an electricity payment method often used by low-income consumers. Fuel poverty is an important public health problem in New Zealand, and is likely to be a particular problem for those using prepayment metering. This paper details a nationwide postal survey of consumers undertaken with the support of three major electricity retailers, which investigated the advantages and disadvantages of using prepayment metering from a consumer perspective. The study surveyed a total pool of 359 randomly selected consumers across the three companies, a response rate of 48%. The study found that while almost all respondents felt the benefits of using prepayment outweighed the risks of running out of credit or 'self-disconnection', 53% of respondents experienced self-disconnection in the past year. Of concern, over a third of respondents experiencing self-disconnection were without electricity for more than 12 hours. The frequency of self-disconnection was also high, with 17% of those disconnecting reporting six or more events in the past year. Government intervention could reduce the risks and disadvantages involved with using prepayment metering, which could then support initiatives aimed at reducing fuel poverty.

**Keywords:**

Prepayment metering; fuel poverty; self-disconnection

## Research Highlights:

- Results of a national postal survey of New Zealand electricity prepayment users.
- Self-disconnection is an extreme outcome of fuel poverty.
- 53% of respondents experienced self-disconnection in the past year.
- Self-disconnection is problematic, lasting 12 or more hours for 38% of those who disconnected.
- Government policies could minimise health effects and capture benefits of prepayment metering.

## Introduction

Fuel poverty, which has been defined as the inability to acquire adequate household electricity (including WHO recommended safe indoor temperatures for health) for 10% of household income (Boardman 1991), remains a significant and unaddressed problem in New Zealand (Howden-Chapman, Viggers et al. 2011). Fuel poverty is distinct from income poverty as it requires policy coordination of capital investment to improve building, heating and other appliance efficiency, while income poverty may be addressed through income support (Boardman 1991). Although there is debate about this definition (Liddell, Morris et al. 2012; Moore 2012; Waddams Price, Brazier et al. 2012), fuel poverty is wide-spread and definitional debates should not preclude preventive multi-sectoral action. The adverse health effects of fuel poverty include physiological and psychosocial effects of exposure to cold indoor temperatures (Liddell and Morris 2010; Marmot Review Team 2011; Hills 2012). Those most at risk of fuel poverty include families with young children (Bhattacharya, DeLeire et al. 2003; Frank, Neault et al. 2006), older people (Morgan, Blair et al. 1996; Wright 2004; Burholt and Windle 2006; O'Neill, Jinks et al. 2006), people with disabilities or ill-health (Harrison 2004), and the unemployed (McAvoy 2007). These groups spend most of their day at home, so require indoor temperature control for longer than people at work or school.

New Zealand has a high rate of excess winter mortality compared with other OECD countries (Davie, Baker et al. 2007), and fuel poverty is a likely contributor to this. A study linking Census and mortality data showed a statistically increased risk of dying in winter among low-income people, those living in rented accommodation and those living in cities (Hales, Blakely et al. 2010). Households, particularly in the private rental sector, commonly rely on electric space heating which is costly and often ineffective (Howden-Chapman, Viggers et al. 2009). This combined with a housing stock of poor thermal efficiency contributes to the cold indoor temperatures experienced by many households (Howden-Chapman, Matheson et al. 2007; Lloyd, Callau et al. 2008).

In May 2007, after the disconnection of the electricity to a household was linked to the death of a woman who relied upon a supplementary oxygen supply, all disconnections were briefly halted (O'Sullivan, Howden-Chapman et al. 2012). But by 2011, more than 30,000 disconnections for non-payment were carried out by electricity retailers, with over 9000 of these occurring in the winter months (July to September). Disconnections are continuing to increase (Electricity Authority 2012a; Wilson 2012) despite the government's focus on consumer 'switching' to increase competition.<sup>45</sup> The government-supported "What's my number?" campaign, which encourages consumers' use of a website to calculate the number of dollars they could save by switching retailers, is credited with

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<sup>45</sup> <http://www.ea.govt.nz/consumer/csf/> - accessed 4 May 2012

the decrease in electricity prices seen in the last half of 2011 (Electricity Authority 2012b). While the campaign may have reduced the relative costs of the 388,000 consumers who changed companies in 2011 (Electricity Authority 2012b), it has not constrained the rise in overall residential electricity prices which were recently increased by 5-10%.<sup>46</sup>

Any benefits to households from switching are likely to have been skewed toward upper rather than lower income households, because of the constraints on switching faced by those on low incomes. Electricity companies require a cash 'bond', usually of NZD\$150-\$200, before they will connect households. Switching also creates additional difficulties for those consumers who have outstanding electricity debts, or a bad credit history, more often those at the severe end of the fuel poverty spectrum who have already experienced the costs of disconnection for non-payment and subsequent reconnection fees. Moreover, for those using prepayment metering an up-front payment is usually required to remove the meter and transfer to another payment method. Despite criticism from the independent Parliamentary Commissioner for the Environment (Wright, Hendy et al. 2009) and the International Energy Agency (International Energy Agency 2011), prepayment meters in New Zealand have usually not been smart meters and smart meters being installed are not required to be capable of remotely switching from prepayment to post-payment and vice versa (Electricity Authority 2010).

The lightly regulated nature of New Zealand's electricity market contributes to local fuel poverty (Howden-Chapman, Viggers et al. 2009). A recent price comparison, which found large regional variations also found that prepayment metering was always more expensive than other payment options, even apart from additional transactional costs (O'Sullivan, Howden-Chapman et al. 2011). Price comparison is complicated by the fractured nature of the electricity market; significant regional price variations and a segmented market with little competition particularly for prepayment. Similar results were found by an independent not-for-profit organisation, which manages the price comparison website "Powerswitch" with government support (Wilson, 2012). Even when comparing the same company's prepayment and cheapest standard post-payment plans, prepayment remains more expensive across 10 regional areas, with prices ranging from 3% - 38% higher than standard post-payment, with a median increased price of around 12% (Wilson, 2012).

International evidence also suggests consumers using prepayment metering are more likely to experience high rates of fuel poverty (Graham and Marvin 1994). Prepayment metering for electricity is often used by low-income consumers with electricity debt, or who have difficulty budgeting (Boardman and Fawcett 2002; Sharam 2003; Electricity Commission 2007; Brutscher 2011; Howat and McLaughlin 2012). While there are possible advantages of prepayment metering such as reduced electricity consumption, and greater awareness and control of electricity use (Coutard and Guy 2007; Faruqi, Sergici et al. 2010), low-income households tend to have less discretionary electricity consumption with fewer opportunities for reducing consumption (Colton 2001).

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<sup>46</sup> <http://www.consumer.org.nz/news/view/nationwide-power-price-hikes> - accessed 10 May 2012

One of the most significant disadvantages to using prepayment metering is the risk of households 'self-disconnecting'<sup>47</sup> or running out of credit on their prepayment meters, resulting in no electricity, which may have serious health implications. Doble (2000) argued that in order to give a useful picture of the pattern of self-disconnection among prepayment meter users, a representative sample of *all* those who use prepayment meters should ideally be studied. Doble (2000) used a random sampling strategy to sample the population of prepayment meter users from company lists in the United Kingdom to investigate the extent of prepayment gas self-disconnections. This study showed that while the number of households experiencing gas self-disconnection was higher than in other surveys sampling community and budgeting agencies, the majority of these self-disconnections were for short periods of time and largely unproblematic (Doble 2000).

There is no collection of official statistics on the number of households self-disconnecting or any other information available on the consumer experience of using prepayment metering in New Zealand. While Doble's (2000) study was a useful precursor to the present study, the Privacy Act 1993<sup>48</sup> restricts the sharing of personal information for uses other than those it was originally collected for. Our study required an innovative participant recruitment and data collection technique of working with three electricity retailers and a third party mailing company, to send the surveys to a representative nationwide sample of prepayment meter users. The remainder of this paper details the methods, then presents the findings of the postal survey, undertaken in late 2010 in New Zealand. It contributes information on consumers' experience of prepayment metering, costs incurred, and outcomes of self-disconnection in households using electricity prepayment metering. We offer policy recommendations to minimise the negative impacts highlighted and increase the potential benefits of using prepayment metering as a tool to mitigate fuel poverty.

## **Aims**

This study aimed to investigate the advantages and disadvantages of using prepayment metering from a consumer's perspective, explore the number of self-disconnections from electricity among these consumers and whether these disconnections were problematic.

## **Specific Objectives**

- To investigate the advantages and disadvantages of prepayment metering;
- To determine the number of prepayment meter users who self-disconnect;
- To investigate the causes of self-disconnection and the length of time households who disconnect are without electricity.

## **Methods**

In 2008, 52,664 prepayment meters were used in New Zealand (Electricity Commission 2008). This is around 3% of households in the 2006 Census.

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<sup>47</sup> The term "self-disconnection" refers to the service being shut off when a prepayment meter runs out of credit. While the term problematically implies the consumer has agency to make a choice to disconnect, the term is widely used and understood so we use it here.

<sup>48</sup> <http://www.legislation.govt.nz/act/public/1993/0028/latest/DLM296639.html> - accessed 8 May 2012

The five electricity retailers offering prepayment meters were approached to gain access to a representative sample of the total population of prepayment meter users. Of these, one had very few consumers using prepayment in a localised area and declined to be involved. A second retailer had the majority of its prepayment consumers residing in the Canterbury region, and following the September 2010 Christchurch earthquake declined to be involved.<sup>49</sup> The three remaining major electricity retailers assisted with the study. A total number of 768 customers were included in the postal survey sample, based on a response rate of 50% (384), chosen so that confidence intervals for proportions would have an accuracy of plus or minus 5% (i.e. the total width of the confidence interval would be 10 percentage points at maximum).

The retailers were provided with a spreadsheet template to select the random sample from their total prepayment customer base. The sample from each retailer was proportional to their share of the total population of prepayment meter users. These retailers provided the contact details of the random sample to a mailing company, which was contracted by the researchers. A unique ID was assigned to each household in the random sample, to enable the researchers, mailing company, and electricity companies to discuss the households without revealing personal details to the researchers.

The mailing protocol used was adapted from the Tailored Design Method, which uses repeat mailings to maximise the response rate (Dillman 1991; Dillman, Smyth et al. 2009). This method was chosen as postal surveys undertaken in New Zealand using repeat mailings have achieved higher response rates than other studies with less intensive follow-up (Baken and Stephens 2005; Awatere 2008; Mainvil, Lawson et al. 2009; Phillips 2012). Methods to improve survey responses identified by systematic reviews were used where practicable, for example giving assurances of confidentiality, question order, and the incentive provided, (Edwards, Roberts et al. 2002; Edwards, Roberts et al. 2009). Given the high residential mobility in New Zealand, and anecdotal evidence from the electricity companies that they are not always informed when account owners moved as the meters can be credited by new residents without service interruption, letters were addressed to "The Householder" to minimise incorrectly addressed mail. To facilitate responses from multi-resident households, an instruction on the front of the survey and all accompanying letters stated that any household member who was over 18 and could discuss using prepayment metering at the address was able to fill out the survey form.

The surveys were sent with accompanying cover letters explaining that the electricity company was mailing the survey, but that the research was being independently carried out by university researchers. There were slight variations in the time between each mailing, and the wording of the cover letters, however changes were stylistic in nature, and the content of each mailing was the same. One company chose not to send the second to last to reminder letter.

As responses were received, the ID codes were reported by the researchers to the mailing company, who then removed those households from the next reminder mail-out. For two of the companies the return address was the mailing company, one company reported the ID codes to the researchers when items were undeliverable.

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<sup>49</sup> This retailer is withdrawing prepayment metering services from this area from September 2012, and is moving towards ending the service nationwide (Steeman 2012).

As is increasingly customary in New Zealand, participants were offered a NZD\$20 supermarket voucher to thank them for completing the survey, which was sent by the researchers on receipt of the survey form, where participants provided their personal details. Ethics approval (Category B) was obtained for the study, and all results are reported anonymously.

The survey data were entered into a Microsoft Access database and analysed using Epi Info version 3.4 (Center for Disease Control, Atlanta, GA). Qualitative data from the open questions were analysed by the first author using an iterative process to thematically code the data. Logistic regression was conducted using Epi Info. Risk factors for inclusion in the model (ethnicity<sup>50</sup>, age group, children in household, previous disconnection for late or non-payment, previous electricity debt, and household income) were chosen prior to modeling. Age group and household income were modeled as ordinal predictors such that the odds ratios reported indicate the change in the odds of the event per additional level of that factor.

## Results

A response rate of 48% (359/750) was achieved for the survey, excluding 11 of the 768 mailed which were returned to sender, and 7 respondents who returned the survey stating they were no longer using prepayment and were therefore ineligible for the study. It is probable that more of the non-respondent surveys should have been marked as 'undeliverable', however the return address was to the electricity companies and few notifications of returned mail were sent to the researchers.

Compared with the general population in the 2006 Census data (Statistics New Zealand 2007), there were fewer male, retirement age, and employed respondents (Table 1). There were high rates of Māori and Pacific participants, but fewer Asian and European participants.

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<sup>50</sup> As New Zealand allows for the multiple reporting of ethnicities by respondents, and the standard ethnicity question from the Census 2006 was used in the survey, we have reported total responses to ethnicity. For the logistic regression analysis ethnicity was prioritised due to the relatively small sample size, as is common practice when analysing health data, using the following order of priority: Māori, Pacific peoples, Asian, other ethnic groups besides European – commonly termed Middle Eastern, Latin American, and African or MELAA, then lastly European, other European, New Zealand European, and New Zealander which were grouped together due to the sample size (Kukutai and Callister 2009). Prioritised ethnicity was further condensed into the reference group “non-Māori, non-Pacific” due to the very small sample size in the non-European/New Zealand European group.



**Table 1: Respondent demographics**

| <b>Demographic variable</b> | <b>%</b> | <b>95% CI</b> |
|-----------------------------|----------|---------------|
| Female                      | 67.9     | 62.8 - 72.7   |
| Average Age                 | 43.9     | 42.4 - 45.4   |
| Paid employment             |          |               |
| Full-time                   | 30.2     | 25.5 - 35.3   |
| Part-time                   | 17.9     | 14.1 - 22.3   |
| Household income ≤\$40,000  | 50.6     | 45.3 - 55.9   |
| Total ethnicity*            |          |               |
| Māori                       | 35.4     | 30.5 - 40.6   |
| Pacific                     | 23.1     | 18.9 - 27.9   |
| Non-Māori, non-Pacific      | 56.8     | 51.5 - 62.0   |
| Children under 18           |          |               |
| At least one in household   | 54.3     | 48.8 - 59.6   |
| None in household           | 45.7     | 40.4 - 51.2   |
| Rental accommodation        |          |               |
| Private rental              | 39.9     | 34.9 - 45.2   |
| Government rental           | 30.2     | 25.5 - 35.3   |

\*As with the national census, the total responses to ethnic groups include all of the people who self-reported that ethnic group, whether as their only ethnic group or one of several ethnic groups.

Gross household incomes were low, with half below \$40,000, compared to the national median household income from regular sources of \$63,237 in 2010 (Statistics New Zealand 2010). Other indicators of financial hardship similarly illustrated socioeconomic deprivation (Table 2). Home ownership was low, with only 27% reporting that they or a family trust owned their house. In comparison, the 2006 Census reported 67% home ownership across the population, with 82% of those making rental payments paying a private landlord (Statistics New Zealand 2011).

**Table 2: Indicators of financial hardship**

| Indicator                                                                  | %    | 95% CI      |
|----------------------------------------------------------------------------|------|-------------|
| Unable to pay telephone, gas, or water bills by due date in past 12 months | 46.5 | 35.3 - 45.7 |
| Received outside help to pay for electricity in past 12 months             |      |             |
| Grant or loan from family/friends                                          | 13.9 | 10.6 - 18.0 |
| Government grant                                                           | 7.0  | 4.6 - 10.2  |
| Government loan                                                            | 1.9  | 0.9 - 4.2   |
| Access to NZ\$500.00 for a family emergency in the next week*              |      |             |
| Self-fund                                                                  | 30.9 | 26.2 - 36.0 |
| Access from family/friends                                                 | 29.0 | 24.4 - 34.0 |
| Not available                                                              | 27.3 | 22.8 - 32.3 |
| Access from Work and Income <sup>vi</sup>                                  | 15.6 | 12.1 - 19.9 |
| Bank loan                                                                  | 13.4 | 10.1 - 17.4 |
| Access elsewhere                                                           | 10.6 | 7.7 - 14.4  |
| Money-lender                                                               | 10.0 | 7.2 - 13.7  |

\*Multiple responses accepted

Self-rated housing conditions were mainly positive (Table 3), however, previous research has found that New Zealanders living in housing typical of low socio-economic status dwellings tend to overestimate their housing conditions (Howden-Chapman, Matheson et al. 2007). In the Housing, Insulation, and Health study, 18% of participants self-rated their dwelling in poor or very poor condition, however when a subsample were assessed by a qualified building inspector 53% of dwellings were in poor, or very poor condition (Howden-Chapman, Matheson et al. 2007).

**Table 3: Self-rated housing conditions**

| Self-rated housing conditions                                | %    | 95% CI      |
|--------------------------------------------------------------|------|-------------|
| Excellent (no immediate repair and maintenance needed)       | 19.8 | 15.9 - 24.4 |
| Good (minor maintenance needed)                              | 35.2 | 30.3 - 40.4 |
| Average (with some repair and maintenance needed)            | 35.8 | 30.8 - 41.0 |
| Poor (immediate repairs and maintenance needed)              | 4.7  | 2.9 - 7.6   |
| Very Poor (needs immediate extensive repair and maintenance) | 2.0  | 0.9 - 4.2   |

Electricity was the main form of hot water heating used and was also the main method of cooking for respondents. Electric hot water heating was used by 90% of respondents, while only 11% reported using gas water heating. Electric cooking facilities were used by 96% of respondents, and 13% used gas cooking. Answers for both hot water and cooking are not mutually exclusive, with some households having access to both electricity and gas.

The duration of reported prepayment meter use (Table 4) varied from less than a year to twenty years. Cumulatively, 63% of households had used prepayment for less than five years. It is difficult to assess whether there was an initial choice to use prepayment metering for many respondents as the most commonly reported reason for starting to use prepayment metering for electricity was that the meter was already in the house when they moved in (Table 4). For many people the fee to

get the meter changed would be a financial consideration; the majority of respondents were in rental accommodation. Few respondents reported that their landlord wanted them to use a prepayment meter, although this might be implicit where a prepayment meter was already installed. Similarly, the decision may have been instigated by others when respondents stated that their electricity company had first informed them about prepayment metering.

It is clearer that households took an active decision to use prepayment, when households stated they requested a prepayment meter be installed when they shifted in. Similarly, most of the 'other' reasons indicated active agency by the households in the decision to commence prepayment for example, that they wanted better control over their electricity consumption or spending than a monthly bill offered, that friends or family suggested they spent less when using prepayment, or that they did not like having a meter reader coming to check their conventional post-payment meter.

**Table 4: Duration and details of prepayment meter use**

| <b>Details of prepayment use</b>                          | <b>%</b> | <b>95% CI</b> |
|-----------------------------------------------------------|----------|---------------|
| <b>Previous payment method*</b>                           |          |               |
| Posting a cheque or paying in person (at the post office) | 54.0     | 48.7 - 59.3   |
| Automatic payment of a set amount (smooth or easy pay)    | 16.4     | 12.8 - 20.8   |
| Direct debit (of the total bill amount per month)         | 10.9     | 7.9 - 14.7    |
| Internet banking or telephone banking                     | 8.1      | 5.6 - 11.5    |
| Always used prepayment metering                           | 8.1      | 5.6 - 11.5    |
| Never paid for electricity before                         | 5.3      | 3.3 - 8.3     |
| <b>Source of initial information about prepayment*</b>    |          |               |
| Friends or family used prepayment metering                | 52.1     | 46.8 - 57.3   |
| Informed by electricity company                           | 21.4     | 17.4 - 26.1   |
| Work and Income, budgeting service, or community group    | 5.3      | 3.3 - 8.3     |
| Advertising                                               | 3.9      | 2.2 - 6.6     |
| Other source                                              | 21.4     | 17.4 - 26.1   |
| <b>Reason for commencement of prepayment meter use*</b>   |          |               |
| Meter in house when moved in                              | 48.2     | 42.9 - 53.5   |
| Debt built up on electricity account                      | 23.4     | 19.2 - 28.2   |
| Had ppm in previous house and requested when moved in     | 10.3     | 7.5 - 14.0    |
| Electricity company wanted you to use prepayment metering | 5.6      | 3.5 - 8.6     |
| Landlord wanted you to use prepayment metering            | 1.7      | 0.7 - 3.8     |
| Transferred from old coin meter                           | 1.4      | 0.5 - 3.4     |
| Other reasons                                             | 18.1     | 14.3 - 22.6   |
| <b>Duration of prepayment meter use</b>                   |          |               |
| ≤ 1 year                                                  | 16.2     | 12.5 - 20.5   |
| 1 – 2 years                                               | 14.2     | 10.8 - 18.4   |
| 2 – 3 years                                               | 16.5     | 12.8 - 20.8   |
| 3 - 5 years                                               | 16.0     | 12.3 - 20.2   |
| 5 - 10 years                                              | 19.9     | 15.9 - 24.5   |
| ≥ 10 years                                                | 17.1     | 13.3 - 21.5   |

\*Multiple responses accepted

When asked “If you had debt on your electricity account before you started using the prepayment meter, why did the debt build up?”, reasons such as estimated bills being too low, bill shock when

the monthly bill arrived, loss of income, poor budgeting, and electricity being expensive were given. However, two thirds of respondents (67%) reported that they did not have electricity debt.

In the year before starting to use prepayment metering, 18% of respondents reported being disconnected for late, or non-payment, of electricity bills. Of these respondents 72% indicated how many times they had been disconnected; 35% had been cut off once, the same proportion had been cut off twice; a further 30% reported being disconnected three or more times for non-payment in the previous year.

Respondents credited their prepayment meter frequently (Table 5). The reported amount spent on electricity per month varied widely, from as little as \$10.00 through to \$800.00, with a mean amount of \$141.66 per month (s.d. \$83.51). The median spend was \$120.00. This is less than the national average household expenditure on electricity of \$148 reported in the Household Economic Survey for the year ended June 2010 (Statistics New Zealand 2010).

**Table 5: Frequency of meter crediting**

| Frequency              | %    | 95% CI      |
|------------------------|------|-------------|
| Every few days         | 17.5 | 13.8 - 22.0 |
| Weekly                 | 52.4 | 47.1 - 57.6 |
| Fortnightly            | 22.0 | 17.9 - 26.7 |
| Monthly                | 5.6  | 3.5 - 8.6   |
| Less than once monthly | 2.2  | 1.0 - 4.5   |

General satisfaction with both prepayment metering and their electricity company was high (Table 6). The majority of respondents agreed or strongly agreed with the statement, *“Some people like the ability to budget with prepayment meters and say the benefits outweigh the risk of running out of credit”*.

**Table 6: Satisfaction with using prepayment metering**

| Reason                                       | %    | 95% CI      |
|----------------------------------------------|------|-------------|
| Satisfaction with using prepayment metering  |      |             |
| Very satisfied                               | 48.5 | 43.2 - 53.8 |
| Satisfied                                    | 27.6 | 23.1 - 32.6 |
| Neutral                                      | 15.3 | 11.8 - 19.6 |
| Dissatisfied                                 | 4.5  | 2.7 - 7.3   |
| Very dissatisfied                            | 3.3  | 1.8 - 5.9   |
| Satisfaction with electricity company        |      |             |
| Very satisfied                               | 37.0 | 32.1 - 42.3 |
| Satisfied                                    | 32.6 | 27.8 - 37.7 |
| Neutral                                      | 21.2 | 17.1 - 25.8 |
| Dissatisfied                                 | 5.3  | 3.3 - 8.3   |
| Very dissatisfied                            | 2.8  | 1.4 - 5.2   |
| Benefits outweigh risk of self-disconnection |      |             |
| Strongly agree                               | 40.4 | 35.3 - 45.7 |
| Agree                                        | 46.8 | 41.6 - 52.1 |
| Disagree                                     | 9.5  | 6.7 - 13.1  |
| Strongly disagree                            | 1.9  | 0.9 - 4.2   |

Participants were asked to name the two best things (answered by 97% of respondents), and two worst things (answered by 80% of respondents) about using prepayment metering in an open question format. The qualitative answers were thematically coded to give the frequencies provided below, and where several answers were given by a respondent, all were included in the analysis rather than only the first two. Frequencies are given as a percentage of those who responded to the questions, i.e. those who did not answer the question have been excluded from this analysis.

**Table 7: Advantages of prepayment metering**

| <b>Advantages of Prepayment Metering</b>           | <b>% of respondents reporting</b> |
|----------------------------------------------------|-----------------------------------|
| No bills                                           | 45.8%                             |
| Monitor usage of electricity                       | 44.1%                             |
| Budgeting easier                                   | 34.9%                             |
| Control/conserve electricity                       | 18.2%                             |
| Prepaying/pay as use                               | 10.7%                             |
| Easy to top up/credit                              | 8.9%                              |
| Payment frequency                                  | 8.1%                              |
| Store to purchase is convenient/close/more options | 4.6%                              |
| Cheaper than on a bill/lower rate                  | 4.3%                              |
| Availability of emergency credit                   | 2.6%                              |
| No disconnection/reconnection fees                 | 2.0%                              |
| No meter readers                                   | 0.9%                              |

Not having a monthly bill was the most commonly cited advantage of prepayment metering (Table 7), with several comments around “*no big bills*”, “*nasty surprises*”, or “*no scary bills*” indicating that the unknown amount (and particularly the usually bi-monthly estimated usage) billed on a monthly post-payment plan was a stressor. Similarly, improved ability to budget, including saving money or spending less was mentioned by over a third of respondents. Comments about prepayment being cheaper were probably related to spending less, although it was not made explicit and could indicate lack of knowledge around pricing. Others commented directly that prepayment was “*not stressful*” or that they appreciated “*being in control*”. Being able to see or monitor their electricity use was beneficial, with several explaining that they better understood which appliances used more electricity, and were able to control usage or conserve their electricity when using prepayment metering. Other advantages included that there was no risk of building up debt, or that electricity services could be maintained while a previous debt was being paid. Some noted that prepayment metering is convenient in a shared living/flatting situation, or that all family members were able to contribute to payments or to conserving electricity.

**Table 8: Disadvantages of prepayment metering**

| <b>Disadvantages of Prepayment Metering</b>                                                               | <b>% of respondents reporting</b> |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------|
| Self-disconnection (running out of credit)                                                                | 28.1                              |
| Outlets too far away/too few outlets to purchase credit                                                   | 18.1                              |
| Having to go to an outlet to purchase credit                                                              | 12.8                              |
| More expensive/extra charges                                                                              | 12.5                              |
| Forgetting to top-up/purchase credit                                                                      | 11.1                              |
| Hours of outlets inconvenient                                                                             | 11.1                              |
| Having no money for credit                                                                                | 8.0                               |
| \$20 minimum top-up too expensive                                                                         | 5.9                               |
| High cost of electricity generally/price increases                                                        | 5.9                               |
| Ringing to reconnect/top-up credit                                                                        | 5.6                               |
| Having to monitor meter                                                                                   | 5.2                               |
| Difficulty estimating credit required                                                                     | 4.5                               |
| Crediting system “down”                                                                                   | 4.2                               |
| Payment method limited (no online/phone/credit card payments)                                             | 4.2                               |
| Unexpected high consumption of electricity (eg having visitors, cold snaps, meter jumps to lower balance) | 2.4                               |
| Having to use emergency/used up emergency credit                                                          | 2.1                               |
| Keying in code                                                                                            | 2.1                               |
| Meter in an inconvenient location in the house                                                            | 2.1                               |
| Meter reader continues to visit                                                                           | 2.1                               |
| Having to limit consumption (heating, cooking, entertainment)                                             | 1.0                               |
| No emergency credit/not enough emergency credit available                                                 | 0.7                               |

The most frequently cited disadvantage was running out or ‘self-disconnecting’ (Table 7). Finding NZD\$20 for the minimum purchase of credit could be difficult, and smaller denominations of NZD\$10 or NZD\$5 were suggested as being manageable, with some indicating this had previously been allowed until the company had changed their policy. Having to pay in advance and not having the flexibility to juggle bills was also mentioned as a disadvantage. Respondents commonly remarked on crediting facilities, that there were not enough outlets, open hours were inconvenient, or that they were too far away or required travel (for some rural customers the nearest outlet was 20km away). There were also some reports that when they wanted to buy credit “*the system was down*” – the electronic transaction facilities or crediting computers were down and they may have had to wait several hours or even days to purchase credit.

Keying in the 20-digit top-up code was a hassle with respondents commenting that when they were required to have a prepayment card that they take to the store when they purchase credit, and are still given a receipt with a top-up code to enter it seemed like “*double-handling*”. Others had difficulty with losing or forgetting to take the prepayment card to the retail outlet when trying to purchase credit, or losing the receipt with the top-up code. Having to ring customer services to reconnect after a self-disconnection or to top-up created further hardship for those who either used a cordless phone requiring electricity, or who were without a home phone as both of these meant using a cellphone (usually on relatively high prepaid rates) or finding a public pay phone. For one company’s customers who are disconnected when the credit drops below \$10 the general feeling was that being disconnected when any credit remains is unfair, one described this as “*...so wrong!*”.

Other disadvantages to using prepayment metering included that it was stressful having to “*constantly monitor*” electricity usage and respondents worried about not having enough money

and or running out of credit ('self-disconnecting'), for example *"Stress level up every few days when light turning to red."* Another said simply *"It's in your face"*. For some it created tension within the household, for instance *"The kids get sick of me telling them to conserve power."* Another problem related to conserving electricity was that some respondents said they had to cut back on heating. For others the time that disconnections came into effect was problematic, especially early in the morning, during nights, and weekends when retail outlets to purchase credit were not open. Although it could be questioned whether it matters if the household members are away during a self-disconnection event, as one person pointed out, *"If it gets low and runs out when for example you are at work, it uses a big chunk to reheat water etc. once you top it back up"*. This also indicates that self-disconnecting for a short period may actually increase consumption slightly. In addition other complaints of self-disconnection occurring while the house was unattended included refrigerator/freezer thawing, not having hot water on their return, and the inconvenience of resetting clocks and appliances.

Some noted that there was no choice between companies (and also no opportunities for market competition to reduce prices), and not being able to move off prepayment to another payment method due to the high cost to change the meter. The availability of emergency credit (usually NZD\$20) caused problems if the debt could not be paid, with one respondent providing the following vivid descriptions: *"If it runs out and you're on your emergency power, you're out of luck!"* and *"All the food in the freezer going off because you can't afford to clear your emergency power."* One electricity company has changed its policy and no longer offers emergency credit which would come off the next top-up as they did previously, unless the householder reports a life-threatening medical condition as per the disconnection guidelines, and some respondents complained about this.

Some respondents noted that the meter, and sometimes the in home display, was in an inconvenient location, for example outside where it was dark, or they would get wet when loading credit or checking the balance, or that it was too high to reach or see easily and they had to stand on a chair. Some had problems with the meter beeping, either with the noise or the disruption caused by *"the warning beeper going off during sleeping hours"*. Similarly the flashing of meter lights might also cause stress for example one respondent described the *"frantic flashing of red light when low on power"*. One of the more unexpected complaints was that meter readers still came to the property to read the meter. The corporate rationale for this is that the meter needs to be checked to ensure it has not been tampered with – perhaps due to the very low use of some of these customers as indicated by the monthly spend on electricity.

Given that price comparison analysis found that prepayment metering was more expensive than standard payment methods, four questions were asked to discover how the respondents compared using prepayment metering to their previous method of payment (Table 8). Less than a third of respondents were aware of increased prices through using prepayment metering, which was surprising. Perceived reductions in consumption and expenditure, and increased awareness of consumption were closer to expected responses.

**Table 8: Comparing Prepayment Metering to Previous Payment Method**

| <b>Comparison statement</b>                                                         | <b>%</b> | <b>95% CI</b> |
|-------------------------------------------------------------------------------------|----------|---------------|
| Electricity costs ---- when paying with the prepayment meter                        |          |               |
| More                                                                                | 29.5     | 24.9 - 34.6   |
| The same                                                                            | 32.9     | 28.1 - 38.0   |
| Less                                                                                | 31.2     | 26.5 - 36.3   |
| I use ---- electricity when paying with the prepayment meter                        |          |               |
| More                                                                                | 10.9     | 8.0 - 14.7    |
| The same                                                                            | 39.1     | 34.1 - 44.4   |
| Less                                                                                | 44.1     | 38.9 - 49.5   |
| I spend ---- on electricity when paying with the prepayment meter                   |          |               |
| More                                                                                | 24.0     | 19.8 - 28.9   |
| The same                                                                            | 30.2     | 25.5 - 35.3   |
| Less                                                                                | 39.9     | 34.9 - 45.2   |
| I think about how much electricity I use ---- when paying with the prepayment meter |          |               |
| More                                                                                | 45.1     | 39.9 - 50.4   |
| The same                                                                            | 27.9     | 23.3 - 32.9   |
| Less                                                                                | 22.3     | 18.2 - 27.0   |

The frequency of self-disconnection was high, with over half reporting having self-disconnected in the past year (Table 9). Most respondents who had self-disconnected in the past year had only done so once or twice, with the mean number of self-disconnections in the past year being four times (mean 4.4, s.d. 6.9), and median two times. However, one in six households of those who had self-disconnected in the past year reported six or more self-disconnections; almost one in ten households reporting ten or more self-disconnections. The length of time the last self-disconnection lasted also varied widely, ranging from, most commonly, an hour or less, up to more than a week. The median length of time of the last self-disconnection was three hours. However, more than a third (38%) of respondents reporting self-disconnection in the past year had spent 12 or more hours, and more than a quarter (29%) 24 or more hours, without electricity when they last self-disconnected. To indicate the broader implications of this, the observed outcomes have been applied to the 52,664 households using prepayment metering in 2008 (Electricity Commission 2008). The reason for the last self-disconnection event (answered by 53% of respondents) was most commonly forgetfulness or lack of organisation in monitoring or purchasing credit. System problems included either outlet payment system outages or problems with the new system being used by one company. Another driver of self-disconnection was unexpectedly high electricity consumption, for example, using heating in cold weather, using the oven more often than usual, having visitors to stay, or after electricity price increases.

When asked what the worst thing was about running out of credit the last time, responses such as “no lights”, “no cooking”, “no hot drinks”, “no hot water”, “not being able to prepare baby’s bottle”, “can’t cook my kids dinner”, “no heating”, “fridge/freezer thaw”, “having to find \$20” (either borrowing from family or friends, or on credit), “having to wait for the shop to open”, and “having to make an extra trip to the shop” were given.



**Table 9: Frequency and duration of self-disconnection**

| <b>Frequency and duration</b>                             | <b>%</b> | <b>95% CI</b> | <b>Extrapolated to<br/>% of NZ<br/>Households</b> |
|-----------------------------------------------------------|----------|---------------|---------------------------------------------------|
| <b>Self-disconnected</b>                                  |          |               |                                                   |
| Never                                                     | 38.7     | 33.7 - 44.0   | 10,720                                            |
| More than 12 months ago                                   | 9.7      | 7.0 - 13.4    | 2,687                                             |
| In the past 12 months                                     | 52.6     | 47.3 - 57.9   | 27,701                                            |
| <b>Frequency of self-disconnections in past 12 months</b> |          |               |                                                   |
| 1                                                         | 20.8     | 14.7 - 27.9   | 5,762                                             |
| 2                                                         | 32.7     | 25.5 - 40.6   | 9,058                                             |
| 3 - 5                                                     | 29.6     | 22.6 - 37.3   | 8,199                                             |
| ≥6                                                        | 17.0     | 11.5 - 23.7   | 4,709                                             |
| ≥10                                                       | 9.4      | 5.4 - 15.1    | 2,604                                             |
| ≥15                                                       | 5.0      | 2.2 - 9.7     | 1,385                                             |
| <b>Duration of last self-disconnection event</b>          |          |               |                                                   |
| ≤1 hr                                                     | 33.3     | 26.8 - 40.4   | 9,224                                             |
| 2 hrs                                                     | 11.8     | 7.6 - 17.2    | 3,269                                             |
| 3 - 5 hrs                                                 | 13.3     | 8.9 - 18.9    | 3,684                                             |
| 6 - 11 hrs                                                | 3.6      | 1.5 - 7.3     | 997                                               |
| 12 - 23 hrs                                               | 9.3      | 5.6 - 14.2    | 2,576                                             |
| 24 - 47 hrs                                               | 17.4     | 12.4 - 23.5   | 4,820                                             |
| 48 - 71 hrs                                               | 6.2      | 3.2 - 10.5    | 1,717                                             |
| ≥72 hrs                                                   | 5.1      | 2.5 - 9.3     | 1,413                                             |
| ≥1 week                                                   | 3.6      | 1.5 - 7.3     | 997                                               |
| <b>Reason for last self-disconnection event</b>           |          |               |                                                   |
| Forgetfulness/organisation                                | 38.7     | 31.8 - 46.1   | 10,720                                            |
| Financial constraints                                     | 29.8     | 23.5 - 36.9   | 8,255                                             |
| Outlet hours/disconnection hours                          | 9.4      | 5.7 - 14.5    | 2,604                                             |
| System problems                                           | 8.9      | 5.3 - 13.9    | 2,465                                             |
| Unexpected high use                                       | 8.4      | 4.9 - 13.3    | 2,327                                             |
| Other                                                     | 4.7      | 2.2 - 8.8     | 1,302                                             |

Risk factors for having a self-disconnection event in the past year were identified through logistic regression (Table 10). These include having been disconnected from electricity services for late or non-payment of bills in the year prior to starting prepayment metering (2.3 increased odds of self-disconnection), and previous electricity debt (1.8 increased odds of self-disconnection). Increasing age of the respondent was also associated with a reduction in risk of self-disconnection (OR = 0.72 for each age group compared with the previous age group, e.g. the 35 – 44 age group had only 72% of the odds of self-disconnection compared to 25 – 34 age group). Presence of children under 18 in the household, and household income were not significantly associated with self-disconnection. Although there were a high proportion of both Māori and Pacific respondents, and there were no significant ethnic differences.

**Table 10: Logistic Regression of Risk Factors for a Self-Disconnection Event in the Past Year**

| Exposure variable                           | Odds ratio | 95% CI      | p-value |
|---------------------------------------------|------------|-------------|---------|
| Prioritised ethnicity                       |            |             |         |
| Māori                                       | 1.33       | 0.77 - 2.31 | 0.308   |
| Pacific                                     | 1.6        | 0.8 - 3.2   | 0.187   |
| Non-Māori, non-Pacific                      | 1          | Reference   |         |
| Age group* <sup>†</sup>                     | 0.72       | 0.6 - 0.86  | < 0.001 |
| Children under 18                           |            |             |         |
| At least one in household                   | 0.94       | 0.55 - 1.61 | 0.835   |
| None in household                           | 1          | Reference   |         |
| Previous disconnection for late/non-payment |            |             |         |
| Yes                                         | 2.29       | 1.1 - 4.74  | 0.026   |
| None prior to switch to prepay              | 1          | Reference   |         |
| Previous electricity debt                   |            |             |         |
| Yes                                         | 1.75       | 1.04 - 2.94 | 0.048   |
| None prior to switch to prepay              | 1          | Reference   |         |
| Household income* <sup>‡</sup>              | 0.97       | 0.87 - 1.08 | 0.607   |

\* Factor modeled as an ordinal predictor variable: odds ratio indicates change in odds of self-disconnection per level of factor compared. <sup>†</sup> Age group categories: 18-24, 25-34, 35-44, 45-54, 55-64, 65+. <sup>‡</sup> Household income categories: \$0-20,000; \$20,001-40,000; \$40,001-60,000; \$60,001-80,000; \$80,001-100,000; \$100,000+.

Another form of self-disconnection, turning off all the electricity to the house at the mains switch to save the credit on the prepayment meter, was used by one in seven (15%) respondents in the past year. However, respondents were not asked for the reason that this action was used and although some indicated that they did it frequently to save credit, others indicated they had done this when they had been away from home for a time.

## Discussion

This survey shows that in New Zealand prepayment metering is typically used by low-income households, as is the case in Australia, England, North Ireland, North America, and South Africa (Graham and Marvin 1994; Boardman and Fawcett 2002; Sharam 2003; Ruiters 2007; Brutscher 2011; Howat and McLaughlin 2012). Use of prepayment metering is becoming more widespread especially with the introduction of advanced metering.

Half of the respondents reported household incomes of less than \$40,000 per year. The national median household income from regular sources was \$63,237 in 2010 (Statistics New Zealand 2010). Compared to the 2006 Census, home ownership is low, and social housing use is high (Statistics New Zealand 2011). Almost 70% of respondents credit their meter every few days or

once weekly, indicating how this group often live week-to-week and tightly manage their budget. Ezipay, the company operating the top-up facilities at retail outlets advertises that one electricity company's customers credit on average eight times per month "*bringing considerable foot traffic to your stores*".<sup>51</sup> Bill stress, or inability to pay other utility bills by the due date was reported by 47% of the respondents. There were 37,443 hardship grants paid by the Government to beneficiaries to help with electricity costs last year, with most grants issued in winter, according to figures recently released to Consumer NZ magazine (Wilson 2012). Our survey respondents more commonly reported receiving help from friends and family, although 7% received a Government grant, and a further 2% a Government loan towards electricity costs. These results indicate that this is a highly, socioeconomically deprived population.

The former Government regulatory body reported that there had not been an increase in use of prepayment metering between 2003 and 2008 (Electricity Commission 2008), during which time there were changes made to disconnection guidelines by the regulator following a highly publicised death caused by a household disconnection (O'Sullivan, Howden-Chapman et al. 2012). No further surveys of retailers offering prepayment have been reported since then. While some households have been using prepayment metering for a significant amount of time, there may have been an increase in use in the past few years, as 63% of respondents in this study have been using prepayment metering for less than five years.

Social agencies report that low-income consumers are forced onto prepayment metering plans when they run into financial difficulty (Pullar-Strecker 2012). Retailers reject this accusation, but state that in some cases, where they cannot extend credit, "*we may limit our offer to pre-payment only*" (Collins 2011; Rudman 2011). While this study was independent of the retail companies involved, some sensitivity was required when developing the questionnaire due to the level of cooperation required. However, several questions can be combined to indicate that some consumers are effectively forced onto prepayment metering. After moving into a house where a meter was already installed, having a debt built up on the electricity account was the second most common reason for starting on prepayment metering. Only 6% of respondents said their electricity company wanted them to use a prepayment meter, although a fifth had first found out about prepayment metering by their electricity company. When these responses are considered, together with a third of respondents having debt *before* they started on prepayment and almost a fifth having been disconnected in the previous year, it appears that, conservatively, for about a third of people using prepayment metering, it was strongly recommended by the retailer and for some customers it might be the only option offered.

Nonetheless, there was a high level of satisfaction among respondents using prepayment meters, which is consistent with the overseas experience (Coutard and Guy 2007). Although just over a third of these participants reported spending less on electricity, almost all of the participants agreed that prepayment metering provides the ability to budget, with these benefits outweighing the risk of running out of credit. This is perhaps surprising when over half of the respondents had run out of credit or self-disconnected in the past year. While half of those experiencing self-disconnection in the past year had done so only once or twice, the high frequency of self-disconnection experienced by one in six respondents is of concern.

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<sup>51</sup> <http://www.ezipay.co.nz/glo-bug.asp>, accessed 4 May 2012

In comparison with the figure of 30,000 disconnections for non-payment on standard post-payment billing in 2011 (Electricity Authority 2012a), there have been an estimated 27,700 prepayment meter self-disconnections. While it may be easier to reconnect from a self-disconnection and therefore this might occur more frequently than disconnection for non-payment of bills, national figures count every disconnection, rather than the number of households disconnecting. If each household that self-disconnects six or more times (17% of those self-disconnecting in the past year) is counted only once, the national rate of disconnection would be increased by 16%. This estimate closely aligns with the 18% of prepayment meter users who were disconnected for non-payment of electricity bills in the year prior to commencing prepayment, indicating that for those consumers who experience financial difficulties when using post-payment, prepayment metering hides the difficulties they continue to face, further evidenced by 30% of those self-disconnecting in the past year citing financial constraints as the reason for the last event.

Unlike the British gas prepayment survey, where disconnections were largely non-problematic (Doble 2000), this is less likely in New Zealand where electricity is more commonly used for both space and hot water heating than in other countries (Howden-Chapman, Viggers et al. 2011). More than a third (38%) of New Zealand respondents reporting self-disconnection in the past year spent 12 or more hours without electricity. While it is possible that these self-disconnections occurred while the house is unoccupied and could be non-problematic, more than a quarter (29%) of respondents who self-disconnected were without electricity for at least 24 hours. A disconnection of this length commonly resulted in respondents describing the implications of not being able to cook or make hot drinks, use heating, take showers, or being in the dark. While these effects may be considered transitory, they can place these consumers in unsafe situations which are potentially life-threatening. For example, a report investigating fatal unintentional house fires between 1997 and 2003 found that 13 deaths occurred in eight unattended candle fires during the period. Three of these households were disconnected from electricity services due to non-payment at the time of the fire, another household was not supplied with electricity due to the remote location (Miller 2005).

Problematically, the survey results showed that the self-disconnection was a chronic strategy. Those who had been disconnected from electricity services for late or non-payment in the year prior to going onto prepayment metering were 2.3 times more likely to have experienced a self-disconnection event in the past year. Previous electricity debt before going onto prepayment metering, which may or may not be paid off before going onto prepayment (some respondents commented that they were still paying off a previous debt), was also a risk factor for experiencing a self-disconnection event, with 1.8 times increased odds. In other words, for those on low incomes, who have already experienced significant problems managing electricity costs, it is not clear that prepayment metering will provide enough budgetary control to avoid further hardship.

There are clearly issues of rights and injustice at play when considering electricity disconnection due to financial hardship, whatever the payment method (Walker and Day 2012). In a survey of retailers offering prepayment metering undertaken by the Electricity Commission in 2008, four retailers reported that they routinely checked up on their prepayment consumers who had run out of credit "where possible" (Electricity Commission 2008). This implies that it is possible for electricity retailers to identify when a prepayment consumer has \$0 credit, or has "self-disconnected". Retailers are currently required to report disconnections for non-payment, but not self-disconnection of their prepayment consumers. Mandatory reporting of self-disconnection

would enable monitoring to identify whether self-disconnection rates change over time, including monitoring of seasonal variations.

Prepayment meters are perceived as a useful budgetary tool by the majority of respondents, who agree that the ability to budget with them outweighed the risk of self-disconnection. However, only one third of respondents were aware that the electricity purchased through prepayment is more expensive than on a comparable billing plan, with price differences in some areas up to 38% higher (O'Sullivan, Howden-Chapman et al. 2011; Wilson 2012). Indeed, for pre-payment account holders, there are additional transactional costs involved, such as travel to retail outlets providing top-up facilities and crediting charges. One of the companies involved in this study charges \$0.65 every time a credit is made to the meter.<sup>52</sup> Furthermore, those using pre-payment meters are not usually offered the prompt-payment discounts received by customers on a post-payment billing who pay by the due date (despite paying in advance of actual usage), neither are they offered low user tariffs for the fixed daily charges required by government legislation. Electricity companies also do not have to incur any transaction costs from debt-collection from customers using prepayment metering.

Although this study was designed to report national statistics as opposed to comparing the results between the three companies who assisted us, some comparison is warranted due to the large number of consumers expressing dissatisfaction with the metering display devices used by one company. There are no functional requirements of prepayment metering devices required by the Electricity Authority, and different devices are used by different companies. There are also no requirements for in home displays or information provided by them where they are deployed, including smart meters currently being installed (Wright, Hendy et al. 2009; International Energy Agency 2011; Electricity Authority 2012c).

One company changed their metering system from a previous system, which offered in home display information such as the amount of credit being used per hour, and the remaining credit available, to a "Glo-bug" in home display that operates as a traffic light system, approximately a month before the first surveys were sent out.<sup>53</sup> The Glo-bug device shows a green light when the balance is above \$10, an orange light indicates the electricity will be disconnected the following day at midday (the credit is below \$10), while a red light warns the electricity will be disconnected that day at midday.<sup>54</sup> To get a credit balance, which is not displayed on the device, customers must either check their balance online, sign up for a daily balance email, or opt to pay for a daily credit balance text message, or phone a customer service number which will cost \$0.50 per call.<sup>55</sup> Only 48% of respondents had a home internet account, so checking the credit balance online is not a viable option for many prepayment users. Similarly, once disconnected, customers must either reconnect with their customer number either online, by text, or phone,<sup>56</sup> which is made difficult without electricity and/or may incur additional charges.

Glo-bug customers made up 39% of the survey respondents, and 46% of Glo-bug customers who responded to the question asking for two worst things about using prepayment named the new

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<sup>52</sup> <http://www.globug.co.nz/about-globug/> - accessed 4 May 2012

<sup>53</sup> <http://tvnz.co.nz/fair-go/power-struggle-3736876/video> - accessed 4 May 2012

<sup>54</sup> [http://www.globug.co.nz/resources/GLO-BUG\\_House\\_training\\_guide.pdf](http://www.globug.co.nz/resources/GLO-BUG_House_training_guide.pdf) - accessed 4 May 2012

<sup>55</sup> [http://www.globug.co.nz/resources/GLO-BUG\\_House\\_training\\_guide.pdf](http://www.globug.co.nz/resources/GLO-BUG_House_training_guide.pdf) - accessed 4 May 2012

<sup>56</sup> <http://www.globug.co.nz/how-to-reconnect/> - accessed 16 August 2012

display unit. The Glo-bug system also reduces the benefits of the direct feedback that prepayment usually provides (Darby 2006; Darby 2011) – apart from the reminder of having the display inside and needing to credit the meter, there is actually less information than would be provided on a monthly bill which states the number of units used, the fixed daily charges, and transmission charges for example. Other studies have similarly found that consumers prefer more information than that provided by the Glo-bug system, and the market can clearly not be relied upon to deliver these services (Anderson and White 2009; Wright, Hendy et al. 2009).

While some users may have a better sense of ostensible control with prepayment meters, which may help to reduce stresses associated with fuel poverty, others indicated that coping strategies used to reduce electricity consumption can be an additional stressor for households, who are already experiencing some of the negative psychosocial outcomes of fuel poverty (Gilbertson, Grimsley et al. 2012). Whether or not electricity conservation, which can involve reducing indoor temperatures below comfortable levels contributes negatively to mental health is difficult to assess between households, as it appears to be determined in part by householders' attitudes (Cupples, Guyatt et al. 2007; Anderson, White et al. 2012). However, there are clear negative outcomes for physical health caused by the physiological responses to exposure to adverse indoor temperatures (Collins 1993; Kovats and Kristie 2006; Liddell and Morris 2010; Marmot Review Team 2011; Nunes, Paixao et al. 2011; Ormandy and Ezratty 2012). The results provide some evidence that prepayment metering encourages households to reduce indoor temperatures below comfortable and safe levels, although further investigation is required.

The group of consumers in our study is clearly economically and socially vulnerable. While they spend less on electricity than their higher income counterparts in absolute terms, this represents proportionally more of their household incomes (Howden-Chapman, Viggers et al. 2011). Looking forward, this population would be especially vulnerable to climate change impacts. While global warming may reduce the number of days home heating is required, Dear and McMichael (2011, p2) pointed out that, "*We should not assume that because the planet is warming dangerously, cold temperatures will become a thing of the past.*" (Dear and McMichael 2011). Yet the consequences of price increases due to electricity companies passing on the costs of carbon through emissions trading is likely to be unfairly high for this group without countervailing government regulation (Roberts, White et al. 2007; Roberts 2008).

### Policy recommendations

Recent years have seen the outcomes of market failure in the domestic electricity market after rigorous deregulation in the early 1990s in the form of rapid and significant price increases over and above those seen in the commercial and industrial markets (Bertram and Twaddle 2005; Howden-Chapman, Viggers et al. 2009). The real price of residential electricity in 2009 was 24.69c/kWh, compared with 14.81c/kwh in 1989 (Elliot, Moore et al. 2011). Instead of engaging in market reform to address this problem, the current Government has continued its programme of encouraging market competition, and is currently in the process of partially privatising the largely

state-owned generating and retailing companies, which is likely to further compound fuel poverty.<sup>57</sup>

Prepayment metering in itself is not a cause of fuel poverty, however the current lack of regulation around prepayment metering and pricing in New Zealand is such that it appears that prepayment metering is in fact contributing to the fuel poverty problem. Lessons could be taken from other jurisdictions such as in Ireland, where prepayment metering is cheaper than other payment methods, and can therefore be argued to form part of the fuel poverty solution (Boardman 2010; Darby 2011). The results of this study have highlighted that regulatory reform of prepayment metering could reduce the burden of fuel poverty in New Zealand by protecting consumers against some of the pitfalls and harnessing the advantages of prepayment metering. In particular we make the following recommendations for Government policy:

- That mandatory reporting of self-disconnection is introduced, and rates are monitored and published in the same way in which disconnection for late or non-payment of post-payment customers statistics are published;
- That hours of possible self-disconnection be set to business hours only, and that crediting facilities must be available at all times when self-disconnection can be allowed to occur;
- That prepayment pricing be required to be at least as cheap (if not at a set percentage rate cheaper) as the cheapest possible post-payment plan offered by the same company in the same geographical area;
- That minimum credit amounts be lowered;
- That additional fees obtaining a credit balance be curtailed;
- That minimum informational standards for prepayment metering devices be set;
- That minimum regulated requirements for smart-metering technologies are developed and implemented (Wright, Hendy et al. 2009; International Energy Agency 2011).

#### Limitations and future directions

The rigorous follow-up methods employed in this study achieved a response rate that was adequate to power the study to identify a self-disconnection rate of 50%, plus or minus 5%. However, we are unable to say anything about the make-up of the group that did not participate in the survey and it is possible that a greater response rate may have shifted the results in either direction. It is also possible that the slightly different wording and timing of letters sent out between companies may have affected the response rates; however this was unavoidable and is part of the nature of conducting studies in a community setting with corporate cooperation.

A further objective of this research was to investigate whether patterns of self-disconnection within households change over time. A follow-up postal survey was undertaken with willing respondents in late 2011, and data analysis is ongoing. This follow-up survey also explored the heating practices of those using prepayment metering to investigate whether electric space heating contributes to the likelihood of self-disconnection. While using prepayment metering is seen as a way of economising, it is unclear whether self-disconnection is viewed the same way. Our previous research suggests that some households choose to switch the main electricity supply to

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<sup>57</sup> <http://www.legislation.govt.nz/bill/government/2012/0007/latest/DLM4326312.html> - accessed 8 May 2012

the house off at the meter board to ration prepayment credit (O'Sullivan 2008), and although 15% reported this action in the present study, the reason for this was not recorded, though the frequency suggests that at least some respondents were regularly economising using this method. We are currently analysing a second study involving longitudinal interviews with people using prepayment metering, or who consulted a home budgeting service regarding electricity bills.<sup>58</sup> This study is also exploring self-disconnection as a means of budgeting, along with other coping strategies when using prepayment metering to manage household electricity use.

## **Conclusion**

Little has previously been known about the advantages and disadvantages of using prepayment metering from a consumer perspective in New Zealand, and this paper contributes usefully to fill this knowledge gap. Respondents' comments align with the results of other studies which explore coping strategies of living on low incomes in cold homes or in fuel poverty. Despite some geographical and cultural differences i.e. high use of electric space heating, some of the experiences of New Zealand electricity prepayment meter users are undoubtedly transferrable to international populations. This study identified some disadvantages to using prepayment metering that may not be experienced by fuel poor households on post-payment plans, in particular the informational asymmetry caused by some metering types offering less usage information than standard billing, and additional charges.

The study shows the operation of a market-based solution for electricity consumers, largely in the absence of government intervention. While there are some advantages to using prepayment metering as it is currently used in New Zealand, some Government regulation could reduce the risks and disadvantages outlined above. Lessons can be taken from this study to inform policy, and may provide useful insights into using market-based products to control consumption in other areas, for example domestic water usage.

The New Zealand situation illustrated by this paper can be viewed as an unfortunate lesson from a liberalised market of how prepayment metering, a technology which with careful Government oversight could empower consumers by increasing awareness of electricity use with the potential to decrease consumption to the benefit of both households and the environment, instead further contributes to fuel poverty. By comparison, the situation in Northern Ireland is a model example of using prepayment metering as an empowering tool to contribute to the reduction of fuel poverty.

## **Acknowledgements**

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<sup>58</sup> <http://www.healthyhousing.org.nz/research/current-research/electricity-prepayment-meter-users-study/>



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**Original Article - Title:** Kids in the Cold: Outcomes for households with children using prepayment metering for electricity.

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### **Abstract**

**Aims:** Although fuel poverty is becoming increasingly researched, there is very limited information currently available on the experiences of and effects on children living in fuel poverty. This paper examines the consequences of using prepayment metering, a payment method typically used by low-income households, on households with children. **Methods:** We present new results from two postal survey datasets, the Electricity Prepayment Meter Users' Survey undertaken in late 2010 and the follow-up survey undertaken in 2011, which explore the outcomes of prepayment metering and living on low-incomes for households with children. **Results:** Among prepayment consumers, households with children experience greater levels of hardship. Households with children were statistically significantly more likely to cut back on grocery spending, and indicated greater levels of financial difficulty than childless households. Although there were no differences between the groups for most indicators of poor thermal comfort levels, households with children were statistically significantly more likely to report seeing their breath condensing indoors on at least one occasion during the winter. **Conclusions:** Policies to address fuel poverty should include protections for prepayment meter consumers, and households with children using this payment method who are especially vulnerable.

Fuel poverty has commonly been defined as the inability to afford adequate households energy services, including maintaining WHO recommended indoor temperatures, for less than 10% of household income.<sup>1,2</sup> Fuel poverty presents a multi-sectoral challenge because it is caused by the energy inefficiency of the house and the available heating sources, combined with income poverty, which prevent the household from achieving healthy temperatures.<sup>1,3</sup> Drivers of fuel poverty in New Zealand, where the problem is estimated to affect one in four households, include the poor quality of the housing stock, relatively high levels of income inequality, and the increasing price of electricity which occurred after deregulation of the industry.<sup>4,5</sup> Fuel poverty has received little attention in New Zealand which has no official definition or measurement of fuel poverty, or specific policy to address the issue.<sup>5,6</sup> This is in contrast with other jurisdictions, such as the United Kingdom where the Parliament, with all-party support, agreed to aim to eradicate fuel poverty as far as reasonably practical by 2016.<sup>7</sup> The effects of fuel poverty are broad, with typical coping strategies of fuel poor households identified by several studies falling into three broad categories including: self-rationing of energy consumption, e.g. restricting heating, lighting, and use of hot water; financial redistribution through restricting other spending, e.g. limiting grocery spending; and in some cases debt and disconnection from energy or other services.<sup>8-10</sup>

A recent review of the health impacts of cold homes and fuel poverty in the United Kingdom highlights many findings which are applicable to New Zealand.<sup>11</sup> In particular, the Marmot Review Team (p 11), commented:

*"Fuel poor households must choose either to spend more than 10% of their income on heating, which has a detrimental impact on other aspects of health and well-being, or to under-consume energy and live in a cold home to save money. Deprived and vulnerable households – especially those who do not have access to social housing – are more likely to live in energy inefficient housing, and less likely to have the resources or the resilience to deal with the negative impacts of cold homes and reduced income."*<sup>11</sup>

The World Health Organization recommends maintaining indoor temperatures of between 18°C and 24°C for the general population.<sup>12</sup> For vulnerable groups, such as the very old or young, a minimum temperature of 20°C is recommended. These temperature ranges have been debated, perhaps due to the use of the term "thermal comfort", in the guideline. Whether electricity conservation, including reducing indoor temperatures below comfortable levels, contributes negatively to mental health may be dependent on attitudes and cultural factors.<sup>10,13</sup> Problematically, in New Zealand space heating is undervalued, and indoor temperatures are cold by international standards.<sup>4</sup> However as Ormandy and Ezratty (In press, p1) note:

*"While the term 'thermal comfort' is used to cover a variety of circumstances, the World Health Organization's guidance on thermal comfort is not just about ensuring a sensation of satisfaction with the ambient temperature, it is inextricably linked to health. It is a guidance for the home environment, and aimed at protecting health, particularly the health of those most susceptible and fragile to temperatures outside that range, such as the very young, and older people."*<sup>14</sup>

In elderly people, respiratory effects have been shown to occur below 16°C, (in those with chronic respiratory disease below 21°C), while increases in blood pressure are seen below 12°C, and risk of hypothermia increases below 6°C.<sup>11,14,15</sup> Fuel poverty and cold indoor temperatures contribute to excess winter mortality and morbidity, especially in temperate countries. A recent study linking New Zealand census and mortality data found the highest risk of dying in winter among low-income people, those living in rented accommodation and those living in cities.<sup>16</sup>

While most of the earlier studies investigating the physiologic effects of adverse temperatures on health focused on adults, some research highlights the outcomes for children. In children with asthma, increasing temperatures inside the home has been shown to reduce symptoms and days off work and school.<sup>17,18</sup> Reduced calorific intake in the winter in low-income families is evidence of the 'heat or eat' problem in the United States.<sup>19</sup> One Boston study found that children from households receiving the Low-Income Home Energy Assistance Programme payments to assist with home energy costs were less likely to suffer undernutrition, be overweight, or require acute hospitalisation.<sup>20</sup> Child health and development in children less than three years of age is negatively affected by household energy insecurity, defined as the household having had an unheated or uncooled day, using a cooking stove for heating, or being threatened with or having been disconnected from utility services in the previous year.<sup>21</sup> A narrative synthesis of five intervention studies examining specific effects of cold housing on health noted that the effects of fuel poverty on children is under-researched, but that adolescents living in cold housing are at risk of mental health problems and engage in increased antisocial behavior.<sup>22</sup>

At the extreme end of the spectrum, children appear to be over-represented in fatalities from unintentional domestic fires relating to fuel poverty. In a report investigating fatal unintentional domestic fires in New Zealand from 1997-2003, 131 deaths were identified in total, 10% of these were due to unattended candle fires, the third most significant risk factor for residential fire fatality.<sup>23</sup> There were 13 deaths in eight candle fires during the study period; eight of these victims were children.<sup>23</sup> In three households the electricity had been disconnected for non-payment, another household had no electricity due to remote location.<sup>23</sup>

Stories of local families struggling to manage high electricity costs, cold homes, and low-incomes are not new, with several examples making headlines in recent years.<sup>24-26</sup> One group of consumers likely to experience high rates of fuel poverty are those using prepayment metering, an electricity payment method often used by low-income consumers with electricity debt, or who have difficulty budgeting.<sup>27</sup> While there are advantages of prepayment metering such as reduced electricity consumption, and greater awareness and control of electricity use,<sup>28,29</sup> low income households tend to have less discretionary electricity consumption and therefore fewer opportunities for reducing consumption.<sup>30</sup> One of the most significant disadvantages to using prepayment metering is the risk of households "self-disconnecting"<sup>59</sup> or running out of credit on their prepayment meters, resulting in their household being without electricity services, which may have serious health consequences.

We investigated the use of prepayment metering from a consumer perspective in a nationwide postal survey of electricity prepayment meter users, and found that while almost all respondents felt the benefits of using prepayment outweighed the risks of running out of credit or self-disconnection, over half of respondents experienced self-disconnection in the past year.<sup>31</sup> One third of respondents experiencing self-disconnection were without electricity for more than 12 hours, and 17.0% reported six or more events in the past year. A follow-up postal survey in late 2011 investigated whether patterns of self-disconnection within households had changed over time and explored the heating practices of households using prepayment metering.<sup>32</sup> The study found that self-disconnection remained problematic over time, and that prepayment metering encourages restriction of space heating in already cold homes. Over half (57.0%) of respondents reported restricting space heating, although more than two thirds reported experiencing shivering and more than half being able to see their breath condensing inside their home during the winter months on at least one occasion.<sup>32</sup>

Parents and caregivers responding to the survey commented on the negative impacts of electricity prepayment metering on their children, for example "*the kids get sick of me telling them to conserve power*", indicating increased family tension.<sup>31</sup> The consequences of self-disconnection were more problematic, with some adult respondents stating that the worst thing about their last self-disconnection event was "*not being able to prepare baby's bottle*", or "*can't cook my kids dinner*".<sup>31</sup> Although not a focus of the original study design, these comments indicate there are specific issues faced by families using prepayment metering which may increase hardship experienced by children in these households. Given that New Zealand has high rates of

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<sup>59</sup> The term "self-disconnection" refers to the service being shut off when a prepayment meter runs out of credit. While the term problematically implies the consumer has agency to make a choice to disconnect, the term is widely used and understood so we use it here.

child poverty, and poor child health and wellbeing equity in general,<sup>33</sup> households with children, who use prepayment metering to pay for electricity, may be particularly vulnerable to the disadvantages of using this payment method.

In this paper, we present new results from two survey datasets, the Electricity Prepayment Meter Users' Survey undertaken in late 2010 and the follow-up survey undertaken in 2011, which explore the outcomes of prepayment metering for households with children.

## Methods

The Electricity Prepayment Meter Users' Survey 2010, fully described elsewhere, was a nationwide postal survey undertaken with the support of three major electricity retailers in New Zealand who provided an anonymised random sample to investigate the advantages and disadvantages of using prepayment metering from a consumer perspective.<sup>31</sup> In 2008, 52,664 prepayment meters were used in New Zealand (Electricity Commission 2008), which equates to around 3% of households.

The 2010 survey sample included a total number of 768 customers, calculated presuming a response rate of 50% (384), providing adequate study power assuming 50% frequency of self-disconnection in the population. The final response rate for the 2010 survey, which included a rigorous protocol of repeat mailings was 47.9%. Of the 359 respondents to the 2010 survey, 324 (90.2%) agreed to postal follow-up and were included in the 2011 sample. The 2011 survey, also fully described elsewhere, achieved a response rate of 61.0% using a similar protocol.<sup>32</sup> In both years respondents were offered a \$20 supermarket voucher to thank them for completing the survey, which were sent by the researchers on receipt of the survey form.

Survey data for both years were entered into a Microsoft Access database and analysed using Epi Info version 3.4 (Center for Disease Control, Atlanta, GA). The uncorrected chi-squared test was used for significance testing, with an alpha level of  $\leq 0.05$ .

## Results

Households with children made up 54.3% of the respondents to the 2010 survey, and 47.8% of the 2011 survey. Comparison of responses to the 2010 survey found few socio-demographic differences between those who did not consent to postal follow-up, those who consented but did not respond to the 2011 survey, and those who consented and responded to the 2011 survey.<sup>32</sup> Statistically significant differences were found between the groups for households with children (chi square = 9.53, p value = 0.009), who were over-represented in the group that consented, but did not take part in the 2011 survey.<sup>32</sup>

The average expenditure per month on electricity differed in households with children (\$175.06 in 2011, and \$158.78 in 2010) and households without children (\$128.38 in 2011, and \$119.48 in 2010). For households with children, the median expenditure per month of \$160.00 in 2011 was unchanged from 2010, whereas in households without children, median expenditure rose to \$120.00 per month in 2011 from \$100.00 in 2010.



Results from the 2010 survey found that households with children were significantly more likely to report that they first found out about using prepayment from family or friends (Table 1). Indicators of 'bill stress' were marginally significantly more common for households with children ( $p \leq 0.10$ ). These bill stresses included: starting prepayment metering because of debt accruing on the electricity account; being unable to pay any of the telephone, gas, or water bills in the past year; and having help from family or friends to pay for electricity in the past year. The likelihood of experiencing a self-disconnection event in the past year was also marginally significantly higher among households with children, with 57.8% reporting an event compared with 47.4% of households without children.

**Table 10: Self-disconnection and bill stress in households with and without children in 2010**

| <b>Outcome</b>                                                                       | <b>Children Proportion (95% CI)</b> | <b>No Children Proportion (95% CI)</b> | <b>Chi-square and p-value</b>            |
|--------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------|------------------------------------------|
| Started using prepayment because debt had built up on the electricity account        | 26.5% (20.3-33.5)                   | 18.6% (12.8-25.6)                      | $\chi^2=2.99, p=0.084$                   |
| First found out about using prepayment metering from family or friends               | 60.0% (52.6-67.1)                   | 45.5% (37.5-53.7)                      | $\chi^2=7.14, p=0.008$                   |
| Self-disconnection event in past 12 months                                           | 57.8% (50.4-65.0)                   | 47.4% (39.5-55.6)                      | $\chi^2=3.68, p=0.055$                   |
| Unable to pay any of telephone, gas, or water bills by due date in past 12 months    | 44.9% (37.6-52.3)                   | 35.3% (27.8-43.3)                      | $\chi^2= 6.64, \text{Probability}=0.084$ |
| Had a grant or loan from family or friends to help pay electricity in past 12 months | 17.3% (12.1-23.5)                   | 10.9% (6.5-16.9)                       | $\chi^2=2.82, p=0.093$                   |

Results significant at an alpha level of  $\leq 0.05$  are highlighted in this and all following tables.

Results from the 2011 follow-up survey similarly found trends that households with children were experiencing greater bill stress than childless households. Receiving help from family or friends over the past year to pay for electricity was marginally significantly more likely among households with children. The follow-up survey also investigated whether households using prepayment metering restrict grocery spending to afford electricity. Almost three of five households with children (56.8%) reported cutting back on groceries to pay for electricity, compared with two of five (41.2%) childless households ( $p \leq 0.05$ ).

When asked if they would be able to access \$500 in the next week for a family emergency, the trend was for households with children to report more difficulty in both survey years (Table 2). Households with children were statistically significantly more likely to report that the money would be unattainable. Households with children were four times as likely to report that they could use a money-lender in 2010, (16.2% compared to 3.8% of childless households,  $p \leq 0.01$ ) an indicator of a precarious financial position. In 2011 the difference was reduced but the absolute numbers increased with more households in both groups reporting they could use a money-lender. Even so, households with children remained over two and a half times more likely to report that they would use a money-lender (22.5% in households with children, 8.5% without children,  $p \leq 0.05$ ).

**Table 2: Options to access \$500 in the next week in case of family emergency for households with and without children**

| Options to access money in a family emergency | 2010 Survey results          |                                 |                                 | 2011 Follow-up survey results |                                 |                                 |
|-----------------------------------------------|------------------------------|---------------------------------|---------------------------------|-------------------------------|---------------------------------|---------------------------------|
|                                               | Children Proportion (95% CI) | No Children Proportion (95% CI) | Significance Chi-square p-value | Children Proportion (95% CI)  | No Children Proportion (95% CI) | Significance Chi-square p-value |
| Self-fund                                     | 28.6% (22.3-35.7)            | 35.3% (27.8-43.3)               | $\chi^2=1.71$<br>p=0.191        | 30.3% (21.0-41.0)             | 48.5% (38.2-58.8)               | $\chi^2=6.36$<br>p=0.012        |
| Family or friends                             | 33.5% (26.8-40.8)            | 23.7% (17.3-31.2)               | $\chi^2=3.94$<br>p=0.047        | 25.8% (17.1-36.2)             | 20.6% (13.1-30.0)               | $\chi^2=0.71$<br>p=0.399        |
| Work and Income                               | 16.8% (11.7-22.9)            | 15.4% (10.1-22.0)               | $\chi^2=0.12$<br>p=0.731        | 16.9% (9.8-26.3)              | 14.4% (8.1-23.0)                | $\chi^2=0.21$<br>p=0.649        |
| Bank                                          | 10.8% (6.7-16.2)             | 16.0% (10.6-22.7)               | $\chi^2=2.01$<br>p=0.156        | 14.6% (8.0-23.7)              | 18.6% (11.4-27.7)               | $\chi^2=0.52$<br>p=0.470        |
| Money-lender                                  | 16.2% (11.2-22.3)            | 3.8% (1.4-8.2)                  | $\chi^2=13.71$<br>p=0.000       | 22.5% (14.3-32.6)             | 8.2% (3.6-15.6)                 | $\chi^2=7.34$<br>p=0.007        |
| Not available                                 | 31.4% (24.7-38.6)            | 21.8% (15.6-29.1)               | $\chi^2=3.92$<br>p=0.048        | 36.0% (26.1-46.8)             | 22.7% (14.8-32.3)               | $\chi^2=3.97$<br>p=0.046        |

Indoor temperature data were not collected from participants in this study, however the follow-up survey included questions to investigate self-rated thermal comfort.<sup>32</sup> Similar indicators have been used in other studies as a proxy for objective measurements when assessing whether indoor temperatures are likely to fall within healthy ranges, and to indicate whether households suffer fuel poverty.<sup>14,34</sup> There were no significant differences between the groups for four of the indicators, although at least two thirds of the respondents to the survey reported problems achieving thermal comfort overall (Table 3). However, households with children were statistically significantly ( $p \leq 0.01$ ) more likely to report being able to see their breath condensing inside their home on at least one occasion during the winter months, with 71.3% of households with children reporting this problem, compared to just under half of childless households.

**Table 3: Indicators of thermal comfort in households with and without children in 2011**

| Outcome                                                           | Children Proportion (95% CI) | No Children Proportion (95% CI) | Chi-square and p-value  |
|-------------------------------------------------------------------|------------------------------|---------------------------------|-------------------------|
| House has been cold this winter                                   | 80.7% (70.9-88.3)            | 75.0% (65.1-83.3)               | $\chi^2=0.86$ , p=0.355 |
| Used heating when cold this winter                                | 83.0% (73.4-90.1)            | 85.6% (77.0-91.9)               | $\chi^2=0.24$ , p=0.625 |
| Had house colder than would have liked this winter                | 71.9% (61.4-80.9)            | 67.4% (57.0-76.6)               | $\chi^2=0.45$ , p=0.503 |
| Shivered inside this winter on at least one occasion              | 70.5% (59.8-79.7)            | 66.3% (55.9-75.7)               | $\chi^2=0.36$ , p=0.548 |
| Saw breath condensing inside this winter on at least one occasion | 71.3% (60.6-80.5)            | 48.4% (38.0-58.9)               | $\chi^2=9.82$ , p=0.002 |

Reasons for having the house colder than they preferred over the winter months were not significantly different between households with and without children. There were also no significant differences in the heating types used as the main heating source. More households with children named "other" heating sources as the main heating

source, most commonly these were specified as using no heating, or using additional blankets or clothes, though again the small difference (15.7% compared with 9.3% of childless households) was not significant. When asked what the reasons for using the heater type specified as the primary heating source were, the only significant difference between the groups was that households with children were less likely to identify convenience as a reason than households without children (34.8% compared to 49.5%,  $p \leq 0.05$ ).

## **Discussion**

The results of this paper suggest that, among prepayment consumers, households with children experience greater levels of hardship. This is in the context of prepayment customers already experiencing financial hardship compared to the general population, with lower levels of home ownership, low household income, and high rates of bill stress, while paying 3-38% more per unit of electricity by using this payment method depending on regional pricing differences.<sup>25,31,35</sup> Households with children were significantly more likely to report cutting back on grocery spending to afford electricity than childless households, which has other flow-on effects on health and wellbeing.<sup>19,20</sup> The problems highlighted here are likely to affect a significant number of children. Based on the most recent national figure of prepayment metering consumers from 2008,<sup>36</sup> around 28,000 households using prepayment metering have at least one child under the age of 18.

As the surveys were not designed to look at households with children specifically, the samples are too small to be definitive; however households with children were significantly more likely to report being able to see their breath condensing indoors on at least one occasion during the winter months than childless households. Almost three quarters (71.3%) of households with children experienced this problem, compared to just under half (48.4%) of childless households. Although reasons for this are complicated, with several potential contributing factors including greater indoor humidity due to higher household occupancy and heating and behavioural practices, households experiencing this problem are unlikely to be achieving indoor temperatures adequate for safeguarding health. Despite there being no differences between the groups for the remaining indicators of poor thermal comfort used, more than two thirds of study respondents overall reported problems achieving thermal comfort and, by inference, healthy indoor temperatures.

Children living in households that use prepayment metering are likely to be living in fuel poverty, as well as experiencing the effects of general poverty, both factors which are harmful to child health and wellbeing.<sup>17,18,22,33</sup> Further research that specifically

focuses on both the experiences of and outcomes for children in fuel poor households is urgently needed. This should also include exploring alternatives to prepayment metering such as the use of informative billing and in home display devices which could provide some of the benefits of increased consumer information and control of home energy use without the risk of self-disconnection.<sup>5</sup> While the problem of fuel poverty is tied to income poverty, energy inefficiency of housing and heating appliances are contributory problems. In New Zealand, fuel poverty is partly driven by the structure of the electricity market and ongoing price increases in the domestic electricity sector,<sup>4,5</sup> which are likely to be exacerbated by further privatisation of the market.

An official definition of fuel poverty must be developed in order to allow measurement of the scale and depth of the problem in New Zealand. This will allow for targeting and monitoring of specific multi-sectoral policies required to address widespread fuel poverty. There has been some recent policy and academic discussion of this.<sup>5,6</sup> This study highlights the importance of retaining minimum standards for healthy home temperatures as part of a definition of fuel poverty, as the results suggest that although consumers using prepayment metering report sub-optimal thermal comfort levels across the board, the indoor environments of households with children are even less satisfactory.

Policies to address fuel poverty should include at minimum: extension of energy efficiency retrofitting of housing and heating appliances with specific targeting towards fuel poor households; improvements in the private rental housing stock which should include the introduction of a mandatory housing 'warrant of fitness' as suggested by the Office of the Children's Commissioner's Expert Advisory Group on Child Poverty;<sup>37</sup> and protections for consumers using prepayment metering to pay for electricity, who are at particular risk of the effects of fuel poverty.<sup>31</sup> In addition, significantly reducing fuel poverty in New Zealand is likely to require regulation of the domestic electricity market to better protect low income consumers. Measures that may be required include alternative tariff structures, for example progressive pricing,<sup>2</sup> and implementing minimum requirements for smart-metering technologies.<sup>31</sup> Furthermore, targeting households with children who use prepayment metering may be justified as this study shows that within this already deprived population, households with children are especially vulnerable.

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