**Understanding New Zealand Homeowners Apparent Reluctance to Adopt
Housing-Sustainability Innovations**

By

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Abstract

This thesis investigates why sustainability innovations are not being adopted at the expected rate when they not only reduce environmental problems but also improve health, comfort, productivity, and economic and social wellbeing. Homeowners' demonstrate an apparent preference for sustainability innovations. However, there are apparent inconsistencies in their decisions as demonstrated by the lack of success of numerous intervention schemes. The aim of this research was to understand the motivations behind New Zealand homeowners' apparent reluctance to adopt sustainability innovations such as solar water heating panels or double glazing.

A mixed methods research approach was taken to account for the numerous explanations and to address the research questions and concerns. This included a preliminary study to further establish the need for this research by investigating the implied market value of sustainability through real estate advertisements; a survey to identify homeowners engaging in this behaviour and their reasons for doing so; and a series of verbal report interviews to develop a qualitative insight of the thought processes behind their decisions.

Numerous groups of homeowners were identified; the focus of this research however were those who displayed apparently unreasonable behaviour in that despite knowing what the logical answer should be they still said that they were not willing-to-pay full price for the innovation. This group were found to represent the largest proportion of homeowners suggesting that our time and resources need to be focussed primarily on convincing this large group of homeowners. The cause of these homeowners apparently unreasonable behaviour was observed to be due to an exaggerated perception of risk. In addition to the obvious risks that the innovation might not suit their house or that the financial return would not occur, these homeowners seemed averse to being seen to be different from the average homeowner.

It is proposed that the findings from this research can be used to plan interventions that either change behaviour or align policy and other marketing responses to the characteristics this group of homeowners displayed.

Key words: Homeowners, Sustainability, Energy Efficiency, Adoption Decisions, Risk

Foreword

It is the intention of this thesis to take you, the reader, through the world of consumer action and decision theory to unmask the mystery of why New Zealand homeowners are not apparently adopting sustainability innovations.

The bringing together of psychology and building science presented challenges not only in the consolidation of methods and ideas, but also in the writing of this thesis. In attempting to overcome this weakness, numerous scenarios are provided where possible to illustrate the ideas presented. Unless otherwise stated, these scenarios are entirely fictional. Where extracts from interviews are used, all identification to the real participant has been removed.

The focus of this research was owner-occupiers (as opposed to landlords or tenants). The term 'homeowner' is used in this thesis to describe these people. Note that at any one time, a homeowner may be an individual, a survey respondent, or a consumer. Unless otherwise stated, any reference to 'homeowners' or 'houses' is implied to be within the New Zealand context.

I hope you enjoy the journey...

Contents

Acknowledgements	ii
Abstract	iii
Foreword	iv
 Chapter 1. Introduction	 1
1. Introduction	2
 Chapter 2. An Apparent Disconnect	 6
1. The Problem	7
2. Conceptualising the Problem	12
2.1. <i>Diffusion Theory</i>	12
2.1.1. The Chasm	14
2.2. <i>An Apparent Preference</i>	16
2.2.1. Attitude-Behaviour Gap	17
2.3. <i>Apparent Irrationality</i>	18
2.3.1. Energy-Efficiency Gap	19
3. Defining the Problem	20
4. Chapter Conclusion	22
 Chapter 3. Influences on Behaviour	 25
1. Individual Psychological Factors	26
1.1. <i>Attitudinal Factors</i>	26
1.2. <i>Value Orientations</i>	28
1.3. <i>Moral Factors</i>	29
1.4. <i>Demographics</i>	31
1.5. <i>Summary: Individual Psychological Factors</i>	32
2. Social Psychological Factors	33
2.1. <i>Social Identities</i>	34
2.2. <i>Social Comparisons</i>	36
2.3. <i>Situational Biases</i>	37
2.4. <i>Perceived Behavioural Control</i>	40
2.5. <i>Trust and Fairness</i>	42
2.6. <i>Summary: Social Psychological Factors</i>	43
3. Behavioural Economic Factors	44
3.1. <i>Bounded Rationality</i>	45
3.2. <i>Aversions to Loss</i>	46
3.3. <i>Anchoring and Commitment</i>	49
3.4. <i>Time Inconsistencies</i>	52
3.5. <i>Summary: Behavioural Economic Factors</i>	55
4. Neuroscience and Emotion	56
5. Characteristics of the Innovation and Context	57
5.1. <i>Characteristics of the Innovation</i>	57
5.2. <i>Contextual Factors</i>	59
5.3. <i>Summary: Innovation and Contextual Characteristics</i>	62
6. Chapter Conclusion	63

Chapter 4. Research Focus.....	65
1. Housing-Sustainability.....	66
1.1. <i>Private and Public Benefits</i>	<i>67</i>
1.2. <i>Focus on Energy Efficiency</i>	<i>68</i>
1.3. <i>Energy-Efficiency Innovations</i>	<i>70</i>
2. Defining a Disconnect.....	73
2.1. <i>Target Group.....</i>	<i>76</i>
3. Research Objectives and Hypotheses.....	78
4. Chapter Conclusion	78
 Chapter 5. Study 1: Preliminary Market Analysis	 80
1. Objectives	81
2. Market Value	82
3. Method	84
3.1. <i>Revealed Preferences.....</i>	<i>84</i>
3.1.1. <i>Implied Priority.....</i>	<i>85</i>
3.2. <i>Study Design.....</i>	<i>87</i>
3.3. <i>Data Collection</i>	<i>89</i>
4. Results.....	91
4.1. <i>An Implied Space Pressure</i>	<i>91</i>
4.2. <i>An Implied Lack of Priority</i>	<i>92</i>
4.3. <i>Innovations Affected by an Apparent Disconnect</i>	<i>93</i>
5. Chapter Conclusion	95
 Chapter 6. Method	 97
1. Influences from Method	98
2. Requirements for a Research Approach	101
3. Mixed Methods Research Approach	102
3.1. <i>Study 2: Survey of Homeowners.....</i>	<i>103</i>
3.2. <i>Study 3: Think-Aloud Interviews.....</i>	<i>107</i>
3.3. <i>Study 1: Preliminary Market Analysis.....</i>	<i>108</i>
4. Chapter Conclusion	109
 Chapter 7. Study 2: Survey of Homeowners	 112
1. Study 2: Survey of Homeowners	113
1.1. <i>Survey Objectives</i>	<i>113</i>
1.2. <i>Survey Design.....</i>	<i>114</i>
1.2.1. <i>Contingent Valuation Scenarios.....</i>	<i>114</i>
1.2.2. <i>Potential Influences on Behaviour</i>	<i>123</i>
1.3. <i>Sample Design.....</i>	<i>129</i>
1.3.1. <i>Sample Population</i>	<i>129</i>
1.3.2. <i>Sample Size</i>	<i>130</i>
1.3.3. <i>Sample Selection</i>	<i>130</i>
1.4. <i>Data Collection and Validation</i>	<i>133</i>
1.4.1. <i>Pilot and Pre-test.....</i>	<i>133</i>
2. Analysis.....	135
2.1. <i>Data Entry and Coding.....</i>	<i>135</i>
2.2. <i>Responding Sample</i>	<i>136</i>
2.3. <i>Factor Analysis of Attitudinal Factors.....</i>	<i>138</i>
2.4. <i>Categorising Respondents</i>	<i>139</i>
2.4.1. <i>Labels.....</i>	<i>140</i>

2.4.2. Segmentation Process	141
2.4.3. Final Groupings	145
2.4.4. The 'Jimmys'	146
3. Results: Influences on Behaviour	147
3.1. Overall Summary	148
3.2. Individual Psychological Factors	150
3.3. Demographics	151
3.4. Social Psychological Factors	151
3.5. Behavioural Economic Factors	152
3.6. Characteristics of the Innovation	156
3.7. Contextual Factors	157
3.8. Results Summary	158
4. Chapter Conclusion	159
 Chapter 8. Study 3: Think-Aloud Interviews	 161
1. Study 3: Think-Aloud Interviews	163
1.1. Interview Objectives	163
1.2. Interview Design	164
1.2.1. Verbalisation Instructions	164
1.2.2. Survey Instrument	165
1.3. Sample Design	166
1.3.1. Sample Population	166
1.3.2. Sample Size	166
1.3.3. Sample Selection	166
1.4. Data Collection	167
2. Analysis	168
2.1. Data Entry and Transcription	168
2.2. Analysis Methods	168
2.2.1. Thematic Analysis	168
2.2.2. Content Analysis	170
2.2.3. Comparison to Study 2	174
3. Results	175
3.1. Thematic Analysis: Underlying Motivations	176
3.1.1. Prevalence of Themes	176
3.1.2. 'Angels and Demons'	177
3.1.3. 'I'm sticking with what I know'	183
3.1.4. 'I will if you will'	187
3.2. Content Analysis: CV Scenario Considerations	190
3.2.1. Overall Considerations	190
3.2.2. Differences between Groups	193
3.3. Comparison to Study 2	196
3.3.1. Effect of Verbalisation Bias	196
3.3.2. Consistency Across Samples	197
3.4. Results Summary	197
4. Chapter Conclusion	199
 Chapter 9. Discussion	 200
1. Disconnected Behaviour	201
2. A Robust Phenomenon	203
3. Influences on Disconnected Behaviour	204
3.1. Perceived Risks	205

3.1.1. Financial Risk.....	206
3.1.2. Functional Risk	207
3.1.3. Social Risk	208
3.2. <i>An Asymmetrical Perception of Risk</i>	210
3.3. <i>Real or Perceived Risk</i>	213
3.4. <i>The Early Majority</i>	215
4. Contribution to Theory.....	217
5. Chapter Conclusion	219
 Chapter 10. Conclusion.....	 221
1. Thesis Summary	222
2. Limitations and Opportunities for Future Research	224
2.1. <i>Look Beyond the ‘Jimmys’</i>	224
2.2. <i>Extend to Other Housing-Sustainability Innovations</i>	225
2.3. <i>Increase ‘Real-World’ Insight</i>	226
2.4. <i>Further Measurement of Risk Perceptions</i>	228
2.5. <i>Direct Measurement of ‘Other’ Variables</i>	228
3. Applications: A Set of Principles	229
3.1. <i>Reframe the Perception of Change</i>	230
3.2. <i>Encourage the Market to Value Sustainability</i>	232
3.3. <i>Guarantee Performance and Compatibility</i>	234
3.4. <i>Reduce the Complexity and Instil Confidence</i>	236
3.5. <i>Make it the Norm</i>	239
4. Final Words	242
 Glossary.....	 244
References.....	246
 Appendices	 268
Appendix A: Study 2 Survey of Homeowners	270
Appendix B: Study 2 Sample Selection Process	281
Appendix C: Selected Demographic Characteristics.....	284
Appendix D: Study 2 Factor Analysis	286
Appendix E: Study 2 Results Summary	289
Appendix F: Study 3 Verbal Report Instructions	292
Appendix G: Study 3 Thematic Analysis.....	294
Appendix H: Study 3 Content Analysis.....	296

List of Tables

Table 1: Sample Statistics	91
Table 2: Frequency Keywords Mentioned	94
Table 3: Description of Survey Versions	119
Table 4: Potential Influences on Behaviour Measured in Study 2.....	123
Table 5: Cell Size for 'DG WTP Total' Variable (after outliers trimmed)	138
Table 6: Margins of Error Used to Classify Respondents.....	143
Table 7: Comparison of Group Sizes across CV Scenarios	144
Table 8: Distribution of the Sample Population in Study 2	146
Table 9: Potential Influences on Behaviour	149
Table 10: The <i>Jimmys</i> 'Average-Other' Comparisons for WTP amounts	151
Table 11: Estimated Percentage of Houses that have DG or SWH	152
Table 12: The <i>Jimmys</i> WTP Responses by the Level of Cost (Version) Received	154
Table 13: Value Placed on Different Co-Benefits (as a proportion of \$100)	156
Table 14: Average Perceived Increase in Resale Value	157
Table 15: Prevalence of Themes	176
Table 16: Frequency Each Theme was Mentioned.....	177
Table 17: Most Common Considerations Mentioned in Each CV Scenario	191
Table 18: Most Common Considerations in the DG Scenario by Segmentation Group	194
Table 19: Most Common Considerations in the SWH Scenario by Segmentation Group ..	194
Table 20: Comparison between WTP Responses from Studies 2 and 3 (Total Sample).....	196
Table 21: Comparison between WTP Responses from Studies 2 and 3 (<i>Jimmys</i> only)	196
Table 22: Proportion Segmentation Groups Represented Both Sample Populations	197
Table 23: Comparison between the Early Majority and <i>Jimmys</i> Population Percentages.	215

List of Figures

Figure 1: Technology Adoption Life Cycle	13
Figure 2: 'Revised' Technology Adoption Life Cycle Demonstrating the 'Gaps'	15
Figure 3: Example Contingent Valuation (CV) Scenario.....	121
Figure 4: Meshblocks Sampled in the Auckland Region	132
Figure 5: Meshblocks Sampled in the Canterbury Region	132
Figure 6: Distribution of Segmentation Groups by Version	153
Figure 7: Total WTP Responses Compared to the Percentage 'Discount'	154

Chapter 1. Introduction

*“Creating more efficient houses and commercial building is a triple win for New Zealanders’
health, our environment and our power bills.”*
(Helen Clark (former prime minister), (NZPA, 2007))

1. Introduction

The lack of change towards housing-sustainability¹ is becoming a growing concern. Despite the numerous intervention and education schemes, homeowners' decisions towards housing-sustainability appear to be an anomaly poorly understood. Why are sustainability innovations, such as solar water heating or double glazing, not being adopted at the expected rate when they not only reduce environmental problems but also improve health, comfort, productivity, and economic and social wellbeing?

Many have started to question this phenomenon asking why New Zealand homeowners continue to live in what is considered an un-sustainable way (Allen and Clarke Policy and Regulatory Specialists, Infometrics, EcoSense, Martin Jenkins and Beacon Pathway Limited, 2007; Sanstad and Howarth, 1994; Tromp, 2008; Yates and Aronson, 1983). An understanding of why homeowners demonstrate what appears to be irrational behaviour is now seen as crucial knowledge for any individual or organisation involved with improving the sustainability of New Zealand houses. As Yates and Aronson (1983) state, if we are to "produce a major change in behaviour, then the structuring of the presentations must be based on our knowledge of what it is that people attend to and why."

In response to this need for understanding, the aim of this research was:

"To understand why New Zealand homeowners are not apparently adopting sustainability innovations."

To achieve this aim, a research project combining psychology and building science was undertaken. The following paragraphs outline how this thesis describes the research:

Chapter 2 outlines the motivation for this research, demonstrating the need to understand what appears to be a complex phenomenon. The 'adoption diffusion' model is shown to provide a framework to map adoption progress in order to understand when sustainability innovations are on track to mainstream diffusion or at risk of market failure. It is shown how this problem could be described as a discrepancy between attitudes and behaviours (*attitude-behaviour gap*), as a lack of rationality (*energy-efficiency gap*), or as an incongruity between adopter groups (*the chasm*). The term '*apparent disconnect*' is coined to represent the phenomenon common to these models. This term serves to represent these theories

¹ The terms 'sustainability', 'housing-sustainability' and 'pro-environmental' behaviour are used interchangeably in this thesis to describe, similar to Kollmuss and Agyeman (2002) and Stern (2000), behaviour or innovations that seek to minimise the impact of housing and household activities on the natural and built environments.

without limiting their potential explanatory contribution or favouring any particular perspective based on a disciplinary or other epistemic perspective.

Chapter 3 continues the background narrative by reviewing the numerous explanations that may provide a plausible explanation for why an *apparent disconnect* is occurring. These range from individual, cognitive and social psychological factors, to economic, technological and contextual characteristics.

Chapter 4 outlines the objectives and scope of this research which is delimited to energy-efficiency innovations. Energy-efficiency innovations are chosen over other sustainability innovations due to the nature of their benefits being predominantly private. This is because instances where private benefits are more salient are viewed as harder to understand in terms of why a homeowner would show *disconnected* behaviour compared to innovations with predominantly public benefits. This chapter also develops criteria to define when a homeowner's behaviour is *disconnected*. Given that the *attitude-behaviour gap* and *energy-efficiency gap* can both be viewed as non-rational and inconsistent behaviour, *disconnected* behaviour is defined as a departure from rationality in that homeowners are not acting consistently with their beliefs. This definition provides a way to segment the population and identify the target group of homeowners – those demonstrating an *apparent disconnect*. It is hypothesised that a large proportion of New Zealand homeowners are showing an *apparent disconnect* towards the adoption of sustainability innovations (H1), and, that this *apparent disconnect* is a robust phenomenon that can be replicated across different samples and innovations (H2). It is further hypothesised that no single explanation or discipline has the breadth necessary to account for this complex phenomenon (H3).

Chapter 5 describes 'study 1', a preliminary study of the market designed to inform the development of the two experimental studies. Using an approach based on revealed preferences, an indication of the implied priority given to energy-efficiency features in real estate advertisements is gained. It is found that when there is an implied pressure to reduce words references to energy efficiency are likely to be dropped. This suggests that energy-efficiency innovations are not valued in the traditional market sense and that follow-up experimental studies need to use a non-market technique if an increased understanding of this *apparent disconnect* is to be made. This study also identifies double glazing (DG) and solar water heating (SWH) as two energy-efficiency innovations that provide a suitable context to understand the nature of this *apparent disconnect* within.

Chapter 6 outlines the development of a mixed methods research approach designed to overcome the limitations specific to each method and to test the hypothesis that an *apparent disconnect* can be replicated over different samples. In addition to the preliminary market analysis discussed in study 1, two experimental studies are introduced. The first is a survey designed to gather the mass quantitative data and identify *disconnected* behaviour using contingent valuation (CV) scenarios and the willingness-to-pay (WTP) tool. This is referred to as ‘study 2’. The second is a qualitative application to this survey using the verbal report (VR) tool to uncover the thought processes underlying respondents’ decisions whether or not to adopt the energy-efficiency innovations. This is referred to as ‘study 3’.

Chapter 7 discusses the design and results of the survey from study 2. Utilising an approach based on CV, homeowners displaying *disconnected* behaviour are identified as those who are consistent and aware of their decision to under-pay for both DG and SWH. The results from this study suggest that the motivations for this group of homeowners *disconnected* behaviour is not due to some psychological, demographic, technological or contextual factor such as their attitudes, income or the length they are planning to stay before resale. In other words, these homeowners do not appear to have significantly different beliefs or circumstances to homeowners who do not display *disconnected* behaviour. It is also found that this group of homeowners think most other homeowners are either ‘just like them’ in that they would also not be prepared to pay for the innovation, or, that they are ‘worse’ than them in that they would be WTP even less than they had.

Chapter 8 describes the results from study 3, a qualitative version of study 2 that asked participants to ‘think-aloud’ as they answered this same survey. A thematic analysis conducted on the transcriptions of homeowners who displayed *disconnected* behaviour, identified two types of themes. The first (‘type-1’), ‘*Disconnected Behaviour*’, describes the dissonance in their responses; whilst the second (‘type-2’), ‘*Rationales for Behaviour*’, encompasses the reasons they expressed for this behaviour. The type-1 ‘Angels and Demons’ theme illustrates the dissonant nature of these homeowners’ thoughts towards energy efficiency decisions. Of the type-2 themes, ‘I’m sticking with what I know’, encompasses the numerous observations where these homeowners show an aversion to financial loss, risk or to making a commitment. The other type-2 theme, ‘I will if you will’, represents the social context and the influence this appears to have on these homeowners’ decisions.

Chapter 9 brings the results from the three individual studies together to provide a more rigorous response to the aim of this research. *Disconnected* behaviour is shown to be a significant phenomenon in that the large proportion of respondents in both studies 2 and 3 ‘knowingly’ display this unreasonable behaviour. A review of the findings each study brought to the table demonstrates that the reason why this target group display *disconnected* behaviour is due to numerous cognitive and social biases that cause an exaggerated perception of risk relative to the benefits they stand to gain. These risks are found to include *financial*, *functional* and *social risks*.

Chapter 10 concludes this thesis through a discussion of how each chapter has contributed towards the aim of this research. The limitations in this research and subsequent opportunities for future research are discussed. These include the need for an increased understanding of the other groups of homeowners identified, that further external validation is needed, and that more research is needed on the relationship between the risks these homeowners perceive. Finally, a set of principles is provided as an example of the practical implications these findings could have for building science and the sustainability debate so that effective public messages that connect with New Zealand homeowners can be developed. In particular, consideration is given to how the perception of change can be minimised, how the financial and functional risks can be reduced, how trust and confidence in their and others actions can be increased, and most importantly, through creating the perception that the adoption of energy-efficiency innovations is the norm.

Chapter 2. An Apparent Disconnect

“Two homeowners see a solar water heating panel. “I want one of those,” says the first.

“Obviously not,” replies the other”.

(Adapted from ‘Economist.com, 2008’)

The previous chapter introduced the aim of this research:

“To understand why New Zealand homeowners are not apparently adopting sustainability innovations.”

The purpose of this chapter is to further explore the need and motivation for this research which stemmed from the fact that homeowners are not adopting sustainability technologies despite an apparent preference for them. The nature and urgency of this problem is demonstrated through the impacts non-adoption is having on the quality of the New Zealand housing stock and the living conditions of its occupants.

The ‘adoption diffusion’ model is shown to provide a framework to map adoption progress in order to understand when a sustainability innovation is on track to mainstream diffusion or at risk of market failure. This model also suggests that there is a need to focus on and understand the motivations of the early majority adoption group.

Finally, this lack of adoption is conceptualised within this thesis as an ‘*apparent disconnect*’ to encompass the numerous explanations and ways this problem has been studied in the past without simultaneously limiting the scope of this research. Regardless of how this problem is framed however: as a *chasm*, an *attitude-behaviour gap* or an *energy-efficiency gap*; the fact is that for some reason New Zealand homeowners are displaying an apparent unwillingness to adopt sustainability innovations into their homes.

1. The Problem

Sustainability is not a new concept. Its roots extend to the Industrial Revolution where Thomas Robert Malthus proposed his theories on the limits to population growth (Dresner, 2002). The sustainability concept has most notably been popularised over the years by the Sierra Club and John Muir, Aldo Leopold and Rachel Carson challenging the consequences of technological progress (Carson, 1962), and through the establishment of the United Nations Environment Programme (UNEP) and the Brundtland Commission (see Dresner (2002) for a full account). Today, many groups, councils, conferences and agreements have been formed to oversee environmental issues. These include for example the United Nations Conference on Environment and Development (UNCED), Business Councils for Sustainable Development, the World Summit, the Kyoto Protocol and the Bonn Agreement. While it is promising to see

the idea of sustainability being talked about both formally and informally, the concern is that this interest is still not evident in the actions of everyday New Zealand households.

As of the latest New Zealand Census in 2006, there were approximately 1.5 million occupied dwellings in New Zealand (McChesney, Smith and Baines, 2006; Palmer, 2007). Using data from the 'Household Energy End-Use Project' (HEEP) conducted by BRANZ² to account for current energy use, the total annual energy consumption of a typical New Zealand house is approximately 11,410 kWh per year (national average across all fuel types) (Isaacs, Camilleri, French, Pollard, Saville-Smith, Fraser, Rossouw, and Jowett, 2006). While kWh figures and equivalent costs vary slightly between different sources³, the consensus is around 11,500 kWh per year. Given the cost of electricity at 21 c/kWh (New Zealand Government, 2008), the average New Zealand household power bill (over summer and winter) is approximately \$200 per month.

While this energy use and cost may be low compared to other developed countries and largely sourced from renewable hydro-electricity (approximately 45%) (Isaacs et al, 2006; Lloyd and Callau, 2006; McChesney et al, 2006; MED, 2006), the problem is that the majority of New Zealand homes are still cold (<16°C) when heated (Clark, Jones and Page, 2005; Cowan, 2007; Howden-Chapman, Viggers, Chapman, O'Dea, Free and O'Sullivan, 2009). The numerous consequences of such living conditions have been well documented (Donn and Thomas, 2001; Chapman, Howden-Chapman, Viggers, O'Dea and Kennedy, 2008; Howden-Chapman, Matheson, Crane, Viggers, Cunningham, Blakely, Cunningham, Woodward, Saville-Smith, O'Dea, Kennedy, Baker, Waipara, Chapman, and Davie, 2007; New Zealand Government, 2007a; 2007b). These side-effects range from health, well-being, productivity and financial impacts at the occupant level, to larger impacts at the national and global level in terms of security of energy supplies, environmental degradation and air pollution (Allen and Clarke Policy et al, 2007; Bates and Kane, 2005).

While improvements to the thermal performance of houses are being made, for example insulation standards were introduced in 1978 and just recently in 2008 double glazing became mandatory, approximately two-thirds of New Zealand's housing stock was built before these standards were implemented (Howden-Chapman et al, 2009; NZBCSD, 2008; Tromp, 2008). Further, even though approximately 80,000 homes are renovated each year

² 'BRANZ' is a New Zealand company that provides information and conducts independent and impartial research and testing for the building industry.

³ Sources include Maria Callau (Home Energy Web), Department of Building and Housing ('Your Guide to Smarter Insulation') and EECA ('Household Energy Use, 2006' and 'Getting Warmer by Degrees').

(NBCSD, 2008), the majority are still in a sub-standard condition that is either not up to current insulation standards or to levels considered energy efficient or healthy (Allen and Clarke Policy et al, 2007; Lloyd and Callau, 2006; Howden-Chapman et al, 2009).

In contradiction to the mandatory thermal performance and efficiency improvements in new houses, overall household energy use has increased (McChesney et al, 2006). This is largely because the last 30 years have seen changes in the way houses in New Zealand are constructed and used (Isaacs, Saville-Smith, Amitrano, Camilleri, French, Pollard and Fraser, 2004). For example, the number and use of appliances and electronic controls requiring standby electricity has increased and most houses now have at least one personal computer (Isaacs et al, 2004). Further, in contrast to the trend towards decreasing occupancy rates (Alcorn, forthcoming; Isaacs et al, 2004), the population and house sizes are growing (McChesney et al, 2006; Palmer, 2007). For example, the average floor area of households has risen from 176m² in 2002 to 191 m² in 2006 (Johnson, 2007)⁴ and the amount of glazing has increased from a 24% total glazing-to-wall ratio in houses built in the period 1910-1919 to an average of 42% in new houses built within the last decade (2000-2010) (Isaacs et al, 2006)⁵. Other speculations for this lack of efficiency gains have included rising land prices (Johnson, 2007) and 'take-back' or 'waste homeostasis' effects which are both labels to describe the lack of net gain from increased energy efficiency (Howden-Chapman et al, 2009; Potter, 2007).

The New Zealand Energy Efficiency and Conservation Strategy (NZECS) states that a 40% rate of improvement in energy efficiency is needed by 2025 in order to reach the various targets outlined in the strategy (New Zealand Government, 2007b; O'Connell, 2006). New Zealand, at 0.5%, is below the current OECD average rate of improvement of 0.7% per year. This is the rate needed to reach the 40% energy efficiency improvement targets (New Zealand Government, 2007b). A recent Statistics New Zealand report also showed that while New Zealand has made social gains, in terms of environmental improvements, New Zealand has actually gone backwards. For example, primary energy supply per person increased overall by 5.9%, the percentage of total household expenditure on energy services increased, and the amount of electricity used from renewable sources fell 13.9% over the 20

⁴ Other sources supporting this trend include Statistics New Zealand reported that the average size of new builds has gone from 131m² in 1991 to 176m² in 2002. The HEEP study found average floor area pre-1978 to be 119 m² compared to 132 m² post-1978.

⁵ Other sources included personal correspondence with: Ian Page and John Burgess (on July 30, 2008) at BRANZ Ltd; and Karl Rigarlsford at Metro GlassTech (on July 23, 2008).

year period from 1987 to 2007 (Statistics New Zealand, 2009). Further, New Zealand's emissions are 22.5% higher than 1990 levels (MED, 2006).

The problem these statistics suggest is that New Zealand houses need to be made warmer (on average) while at the same time reducing New Zealand's overall energy use. Housing-sustainability innovations therefore present a viable solution to overcome this problem. The anomaly exists though in why New Zealand homeowners are not apparently adopting these innovations.

The number of programmes or policies that exist specific to sustainability in New Zealand (O'Connell, 2006) would suggest that housing-sustainability is viewed as an important issue. These include for example Clause H1 of the Building Code, the New Zealand Standard SNZ/PAS 4244:2003, the New Zealand Housing Strategy, the New Zealand Energy Efficiency and Conservation Strategy (NZECS), and the New Zealand Energy Strategy (DBH, 2006; New Zealand Government, 2005; 2007a; 2007b; Standards New Zealand, 2003). The fact that a separate organisation, the 'Energy Efficiency and Conservation Authority' (EECA), has been established by Government to oversee energy use, also demonstrates the importance of this area. As well as being responsible for the 'NZECS', EECA has implemented efficiency standards such as the 'Minimum Efficiency Performance standards' (MEPs) and 'Energy Star' product labelling for electrical appliances, the Home Energy Rating Scheme (HERS), and provides grants for the installation of solar or heat pump water-heating systems. Just recently, the new 'EnergyWise™ Heat Smart' home insulation programme was implemented that offers a subsidy up to \$1,300 for insulation and \$500 for clean heating⁶.

In addition to the programmes, schemes and policies mentioned above, other means of reaching and informing the public of housing-sustainability actions have also been tested. These have included competitions to stimulate ideas and enthusiasm (for example the 'Sustainable Habitat Challenge' (SHaC 09) by Otago Polytechnic and the 'Starter Home Design' Competition instigated by the Department of Building and Housing) and show homes to physically demonstrate possibilities (for example Beacon Pathway's⁷ NOW Home's®). Environmental education for children (for example 'EnviroSchools'), Green Home Loans, and advisory services (such as the 'Eco Design Advisor' developed by BRANZ and 'Right house' developed through Meridian Energy - a New Zealand power company) have also been used.

⁶ See www.energywise.govt.nz/funding-available/insulation-and-clean-heating (Retrieved January 31, 2010 from the World Wide Web)

⁷ 'Beacon Pathway' is a collaborative research consortium focussed on improving the sustainability of New Zealand homes.

These examples not only illustrate the various approaches taken by a variety of groups but also the obvious concern and urgency surrounding the sustainability of New Zealand houses. Despite the various approaches, few are successful. For example, while the recent EnergyWise™ ‘Heat Smart’ scheme is one successful example with demand exceeding expectations (Harris, 2009; NZBCSD, 2009; Schouten, 2009), in 2007, homeowners showed little interest in the \$500 solar hot water subsidy (NZPA, 2008a) (see EnergyConsult (2005) and McChesney et al (2006) for further examples).

It could be argued that the ineffectiveness of current intervention programmes is due to their focus on creating or reinforcing existing environmental attitudes within knowledge- (or information-) deficit models where the assumption is that more information and increased knowledge will translate into a change in behaviour. Many (Blake, 1999; Kollmuss and Agyeman, 2002; Hannant, 2007; McKenzie-Mohr and Smith, 1999; NCC, SDC, Defra and DTI, 2006; Schultz, 2002; Swim, Clayton, Doherty, Gifford, Howard, Reser, Stern and Weber, 2009; Walton, Thomas and Dravitzki, 2004) have shown how this approach is ineffective in situations where people already have an adequate level of understanding - as it appears New Zealand homeowners already do. For example, Trotman (2007) found that even when unprompted, half of the participants in their study could provide a reasonable description of the features of a sustainable house and were familiar with the benefits associated with these. Note that information dissemination can have a positive effect in instances where lack of knowledge is a barrier to action (McKenzie-Mohr, 2006). However, the Oxera (2006) study also highlights that campaigns to generate awareness or knowledge do not work even when homeowners are lacking in knowledge. They believe that this is because homeowners perceive a ‘cost’ in finding out about these issues.

This concern, that housing-sustainability is not being adopted, therefore becomes more pronounced when the negligible success of these previous programmes and schemes designed to encourage homeowners to uptake sustainability technologies are taken into consideration. With the cost of energy rising and an estimated NZ\$1.1 billion spent each year to keep our homes warm and running (Davies, 2008), it would seem like a win-win situation to everyone, from the government to the citizens. However, despite offering a monetary incentive, these schemes still see low participation rates. This suggests that the reasons behind this lack of adoption are far more complex than a simple economic or information barrier (Allen and Clarke Policy et al, 2007). Thus, there is a real need to understand why homeowners are not apparently adopting sustainability innovations.

2. Conceptualising the Problem

This problem has been conceptualised in many ways. These include: the *attitude-behaviour gap* – where we say one thing but do another (Marcell, Agyeman and Rappaport, 2004; UMR and Consultus New Zealand, 2005); the *energy-efficiency gap* – where we do not uptake energy-efficiency improvements despite them being cost-effective (Allen Consulting Group, 2004; Hausman, 1979; Sanstad and Howarth, 1994); and, through *the chasm* in the ‘adoption diffusion’ model – where successful diffusion depends on responding to the characteristics of the early majority adoption group (Moore, 1991; Morrison, 2006; Rogers, 2003; Valente and Schuster, 2002). The following sections describe each of these perspectives.

2.1. Diffusion Theory

Diffusion of Innovations is the theory of how new ideas or technologies are adopted into society. The ‘adoption diffusion’ model is most commonly associated with Everett Rogers who in 1962 described it as “the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 2003)”. In this model, there are four important elements to the diffusion of new ideas: the innovation, the communication channels, occurs over time, and the members of the social system (Rogers, 2003). The importance of each of these is discussed in the following sections.

The members of this ‘social system’ are classified into five categories depending on the time it takes for them to adopt the innovation. As shown in figure 1 (over page), these categories and their approximate representations in a population are the innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and the laggards (16%) (Moore, 1991; Rogers, 2003; Walker, Boyd, Mullins and Larreche, 2003).

An innovation is classified as a technology or idea that is perceived as new (Rogers, 2003). An innovation “represent[s] some new level of demand on the consumer to absorb a change in behaviour (Moore, 1991)” and therefore can be thought to presume some change in society. The term ‘innovation’ is used in this thesis to describe the broad mix of actions, ideas, technologies or products that can be applied to increase the sustainability of a house. Specific innovations that this research tests are defined in chapters 4 and 5.

Figure 1: Technology Adoption Life Cycle

(Source of Image: Moore, 1991)

Rogers proposed that an individual's decision process goes through five stages when considering the adoption of an innovation: knowledge/awareness, persuasion/interest, decision/evaluation, implementation/trial, and, confirmation/adoption (Rogers, 2003; Walker et al, 2003). Many behaviour change campaigns and marketing strategies therefore focus on these stages as intervention points for encouraging uptake (Geltz, 2008; Valente and Schuster, 2002; Walker et al, 2003). However, by themselves these diffusion variables have been found to explain little variance in behaviour (Valente and Schuster, 2002). Even Rogers notes himself that during the 'decision stage' (considered the most crucial stage), the individualistic nature of this decision process means it is difficult to acquire empirical evidence as to what is actually influencing an individual's decision to accept or reject the innovation (Rogers, 2003). Walker et al (2003) suggests that personal influence is the key to this. What these influences might be are further explored in the following chapter.

This model of the decision process also assumes that awareness leads to positive attitudes which then eventually lead to the corresponding behaviour. Much behaviour does not follow this learning order, and Valente and Schuster (2002) suggest that sustainability behaviours are one type that fall into this group. Often the behaviour (for example switching off appliances not in use) may be adopted first. This then creates positive attitudes and knowledge of the benefits (for example from receiving lower power bills). That is, the benefits of engaging in this behaviour are learnt after-the-fact.

While diffusion theory is only one model of change (for example see de Jager (2007) for a description of the 'Satir Change Process Model' and Bayne (2006) for a description of the

‘Technology Acceptance Model’), what they all have in common is the assumption that change is a process, not an event: a naturally slow process (Valente and Schuster, 2002). The adoption speed for a particular innovation is thought to be influenced by the level of risk, relative advantage and simplicity, compatibility with existing behaviours, the ease and cost to trial it, and how easy its benefits are to understand (Walker et al, 2003). Given the complexity and cost of many sustainability innovations, these criteria do not bode well for swift adoption. Further, relying on natural diffusion for sustainability innovations may not be an option we have given the need to improve living standards and the desire to increase national rates of improvement by 2025 (New Zealand Government, 2007b). It would appear that there is a need to speed up this diffusion process and increase the rate of up-take.

Aside from increasing the rate of diffusion, Rogers (2003) also illustrates how innovations may not be adopted despite their obvious ‘objective’ advantages. One reason for this is whether interpersonal communication between peers occurs (Rogers, 2003). While communication about the innovation is believed to be how attitudes towards the innovation are formed, communication between similar minded individuals (peers) is considered more effective than communication with individuals who are different on certain attributes (Rogers, 2003). Problems therefore occur when trying to pass the innovations from one adoption group to another, as the adopter groups possess different adoption characteristics (Moore, 1991; Rogers, 2003). This problem is referred to as *‘The Chasm’*.

2.1.1. The Chasm

Geoffrey Moore (1991) describes how the natural adoption process is at risk to cracks occurring between the different adopter groups. Moore argues that these cracks occur because each group represent unique psychographic profiles that respond to innovations and marketing approaches differently (Moore, 1991; Gladwell, 2000; Walker et al, 2003).

The most crucial and vulnerable crack is the period between when the early enthusiasts adopt the technology and when the rest watch to see if they think the innovation is worth adopting also (Moore, 1991). Moore labelled this potential crack *‘The Chasm’*, describing it as the most difficult step to cross when an innovation is introduced into society or the market (Moore, 1991). If an innovation falls into this chasm, the risk is that it will never be adopted and become a market failure. This therefore highlights the importance of successfully convincing the group labelled as the ‘early majority’ to adopt the innovation.

Figure 2 demonstrates the model of the adoption curve with this notional chasm point, plus each of the 'cracks' between the adopter groups.

Figure 2: 'Revised' Technology Adoption Life Cycle Demonstrating the 'Gaps'
(Source of Image: Moore, 1991)

As already mentioned briefly, the primary reason why this chasm occurs is believed to be due to the different expectations of the early adopters ('the enthusiasts and visionaries') compared to the early majority (described as the 'the pragmatists') (Moore, 1991). As Gladwell (2000) illustrates, the attitudes of the early adopters and the attitudes of the early majority are "fundamentally incompatible." For example, compared to the innovators and early adopters who are willing to adopt an innovation when it still has uncertainties surrounding it, the early majority are more risk-averse and will only adopt an innovation once it has been well-defined and proven (Walker et al, 2003).

The limited prevalence of housing-sustainability features in New Zealand houses suggests that for many sustainability innovations only the far left tail of this adoption curve has been penetrated: implemented by the innovators and in some cases taken on by the early adopters. For example, only 1.1-2.0% of houses have solar panels (Palmer, 2007; EECA, 2008) and before the new H1 regulations were implemented, only 4% of existing houses were double glazed⁸. These statistics suggest that for many sustainability innovations, the chasm risk is a potential reality if not an explanation already for the lack of adoption.

⁸ Personal correspondence with Roman Jaques (BRANZ) (November 17, 2008) and Verney Ryan (Beacon Pathway) (November 19, 2008)

The chasm presents one way to represent this lack of adoption problem. It has been shown however that economists, sociologists and psychologists have different perspectives on what affects adoption decisions (Morrison, 2006). While sociologists focus on the importance of inter-personal communication (Morrison, 2006), economists tend to focus on the profit an innovation presents, and psychologists on attitudinal factors. Two other ways through which psychology and economics have represented how this model of the adoption process is disrupted, is through the *'attitude-behaviour'* and *'energy-efficiency'* gaps.

2.2. An Apparent Preference

Numerous studies have shown New Zealand homeowners to say sustainability related principles are an important concern in their housing decisions. For example, the 'Household Sustainability Benchmark survey' conducted through the Ministry for the Environment (Johnson, Fryer and Raggett, 2008) found that less than 1% of respondents were unwilling to make at least one improvement to the energy efficiency of their home. The 'Lincoln Envirotown survey' found high levels of interest from their residents towards sustainable or green housing design (Lincoln Envirotown Trust and Landcare Research, 2006), and Research New Zealand's (2007) survey found 83% of New Zealanders to view sustainability as an important priority. Further, the 2007 'ShapeNZ' survey (Neilson (NZBCSD), 2008) found that 68% of the 1,444 respondents were planning to buy energy-efficient appliances and that 34% plan to buy or rent an energy-efficient house.

If what homeowners say were any indication of adoption, then at first glance, this concern over the change process and chasm risk would appear unwarranted. However, sales figures and housing statistics do not match these portraits of 'caring consumers' found from such surveys. For example, although 35% of respondents in the NZBCSD study (NZBCSD, 2008) talked of installing solar water heating as a way of lowering their home's energy bills, just over 10% of new houses built during 2007 (approximately 1.6% of the total building stock) have it installed (Karlik-Neale, 2008; Page, 2008). Further evidence of what appears to be inconsistent behaviour was found from a longitudinal pilot study of New Zealand homeowners who were designing a new house or planning renovations to an existing one (Christie, 2005). This study found that despite sustainability being stated as an initial priority, it was not an important motivation behind their final decisions.

This well-known peculiarity - where we say one thing but do the other - is commonly referred to within the literature as the '*attitude-behaviour gap*' (or 'value-action gap'). This term describes the fact that the link between a person's attitudes and their behaviours is at times weak.

2.2.1. Attitude-Behaviour Gap

The '*attitude-behaviour gap*' was first identified by Richard LaPiere, a Stanford sociology professor, in the 1930's. LaPiere (1934) observed that despite the apparent prejudiced attitude of Americans towards Chinese at that time (as measured in numerous surveys), when he travelled around America with a Chinese student and his wife, in only 1 out of the 251 instances where they made hotel reservations or were served at restaurants, were they refused. Since then, this ubiquitous phenomenon has been observed in countless studies and has been well-documented in many fields (Kollmuss and Agyeman, 2002) including environmental issues (McKenzie-Mohr and Smith, 1999; Eagly and Kulesa, 1997).

It is a common reality that people have divided or conflicting preferences (Sagoff, 1988). Sustainability related decisions do not appear to be exempt from this discrepancy as it is evident within the environmental literature from the early beginnings. For example, while the 1987 Brundtland report "*Our Common Future*" (WCED, 1987) had some success in initiating talk around the sustainability issue at an international scale, it had little success in turning this talk into real action (Dresner, 2002). Other examples of this attitude-behaviour gap within the sustainability topic have been demonstrated by Marcell et al (2004) who found a disparity between American college students' environmental concern and their actions to prevent climate change. Despite finding that 97% of Australian consumers had some interest in sustainability, McGee, Partridge and Lewis (2006) note the presence of an attitude-behaviour gap, and McKenzie-Mohr and Smith (1999) document numerous other international examples. Closer to home, the New Zealand Business Council for Sustainable Development (NZBCSD) found that although respondents "were generally interested in talking about many of the topics, [they] tended to shy away as soon as the discussion turned to specific actions that they could do themselves (UMR and Consultus New Zealand, 2005)". Cupples, Guyatt and Pearce (2007) also note the presence of an attitude-behaviour gap amongst Christchurch respondents with regards to home-heating practices.

The following chapter reviews explanations for why attitude-behaviour discrepancies could occur. The fact to take for now though is that given the lack of success from previous

research and campaigns, it appears that this gap is not due to a simple discrepancy between attitudes and behaviours best explained by a single psychological variable or overcome through information campaigns (Cupples et al, 2007; Kollmuss and Agyeman, 2002; Marcell et al, 2004). Perhaps the UK communications group Futerra's (2005) description of the situation is correct: "forget bridging the 'value-action' gap. [...] We must stop searching for the sparkly magic bridge that simply leads from values to action or from attitudes to behaviour. People's behaviours, attitudes, values and awareness are all different and linked in complicated ways – if they're linked at all."

Regardless of whether values lead to action or not, the very fact that discrepancies exist between them suggests that some 'other factor' is influencing, disrupting or 'holding-back' the adoption process of sustainability innovations. Another way this lack of adoption of sustainability innovations has been conceptualised is through economics and the model of 'Rational Economic Man': *Homo-Economicus*.

2.3. Apparent Irrationality

Behavioural economics provides another perspective as to why homeowners do not adopt sustainability innovations (Yates and Aronson, 1983). Behavioural economics arose from the numerous anomalies that violated the assumptions of neoclassical economics and the model of man as *Homo-Economicus*. This model characterised humans with the ability for perfect reasoning: the ability of 'rationality'. It assumed that people make decisions in order to maximise their individual preferences: their 'utility' (Gilad, Kaish and Loeb, 1987; Jones-Lee and Loomes, 2004; Loewenstein, 2007).

Key assumptions of neoclassical economics include that an individual has perfect knowledge or access to all the information they need, and, that they possess stable preference functions that accurately predict their satisfaction (Kahneman, Knetsch and Thaler, 1991; Tversky and Kahneman, 2004). Many found these assumptions too unrealistic however, noticing that our preferences are context dependent and not always consistent or correct, and, that in most decisions we often only have access to partial or imperfect information (Etzioni, 1986; Loewenstein, 2007; Maital, 2004; Ritov and Kahneman, 1997; Simon, 1957; Tversky and Kahneman, 2004).

Another assumption of neoclassical models is that consumers conduct a rational evaluation of the relevant costs and benefits (Sanstad and Howarth, 1994). Recent evidence however

shows that for seemingly irrational reasons, homeowners do not uptake cost-effective energy-efficiency improvements that are privately beneficial (Loewenstein, 2007; Sanstad and Howarth, 1994; Sanstad, Hanemann and Affhammer, 2006). This apparent irrationality is commonly referred to as the '*energy-efficiency gap*' (McChesney et al, 2006).

2.3.1. Energy-Efficiency Gap

The '*energy-efficiency gap*' is defined as "the difference between actual behaviour and what a simple economic theory of cost minimisation would predict (Swim et al, 2009)." It is characterised by when a consumer does not invest in an innovation because they have an implicit discount or hurdle rate⁹ that exceeds the internal rate of return (IRR) of the investment.

The energy-efficiency gap was first recognised in the 1970's and since then many examples have been documented (Sanstad et al, 2006). These studies found that the apparent reason why homeowners were not up-taking cost-effective energy-efficiency improvements was because they were discounting the returns (benefits) at substantially higher rates than normal market interest rates. That is, it appeared that homeowners' required higher rates-of-return for energy-efficiency investments compared to other investment decisions (Sanstad et al, 2006). This made the trade-off between the initial purchase prices and operating costs seem less beneficial than they actually were (Allen Consulting Group, 2004; Hausman, 1979; Sanstad and Howarth, 1994). While Hausman (1979) found a discount rate of about 20% (that varied inversely with income) for household air-conditioner purchases, it is believed that discount rates for energy-related decisions may even reach as high as 800% per year (Sanstad and Howarth, 1994).

While many aspects of the problem have been studied, it is still largely inconclusive what the cause of this excessive discounting is (McChesney et al, 2006; Oxera, 2006; Sanstad and Howarth, 1994; Sanstad et al, 2006). There are generally two sides to the argument of what causes this phenomenon: market barriers or market failures. Market barriers include split incentives, high initial costs, lack of information or access to capital, weak price signals (for example un-priced externalities), and risk and uncertainty factors (New Zealand Government, 2007b; Sanstad et al, 2006; Vujcich, 2008). Market failures or imperfections include the observation that people do not operate optimally in markets because they make mistakes in calculation, omit relevant information, or have trouble determining how to make

⁹ The term 'hurdle rate' refers to the minimum acceptable rate of return (MARR).

the correct decisions (Sanstad and Howarth, 1994; Vujcich, 2008). Some even challenge whether high discount rates are actually the cause of this problem (Oxera, 2006). For example, instead of homeowners weighing future savings much less in a decision than the upfront cost (that is, because of a high discount rate), results from the Oxera (2006) study suggested that future savings were not taken into account at all in decisions around the installation of insulation or energy-efficient appliances.

Regardless of what causes the energy-efficiency gap, the very observance of this gap disregards the belief that energy-efficiency innovations will be adopted when they are cost-effective. This apparent irrationality, where homeowners' behaviours are not consistent with economic reason, again suggests that some 'other factor' is affecting the diffusion process for sustainability innovations into New Zealand homes.

3. Defining the Problem

The previous sections have demonstrated the numerous ways this problem - that New Zealand homeowners are not adopting sustainability innovations - can be conceptualised. Some refer to it as a communication gap between differing individuals, others as a gap between attitudes and behaviours, and still others view it as an inability to behave rationally. From the *attitude-behaviour gap* perspective, the assumption that attitudes predict behaviours fails due to some 'other factor' disrupting the translation to action. From the *energy-efficiency gap* perspective, the assumption that homeowners will adopt innovations when it makes economic sense fails, again due to some 'other factor' influencing homeowners' ability to think economically rationally. And finally, from *the chasm* perspective, the assumption that innovations will be naturally diffused through society fails due to some 'other factor' that restricts the innovation being passed from the early adopters to the early majority group.

Which position, if any, is the more appropriate to take is unknown. For example, while the energy-efficiency gap provides a framework to question why homeowners make non-optimal decisions around energy use, it is entirely possible that this lack of adoption is not influenced through market barriers or economic motivations, or best explained in terms of rational decision-making. At the same time however, whether the literature around the attitude-behaviour gap encompasses the whole truth about the nature of this problem is also questionable. This is especially given that the attitude-behaviour gap might be a

methodological artefact exaggerated through its measurement (see chapter 6 for a further discussion). Further, the energy-efficiency gap and attitude-behaviour gap are both flawed as Crosbie (2006) also emphasises because “they both consider energy purchase and use in self-contained individual or household ‘units’ detached from their socio-cultural context.” That is, they do not consider what influence social factors may play. While the chasm does refer to social contexts and the role of interpersonal influences, it was considered limited due to its reliance on pre-defined market segments that might not be applicable to sustainability innovations. These issues, of attitude-behaviour discrepancies and whether homeowners behave rationally when making energy-related decisions, have also been studied extensively leading one to ask as Sanstad and Howarth (1994) questioned 15 years ago with respect to the energy-efficiency gap: “why has all the work done to date failed to clarify debates over consumer rationality and its ties to energy efficiency?”

As no single perspective was considered ‘perfect’, a wider berth in a term or label was needed to understand the apparent anomalies in homeowner decision-making so that any potential influences would not be disregarded from the research out-set. It may be for example that this problem is better represented as an imbalance between emotion and reason, with homeowners relying too heavily on unconscious emotional processes when making decisions (Lehrer, 2009). It is also possible that this lack of adoption is due to all three factors: 1 - an inconsistency between attitudes and behaviours, 2 - a lack of economic rationality, and 3 - inefficient communications between different ‘groups’ of homeowners.

A cross-disciplinary approach was therefore taken for this research to account for these numerous factors without unnecessarily restricting the research focus. The need for a cross-disciplinary approach is not novel. For example, in 1979, Arnoux (1979) believed that it was time researchers started to look past economic explanations that were bulked up by psychology, and in 1994, Sanstad and Howarth (1994) argued that the reason for the lack of widely-accepted answers towards the energy-efficiency gap was due to disciplinary fragmentation. Sanstad and Howarth (1994) proposed a case for methodological pluralism stating that the key points from economic, behavioural and technological literatures need to be drawn on in order to account for the observed phenomenon. Etzioni (1986) proposed an explanation that included influences from cognition, personality and societal foundations as well as maintenance and adaptation requirements, and Elster (1989) states that instead of viewing social norms and rational choice as opposing explanations, “a more adequate formulation would be that actions typically are influenced both by rationality and norms.”

Whichever perspective is taken - psychological, sociological, behavioural economic or technological - the problem or underlying issue remains the same: that there is some unknown influence on New Zealand homeowners' willingness to change and adopt sustainability innovations. For these reasons, a description that is more objective and less emotionally loaded is used to encompass the general theme of this underlying issue without unnecessarily limiting the judgement and scope of the research to previous perspectives or a particular discipline. This term is an *apparent disconnect*.

'Disconnect' was chosen over other potential terms because it does not imply or assume anything about the cause or nature of homeowners' lack of adoption except that what they are currently doing appears to contain a discrepancy. For example, 'apparent inconsistency' was not used because the possibility exists that homeowners are actually consistent in demonstrating this illogical behaviour; they could be consistently inconsistent. Likewise, 'apparent irrationality' was not appropriate because from a homeowner's own perspective, their actions probably appear rational; they could be rationally irrational. Note that 'consistency' and 'rationality' are both still considered important in defining when behaviour appears *disconnected*, as will be returned to later in chapter 4. This *disconnect* was described as 'apparent' to acknowledge the fact that while there subjectively appears to be an obvious *disconnect*, it was unknown at the research outset whether this phenomenon is 'real' or 'false'. This term, *apparent disconnect*, is therefore considered objective and all-encompassing because the nature and characteristics of this *apparent disconnect* are not implied.

4. Chapter Conclusion

This chapter introduced the motivation for this research: that the majority of New Zealand homeowners are not adopting sustainability innovations despite living in sub-adequate housing from an economic, health and comfort perspective. This is despite the many policy and intervention attempts to encourage adoption and homeowners' apparent preference for sustainability. The illogicality of this situation is further highlighted given that New Zealander's spent approximately \$1.8 billion¹⁰ in total on housing alterations and renovations in the year ended 30 June 2007 (Statistics New Zealand, 2007). That is, it does

¹⁰ Figure assumes 1.5 million households. Care should be taken when interpreting this figure as Statistics New Zealand (2007) reports a Sampling Error between 23% and 27%.

not appear that they are averse to spending money for ‘other types’ of home improvements. The evidence presented in this chapter therefore suggests that there is some ‘other factor’ influencing their adoption decisions.

This chapter summarised a model of the adoption process which can be applied to the manner in which sustainability innovations are diffused into mainstream society. While the ‘adoption diffusion’ model may have flaws, as a general theory it provided a framework to map adoption progress. This provided a way to understand whether housing-sustainability is on track to mainstream diffusion or not. Given the evidence reviewed so far, the ‘adoption diffusion’ model also suggested that there is a need to understand the motivations behind the early majority group in order to pass sustainability innovations from the early adopters into the mainstream market and prevent market failure.

It was shown how this problem could be described as a discrepancy between attitudes and behaviours (*attitude-behaviour gap*), as a lack of rationality (*energy-efficiency gap*), or as an incompatibility between adopter groups (*the chasm*). The term ‘*apparent disconnect*’ was coined to represent the phenomenon common to these conceptions of how the decision process prevents a behavioural response without limiting their potential explanatory contribution or favouring any particular perspective based on a disciplinary or other epistemic perspective.

The model of the adoption curve highlighted the need to focus on the motivations of the early majority group to ensure mainstream diffusion. However, who the early majority are with regards to the adoption of sustainability innovations and whether they are the same group of homeowners who show an *apparent disconnect*, is currently unknown. Also, the extent that this *apparent disconnect* actually occurs is currently un-quantified. Is it even a real problem or cause for concern? When can homeowners’ behaviours be classified as *disconnected*? While ‘consistency’ and ‘rationality’ were considered too loaded to use as a descriptor label for this phenomenon, they were still considered important parameters for identifying when homeowners show an *apparent disconnect*. These questions will be returned to in chapter 4 when the research focus is defined.

For now, the findings reviewed in this chapter suggest that a greater understanding of the motivations or influences behind this *apparent disconnect* is needed. This understanding is essential if the goal is to shorten the transition from innovators to majority adoption, or, to prevent a complete market failure for housing-sustainability innovations. The following

chapter reviews the numerous models and explanations that may aid this understanding. It appears however that 'homeowners', and the economic, technological and social institutions they are entangled within, are complex.

Chapter 3. Influences on Behaviour

"We are pawns in a game whose forces we largely fail to comprehend."
(Ariely, 2008)

The implications from chapter 2 are that it is currently unknown how best to conceptualise this problem, now termed an *apparent disconnect*, and that it is unknown what factors may be influencing or causing this.

There are numerous perspectives around the nature and causes of this *apparent disconnect*. These range from psychological, social, and behavioural economic, to technological or contextual based perspectives. This chapter reviews these numerous factors and establishes which ones are believed to be of greater priority to measure given the practicalities of data collection. It is concluded that no single explanation or discipline has the breadth of coverage necessary to aid our understanding of this apparently complex phenomenon.

Many of the influences discussed transcend the different disciplines and they do not fit into one particular 'box'. For example, many can be classified as 'psychosocial', involving both psychological and social aspects on behaviour; the behavioural economic perspective is essentially a psychological perspective drawing on cognitive and emotion-based mechanisms, albeit with a focus on economic decisions; and the technological or building science based perspectives contain perceived contextual influences that also have strong psychological undertones. Despite this, distinctions between disciplinary fields are maintained to provide structure to this chapter and to develop a picture of how these different disciplines explain why an *apparent disconnect* could exist.

1. Individual Psychological Factors

This section describes the numerous individual or internal psychological barriers that have been thought to influence pro-environmental behaviours, and subsequently, could explain why homeowners show an *apparent disconnect* towards the adoption of sustainability innovations.

1.1. Attitudinal Factors

Attitudinal factors have been commonly mentioned as causal factors for environmental behaviour since issues concerning the environment entered the vocabulary of psychologists in the 1960s (Kollmuss and Agyeman, 2002; Milfont, Duckitt and Cameron, 2006; Pelstring, 1997; Swim et al, 2009). Since then, many scales to measure general environmental

attitudes have been developed. The most widely used include the 'New Environmental Paradigm' (NEP) developed by Dunlap and Van Liere (Dunlap, Van Liere, Mertig and Jones, 2000), the 'Environmental Concern Scale' (EC) (Weigel and Weigel, 1978), and 'Awareness of Consequences' (AC) (Stern, Dietz and Kalof, 1993).

Many campaigns have adopted the tactic of 'speaking' to these attitudinal factors in an attempt to promote pro-environmental behaviour. However, as discussed in chapter 2, these approaches have shown limited success in that stated attitudes do not tend to correlate with actual behaviour. While some may refer to this discrepancy as an *attitude-behaviour gap*, others have since concluded that attitudinal factors are only a moderately good predictor of how people will act because they affect behaviour indirectly (Corbett, 2005; De Groot, Steg and Dicke, 2007; Nordlund and Garvill, 2002; Tarrant and Cordell, 1997).

There are many studies and theories as to why these divergences between values, attitudes and behaviours still occur. Explanations are numerous and include personal experiences, normative influences, socioeconomic and political constraints, perceived control over the behaviour, discrepancies in beliefs over time, and methodological implications from the measurement of these attitudes and behaviours (Blake, 1999; Eagly and Kulesa, 1997; Kollmuss and Agyeman, 2002; Tarrant and Cordell, 1997). McGee et al (2006) also offer the explanation that the reason for this apparent attitude-behaviour gap is because "consumers do not consider sustainable features in isolation, but in relation to other more significant, and often conflicting drivers."

Another reason for the inaccuracy of attitudinal scales (such as those above) to predict actual behaviours is their lack of consideration for other external non-attitudinal factors (Tarrant and Cordell, 1997) or for mediating or moderating variables like personal moral norms (Harland, Staats and Wilke, 2006; Nordlund and Garvill, 2002; Stern, 2000; Schwartz, 1977). For example, Icek Ajzen (1991) in his 'Theory of Planned Behaviour' illustrates how on their own, general attitudes and personality traits have poor predictive ability for specific behaviours. Instead, Ajzen (1991) shows that behavioural achievement can be more readily predicted when attitudes towards the behaviour, subjective norms, perceived behavioural control, motivation (intention), and ability to act on these motivations (actual behavioural control), are combined. Stern (1999, 2000) also believes that three other major factors need to be considered: contextual factors, personal capabilities, and habits (Stern, Dietz, Abel, Guagnano and Kalof, 1999).

Given the lack of success from previous campaigns, as Haanpää (2007) also suggests, it seems that attitudinal factors do not have much intrinsic meaning. It is also possible that existing attitudes act as a barrier to pro-environmental behaviour. For example, the New Zealand culture appears to favour a 'tough pioneering' mentality that encourages an acceptance to being cold (Cupples et al, 2007; McChesney et al, 2006).

While the implications from the above discussion are that attitudinal factors do not necessarily predict behaviour, they might still be important. This is especially when considering that they are highly entwined with social factors. For example, as Valente and Schuster (2002) illustrate, an individual may adopt a certain attitude (for example choosing to believe in climate change) in an attempt to gain rewards or approval from important others. This section has also highlighted the limitations apparent from the measurement of these attitudes and behaviours. As will be discussed further in chapter 6 (section 1), these methodological influences have implications for the choice of research approach.

Due to the often ambiguous distinction and lack of unified agreement on the use of 'attitudes' and 'values' (see De Groot (2008) and Evans (2007) for a discussion), a distinction needs to be made between the use of these two concepts for the purposes of this thesis. Similar to previous researchers (De Groot, 2008; Stern et al, 1999), this distinction is that while homeowners' attitudes can change depending on the context, their value orientations are more stable and enduring characteristics that influence their general outlook on life.

1.2. Value Orientations

According to Schwartz (1977, 1992), values exist along two dimensions: self-transcendent to self-enhancement, and conservative (traditional) values to openness-to-change. Recent studies have expanded Schwartz's original model into three types of value orientations (De Groot, 2008; Eagly and Kulesa, 1997; Milfont et al, 2006; Schultz and Zelezny, 2003; Stern et al, 1999):

- *Egoistic* – values focussed on maximising individual outcomes;
- *Social-altruistic* – values reflecting concern for the welfare of others;
- *Biospheric* – values emphasising the ecosystem and biosphere.

While environmental actions were traditionally believed to be a collective good related to the self-transcendent (altruistic) and conservative ends of Schwartz's value dimensions

(Schultz and Zelezny, 2003; Stern et al, 1999), recent research has shown how egoistic value orientations are also important (De Groot et al, 2007; Milfont et al, 2006; Schultz and Zelezny, 2003). This is because an individual with an egoistic value orientation is believed to consider environmental behaviours when the perceived benefits exceed the costs to them, or, when the messages appeal to self-enhancing values (see Swim et al (2009) for a further discussion).

One reason proposed for the lack of success of previous psychological measures, is that they appeal to the wrong value orientations. For example, Schultz and Zelezny (2003) argue that environmental messages that appeal to altruistic or self-transcendent values are inadequate given that the predominant values in Western cultures tend to be centred on self-enhancing or egoistic concerns. The economic theory behind the *energy-efficiency gap* and rational choice theory (as discussed in chapter 2, section 2.3) would also suggest that individualistic reasoning, or self-interest, is a key motivation. The fact that market norms prevail over social norms when both are present (Ariely, 2008; Brafman and Brafman, 2008; Levitt and Dubner, 2006; Sagoff, 1988), further demonstrates the egoistic nature inherent in society today and the supremacy of self-interest over social-altruistic motives.

However, many characteristics of sustainability are predominantly public in nature in that they benefit some collective group or external system. It would therefore appear irrational for an egoistic homeowner to install sustainability innovations in their home for the greater public benefit when they are not personally benefiting. One explanation for why a homeowner may act this way is because they feel a moral obligation or because they want to acquire the moral satisfaction.

1.3. Moral Factors

Moral norms and the concept of *moral satisfaction* are believed to motivate pro-environmental behaviour because an individual may feel obligated to act or because doing so will make them 'feel good'. For example, Stern (2000) found moral norms to form the main basis for an individual's predisposition to pro-environmental actions, and Gladwin, Newbury and Reiskin (1997) describe how sustainability can fundamentally be viewed as a moral problem.

Schwartz (1977) originally proposed the concept of *personal moral norms* in his 'moral-norm-activation' theory. He described them as "feelings of moral obligation to act on one's personally held norms (Schwartz, 1977)." Since then, numerous models (Nordlund and Garvill, 2002; Stern, Dietz and Black, 1986; Stern et al, 1999) have extended Schwartz's model beyond personal actions to environmental decisions on the argument that environmental issues are inherently public goods that require altruistic motives activated by moral norms (Stern, 2000).

The concept of *moral satisfaction* was popularised by Kahneman and Knetsch (1992) when they suggested that willingness-to-pay values are attitude expressions related to ratings of moral satisfaction. Moral satisfaction is described as the "tendency of respondents to express general support for a 'good thing' or 'worthy cause', rather than their valuation of the good in question (Baker, Robinson and Smith, 2008)". As such, it is often referred to as 'the warm glow' effect or the 'feel good factor'. Other studies (Defra, 2008; Trotman, 2007) have also found this idea of attaining moral satisfaction to be a motivating factor for pro-environmental behaviour. As summarised in one participant's expression: "better on the environment, better on my conscience (Trotman, 2007)".

However, like attitudinal factors, the influence of moral norms and the motivation to acquire moral satisfaction for housing-sustainability related decisions is unproven. For example while Harland et al (2006) illustrated the influence of moral norms on pro-environmental behaviour when they included them in a model with the three determinants of the 'Theory of Planned Behaviour' (TPB) (attitude, subjective norm, and perceived behavioural control), they also found that the correlations were weak. This suggests that the relationship between moral norms and pro-environmental behaviour is general at best. Further, as moral norms are believed to be the last step in the theorised attitude-behaviour process, an individual's general values and personal dispositions are likely to have already influenced their moral norms.

If homeowners do invest in housing-sustainability innovations to attain moral satisfaction, it implies that they are buying the moral good. However, by placing such a 'moral-premium' on sustainability innovations, it is likely that only homeowners who either want to make a social statement or who have a strong value-set towards the environment will pay this premium. Therefore, relying on homeowners to adopt sustainability for the moral satisfaction is likely to only have a small impact: "prophecies of doom and gloom or trying to appeal to a moral imperative; those tactics appeal to a very small minority that change their

behaviour (Reuters, 2009)." Gardner and Stern (2002) further note that interventions based on moral and educational approaches generally have limited success compared to other intervention types.

When taken in consideration with issues of trust and fairness (as discussed in section 2.5), moral norms may also inhibit homeowners from acting. For example, Stern et al (1986) shows how people apply their moral norms to others, including industry and government. Therefore, if a homeowner perceives others, especially those who they see as being responsible, as not acting in accordance with their personal moral judgements, then they will perceive this as unfair and not act themselves.

The evidence presented in this section suggests that while some studies show moral norms or feelings of a moral obligation to act as being a key part of an individual's attitudes towards environmental issues (Stern et al, 1986), if the aim is to encourage majority adoption, then moral appeals are likely to have limited success.

1.4. Demographics

Income, gender, and education levels are commonly viewed as important factors to pro-environmental behaviour (Hines, Hungerford and Tomera, 1987; Kollmuss and Agyeman, 2002). For example, Stern (2000) notes how much pro-environmental behaviour are constrained by income and Howden-Chapman et al (2009) found energy-efficiency measures to most likely be adopted by middle-income households. The reasoning behind such observations is that low-income groups find it difficult to afford the innovations whereas those on higher incomes have less incentive to save energy. Other studies have found however that the probability that a person will act pro-environmentally is increased with higher income and education levels and lower age-groups (Hines et al, 1987; Kollmuss and Agyeman, 2002). Further, while Torgler and Garcia-Valinas (2006) found women and older age groups (above 30) to show a lower probability of voluntary participation in environmental organisations, Stern et al (1993) found women to be more accepting than men about the effects of environmental problems.

Life-stage is another commonly mentioned predictor. For example, Trotman (2007) found that one of the key drivers for people to make changes to their homes was when changes in lifestyle or life-stage occurred (for example, when the children leave home or when retirement is reached).

In terms of the effect that different *ethnic or cultural backgrounds* may have on an individual's adoption behaviours, the evidence is again contradictory. For example, while Syme, Kals, Nancarrow and Montada (2006) found little evidence of cross-cultural differences between their two samples, Milfont et al (2006) found New Zealanders' with different ethnic backgrounds to show different levels of value orientations as motives for environmental concern (as discussed in section 1.2). That is, pro-environmental behaviour for Asian New Zealanders was predicted from biospheric and altruistic concerns, whereas European New Zealanders were only motivated by a biospheric value orientation.

The extent that demographics influence an *apparent disconnect* towards housing-sustainability innovations therefore appears debatable. If they do have an influence, it appears unlikely that they would influence behaviour directly on their own. For example, Haanpää (2007) believes that institutional variables may mediate the relationship between socio-demographic variables and environmental attitudes.

1.5. Summary: Individual Psychological Factors

It seems unlikely given the disparity in findings, the measurement limitations and the lack of success from previous campaigns, that the individual psychological factors described in this section can provide a complete explanation for any *apparent disconnect*. As a result, many have developed models that combine numerous factors. For example, some view personal moral norms as mediating factors, that when combined with values and awareness, will predict pro-environmental behaviour (Nordlund and Garvill, 2002; Stern et al, 1999). The 'Reasonable Person Model' of environmentally responsible behaviour developed by Corbett (2005) found that when the independent variables of self-interest, altruism, personal norms, desirable choices, and participatory problem solving were combined, that they explained 52% of the variance in environmentally responsible behaviour. Stern et al (1999) developed the value-belief-norm (VBN) theory that links value orientations, moral norms, and different beliefs through a five variable causal chain to various environmental behaviours (Stern, 2000). They also found that in addition to moral norms, attitudes towards environmental organisations (environmental citizenship) and government (policy support) were also strong predictors of pro-environmental inclinations (Stern et al, 1999). Others still argue however that values, beliefs or norms simply do not work because people often have competing interests, lack the personal capabilities, and are concerned as to what others may think (Hannant, 2007; McGee et al, 2006).

Given the conflicting evidence over the influence that these factors may have, the decision was made to measure all of these factors in the experimental research (see chapter 7, section 1.2.2) to determine what influence they have in the context of this *apparent disconnect*.

2. Social Psychological Factors

The previous section looked primarily to the individual for influences on their adoption behaviours. However, our surrounding social environments are also sources of information and potential bias. These interactions we have with other people, whether we know them personally or not, have a significant influence as to how we perceive our actions and ourselves (Festinger, 1954). As Marshall (2009) illustrates, “people’s attitudes towards climate change, are belief systems constructed through social interactions within peer groups.” Consequently, many explanations for seemingly irrational behaviours have been demonstrated to be in motivation of social positioning, as this section will discuss.

Previous research has shown *social norms* to be both a motivator and a deterrent to pro-environmental behaviour (Defra, 2008; McKenzie-Mohr, 2006; Swim et al, 2009). Social norms are shared cognitive representations that are believed to have a significant influence on behaviour (Ajzen, 1991; Cialdini, 2003; Elster, 1989; Hogg and Reid, 2006). Social norms differ from other norms (for example personal, moral, and legal) in that they are not self-imposed rules or internalised self-expectations, but instead are enforced only by members of the general community (Etzioni, 1986; Schultz, 2002).

There are many different types of social norms, some of which are helpful and some maladaptive (Elster, 1989). In fact, many are collectively not the most optimal or useful action to take: the “social usefulness of social norms cannot be taken for granted (Elster, 1989)”. While there may be debate about which ‘type’ of social norm (subjective, descriptive or injunctive) has more influence over behaviour (for example see Cialdini (2003)), the following sections show the numerous ways individuals can be influenced by them or behave in order to conform to these imagined social constructions.

2.1. Social Identities

An individual's personal identity is a combination of their values, life goals and their *social identity* - the groups they feel they belong to (Crompton and Kasser, 2009). While identities are an individual matter, they are inherently social in that they depend on social interaction and contribute to social meaning (Crompton, 2008; Hogg and Reid, 2006). That is, an individual distinguishes their self-concept, or identity, through knowledge of whether they 'belong' to a certain social group (Hogg and Reid, 2006).

A growing number of social norms and expectations about the actions homeowners should be taking to reduce their household's energy use have started to emerge over the years. These new values and norms have resulted in new lifestyles and identities (Rapoport, 2001). The most commonly reported of these is the *green identity* concept.

Having a green identity (also referred to as an 'environmental identity'), is generally associated with having no concern for material possessions as a means to display status and personality (Crompton, 2008). A green identity is not always viewed by homeowners as a positive trait, and this position is often rejected and retaliated against because people who engage with this social identity are often not seen as being part of 'mainstream' society. Instead, green identities are often associated with either being 'hippie' or 'thrifty', or as something that only people with a lot of money can afford to do. In other words, this identity is not associated with the 'average homeowner'. For example, in their qualitative survey of householders, Trotman (2007) found a small number of participants to agree with this perception of housing-sustainability as being something that 'greenies' or 'other' (young or wealthy) people do, and not for the mainstream. Further, the Defra (2008) study found that maintaining one's self-identity against the negative perceptions of a 'green' lifestyle was a common barrier to action. Their study found that about one-third of respondents felt being green was an alternative lifestyle that was not for the majority (Defra, 2008). While Trotman (2007) also found self-expression or expression of ownership to be a key factor motivating people to make changes to their home, it seems that some forms of expression (notably expressions of sustainability) are viewed negatively. Thus, homeowners may not be adopting housing-sustainability innovations in order to avoid being labelled with this social identity.

Consumerism, social identities, and environmental issues are believed to be linked (Klein, 1999; Bunting, 2007). Consumerism is believed to bring identity through how we articulate

ourselves by the material goods we buy (Arnoux, 1979; Baudrillard, Lovitt, and Klopsch, 1976). As both Baudrillard et al, (1976) and Arnoux (1979) describe, consumption is no longer related to the use-value a good provides, but rather, to the social meaning (for example the status or prestige) it brings to the 'owner'. The symbolic value we gain from buying a solar water heating (SWH) panel may be just as important as the instrumental use we get from it. For example, Christie (2005) found social factors associated with status to be one of the main motivators (alongside personal influences) behind homeowners purchasing decisions for sustainable innovations. Rapoport (2001) also illustrates this through his discussion on the relationship between housing and culture. He demonstrates how houses, which are fundamentally about instrumental functions, can also express identity these days through the images and meanings their designs communicate. The implications of this for housing-sustainability innovations is that if there is currently no social recognition or symbolic value attached to housing-sustainability innovations, then they are unlikely to be adopted just because of the 'use-value' they provide. Therefore, while housing-sustainability innovations may be valued for their non-energy or non-market benefits (see section 5.1), homeowners also need to receive some form of social meaning from these innovations in order to adopt them.

The other aspect of consumerism that links it to issues of environmentalism is the impact consumerism has on the natural environment through resource exploitation and waste (Bunting, 2007; Cudworth, 2003). For example, Haanpää (2007) argues that environmental behaviours are characterised by particular consumer styles and post-modern lifestyle features. This has resulted in the idea of 'green consumerism' (Haanpää, 2007) which can be viewed as another representation of green identity.

The *citizen-consumer* discrepancy popularised by Sagoff (1988; 2008), also provides an explanation as to why sustainability and consumption behaviours appear at odds (Frame and Newton, 2007). Sagoff shows how as citizens we may favour laws or ideas that protect our broad values towards environmental and social issues, but that these beliefs conflict with our behaviours as consumers. The former Parliamentary Commissioner for the Environment (PCE), Morgan Williams, also observes this discrepancy: "the Arcadian progress myth (is) at odds with the deepest wishes of most New Zealanders for the nature of their recreational landscape (Young, 2007)." From a positive perspective however, this citizen-consumer notion also suggests that green consumerism can be increased through integrating citizenry beliefs with consumption issues (Frame and Newton, 2007). For example, Frame and

Newton (2007) suggest that sustainable consumption marketing could be made more effective if citizenship and consumption issues are brought together. For example, advertising campaigns aimed at reducing energy use should target homeowners' rights as consumers to have electricity and the luxuries it provides them in their homes, whilst at the same time referring to their responsibilities as citizens to reduce regional or national energy consumption.

Given that a green identity can be viewed as both an incentive and disincentive for homeowners to adopt sustainability innovations, it therefore seems appropriate to assess the level that respondents identify with this identity and their views on others who do identify with this 'greenie' value set. The citizen-consumer discrepancy can ultimately be viewed as a conflict in value-orientations (as discussed in section 1), in that an individual can approach a task either altruistically or from a self-interested perspective (but not usually from both at the same time) (Brafman and Brafman, 2008). It is therefore believed that if a citizen-consumer discrepancy is one cause for an *apparent disconnect* then this would be observed through measurements of these two value orientations.

Social identities are often formed through social interactions (Buunk and Mussweiler, 2001; Hogg and Reid, 2006). Of most relevance to this thesis, are the types of social interactions that involve a social comparison.

2.2. Social Comparisons

People are always comparing themselves to others so that they know where they 'fit' in the wider social context in terms of their views, beliefs, and actions (Buunk and Mussweiler, 2001; Festinger, 1954). From these social comparisons, people derive knowledge "about what is the 'proper' course of action (Swim et al, 2009)." As Festinger (1954) describes, social influences are the result of our need for self-evaluation which is achieved through comparisons to others. To have this normative knowledge is therefore important to most individuals as those who depart from the norm are often viewed as outsiders (Brafman and Brafman, 2008). This tendency for us to compare ourselves to others and to change in order to fit others expectations and labels, is appropriately referred to as the *chameleon effect* (Brafman and Brafman, 2008).

The Defra (2008) study demonstrates how important it is for homeowners to feel that they 'fit' within the expectations of society with the finding that respondents' motivation to

change was largely determined by whether they perceived the new pro-environmental behaviour to fit within societal norms. From the other perspective, a New Zealand study found that one reason why homeowners did not adopt the sustainable behaviour was if they perceived no change in the status quo that they perceived a need to keep up with (Trotman, 2007).

The emphasis Ajzen (1971) gives the role of these normative beliefs for effective behaviour change communications, further reiterated the belief that social comparisons were an important factor to measure for this research. This is especially when considering that other researchers have found participants to refer unprompted to other people and society when making their valuations. For example, Svedsater (2003) found that respondents seemed concerned with what others would do or fail to do. It may be for example that because homeowners are comparing themselves to other homeowners who also do not adopt sustainability innovations, that they perceive non-adoption to be the 'proper course of action'. Further examples of how social comparisons could be influencing homeowners' adoption behaviours will be illustrated in the following section.

Social comparisons are typically situated in social situations where individuals can observe one another (Buunk and Mussweiler, 2001). While social situations provide the backdrop for social comparisons from which social identities and social norms are evaluated and formed, the fact that people do not always behave in ways that express their true values means that social situations sometimes provide unreliable depictions of beliefs and consequently, are breeding grounds for bias (Hogg and Reid, 2006).

2.3. Situational Biases

Social situations are highly influential on individual behaviour and as such are responsible for numerous cognitive biases (Smith, Nolen-Hoeksema, Fredrickson and Loftus, 2003). Situational biases are also sometimes referred to as 'conformity' or 'collective action problems' as they deter collective action. Situational biases include the *false consensus* and *false uniqueness bias*, *false polarisation*, *pluralistic ignorance*, the *confirmation bias* and *diffusion of responsibility*.

The *false consensus* and *false uniqueness bias* describes our tendency to overestimate the number of people behaving in a manner similar to us when we know we are engaging in the non-desirable behaviour (false consensus), and, to underestimate the number who are

behaving favourably (false uniqueness) (Monin and Norton, 2003). For example, Monin and Norton (2003) found that when a water shortage prompted a ban on showering, those who bathed during this ban thought that showering was more prevalent than the non-bathers did. The prevalence of the desirable and common behaviour (not showering) was also consistently underestimated by those who showered (Scott and Koger, 2005).

In contrast to the false consensus bias, the *false polarisation bias* describes the misconception when people view differing others as having negative motives, being more susceptible to bias, and as having more extreme views than they really are (Monin and Norton, 2003). This perceptual asymmetry may be at play when people use or think of 'green identity' or 'environmentalist' labels for example. That is, those who embrace these identities or labels (and those who reject it), are likely to have much exaggerated (or polarised) views of the other (Scott and Koger, 2005). The Monin and Norton (2003) study also showed a false polarisation bias in that both bathers and non-bathers thought the other differed greatly in their concern for the community. Participants' self reports showed that this false polarisation of others was illusory however.

The *bystander* or *diffusion of responsibility effect* is another commonly reported factor thought to explain why people do not behave sustainably. In this case, lack of action is believed to occur because of the presence of others, as "the burden of responsibility does not fall solely on him or her (Smith et al, 2003). Futerra (2005) provides an example of the bystander effect for climate change where because people know that other people are also aware of the problem, they think someone else will act.

Pluralistic ignorance describes the situation where an individual mistakenly believes they know what others think. Consequently they reject a private norm and wrongly conform to another they believe others accept (Hogg and Reid, 2006; Smith et al, 2003; Thaler and Sunstein, 2009). Pluralistic ignorance is considered a 'perceptual paradox' as it often results in conformity to imagined social norms (Hogg and Reid, 2006) that can persist through 'generations' as demonstrated by MacNeil and Sherif (1976). The Monin and Norton (2003) study also found this bias as bathers thought that other bathers cared less than they did and non-bathers thought other non-bathers cared more than they did. In contrast to the false consensus bias where people wrongly assume others think like them, pluralistic ignorance involves situations where many want to behave a certain way but are afraid to do so because they think others do not hold their view. For example, a false consensus for recycling would mean that a homeowner believes most other people do not recycle even

though most others openly state or exhibit that they do. In contrast, a situation of pluralistic ignorance would occur when a homeowner wants to recycle but wrongly believes that others do not want to recycle (when in fact they do) and therefore conforms to the perceived social norm out of fear for being excluded for going against it.

In comparison to situations of pluralistic ignorance, the *confirmation bias* describes how it is in our nature to search for evidence that confirms our decisions or beliefs (Ashcraft, 1998). For example, we are more likely to notice others who behave similar to us (for example the neighbours who do not put the recycling out) and not as likely to notice those who do not (the other set of neighbours who do recycle).

The biases mentioned in this section are largely a result of the *availability heuristic*¹¹ which Tversky and Kahneman developed to describe the fact that “people judge the likelihood of an event based on how easily they can remember examples or instances (Ashcraft, 1998)” (Scott and Koger, 2005). For example, Gardner and Stern (2002) provide several studies that demonstrate how the availability heuristic may lead people to focus on sustainable behaviours with outcomes they can imagine and to not focus on behaviours with less tangible outcomes or effects (for example, global warming).

Three other biases related to availability that can shape our judgements of sustainable behaviours include the *frequency*, *familiarity* and the *salience and vividness bias* (Ashcraft, 1998; Thaler and Sunstein, 2009). The salience and vividness bias may explain why bad instances of SWH installations are more likely to be remembered by homeowners than the many more good instances. That is, the more dramatic an event, the stronger an impression it is likely to leave (Ashcraft, 1998). Because of the behaviour of a few extreme or salient individuals whose actions are perceived as radical and far from mainstream society, this bias also presents one way through which negative associations with green identities could be formed. From a different perspective, Yates and Aronson (1983) demonstrate how a remark from a friend on the performance of an innovation will have more impact on a homeowner’s imagination than numerous impersonal data summaries. In combination with the confirmation bias, these availability biases may explain why homeowners are apparently holding on to their current views.

The situational biases described in this section demonstrate how homeowners may be using other homeowners as models to indicate when to act or not. While these biases present

¹¹ A *heuristic* is a ‘rule of thumb’ or an informal strategy used to provide an answer (Ashcraft, 1998).

opportunities to encourage social change, they also illustrate why an *apparent disconnect* could even exist. In particular, it seems that biases associated with the availability heuristic (for example, confirmation and frequency) are likely to have some part to play through normative (social) comparisons, as homeowners are more likely to notice others as being the same as them, thus confirming their beliefs that non-adoption is 'normal'. Alternatively, given the stated values of homeowners, it is also likely that an *apparent disconnect* could be represented as a situation of pluralistic ignorance. Either way, because non-adoption is currently the norm, there are consequently fewer instances for their beliefs to be changed – hence a paradoxical situation.

2.4. Perceived Behavioural Control

Due to the large-scale and global nature of environmental issues, perceptions of *behavioural control* are common psychological barriers, as many believe that their actions are too small to make a difference (Swim et al, 2009). While biases relating to behavioural control manifest at the individual level, they are typically characterised as social because the individual fails to recognise the combined impact their actions would have at a collective level if everyone else also engaged in the same action (Swim et al, 2009; Walton et al, 2004). In this sense, issues of behavioural control can be viewed as collective action problems influenced by our need to compare ourselves to others and the norm.

As mentioned in section 1.1, a key component of Ajzen's 'Theory of Planned Behaviour' (TPB) model is the concept of perceived behavioural control (Ajzen, 1991; Francis, Eccles, Johnston, Walker, Grimshaw, Foy, Kaner, Smith and Bonetti, 2004). In this model, Ajzen shows behavioural control to have two aspects: how much control the person has over the behaviour and the level of confidence a person feels about being able to perform the behaviour (Francis et al, 2004). The first of these two aspects is evident in the following social biases. While the second is predominantly an influence at the individual level (as discussed further in section 5.2), it can also be viewed as a social bias in that self-esteem is thought to play a prominent role in the likelihood and type of social comparisons an individual may display (Buunk and Mussweiler, 2001).

Two types of behavioural control biases believed to be rationalisations for attitude-behaviour inconsistencies are the perceptions of *futility* and *fatalism* (Walton et al, 2004). These social cognitions are typically characterised by a sense of helplessness: a perceived

inability to bring about change. Futility describes the belief that there is no point making changes as it will not make a difference, whereas fatalism is the belief that everything is predetermined and that one holds no control over their future (Rogers, 2003). Individuals with a futile perspective may also be viewed as having an *external locus of control* (Futerra, 2005; Kollmuss and Agyeman, 2002; Teddlie and Reynolds, 2003).

The influence of these behavioural control biases can be seen in the results from previous studies. For example, a survey conducted by Research New Zealand (2007) found that only 37% of respondents thought 'ordinary' New Zealanders could have an influence on New Zealand's sustainability. This is despite most (83%) saying that they considered sustainability to be an important issue. In contrast, more (72%) thought government or local councils were in a better position to act (Research New Zealand, 2007). In a survey of Australian consumers, McGee et al (2006) found many to believe that their actions 'can't make a difference' to the big picture. In contrast, Defra (2008) found 'being part of something' to be a common motivator for pro-environmental action. However, at the same time 'disempowerment' is noted as a common barrier to action (Defra, 2008). The American Environics (2006) study found fatalism to be one of the top values that their psychographic group the 'murky middles' agreed with, and Rogers (2003) states that later adopters are more fatalistic than earlier adopters. In their qualitative study of New Zealand householders, Trotman (2007) found that many New Zealander's thought that their personal actions will have little impact on the larger problem. Further, it is generally agreed that appeals to fear or narratives of eco-apocalypse only provoke feelings of fatalism, discourage action, and subsequently create resistance to change (Eagly and Kulesa, 1997; Nordhaus and Shellenberger, 2007a; 2007b).

The likely influence that perceptions of futility or fatalism may have on homeowners' decisions around housing-sustainability innovations is again questionable. For example, while Walton et al (2004) in their study measuring commuters' concern for the effects of vehicle emissions found futility and fatalism to correlate negatively with environmental concern and knowledge of emissions, they did not find a significant relationship between either futility or fatalism with actual transportation choices and behaviours. They concluded that while futility and fatalism may be a factor influencing commuters' attitudes, they were not important motivators behind their final decisions and subsequent behaviours (Walton et al, 2004). Despite this, the majority of the evidence reviewed in this section suggests that

perceptions of futility or fatalism may have some role, if minimal, to play in explaining this *apparent disconnect*.

2.5. Trust and Fairness

Issues of *trust* and *fairness* have been shown to be either motivators or barriers to pro-environmental behaviour (Swim et al, 2009).

*Fairness*¹² has been demonstrated to be important in both economic decisions (Kahneman, 2003; Loewenstein, 2007) and non-economic decisions (Futerra, 2005; Swim et al, 2009). Thus, as well as arising due to economic inequality, issues of fairness can also be viewed in terms of social utility in that people do not like to feel that others are benefiting from them or 'breaking the (unwritten) rules'. As Futerra (2005) describe with regard to the climate change problem, "free riders spoil everything." The success of the '0800-Smokey' campaign run by Auckland Regional Council, where drivers were asked to report in other drivers with 'dirty' vehicle exhaust (Frame, 2004), is an illustration of how the need for perceived fairness can be a significant motivator for pro-environmental behaviour.

The *norm of distribution or equality*, which regulates the fair allocation of income and goods, has also been demonstrated to be a strong motivator for pro-environmental behaviour (Elster, 1989). Note how this norm is closely related to Kahneman and Tversky's concept of *loss aversion* (Kahneman et al, 1991) (see section 3.2) in that people may be more willing to accept a loss than to accept a distribution they find unfair (Elster, 1989).

With regards to *trust*, the evidence suggests that many distrust the messages from scientists ('experts'), businesses and government, especially when it is viewed as a threat to their freedom (Swim et al, 2009). Therefore, while some may view business or government as responsible for taking or leading action, others may view such involvement negatively.

The influence that perceptions of fairness and trust may have on homeowners' *apparent disconnect* towards sustainability innovations was therefore considered a plausible factor to be examined given the findings from previous research presented in this section. This is especially when considering Syme et al's (2006) findings that overall appraisals of fairness have more motivation on pro-environmental behaviour than monetary or self-interest (egoistic) variables.

¹² Note that Kahneman (2003) refers to *fairness* within economic situations as an issue of 'selfishness'.

2.6. Summary: Social Psychological Factors

The incredible power and sway that social contexts can have on our behaviours was introduced in this section. Despite the evidence, some still believe that social factors are not as significant to pro-environmental behaviour as other factors might be. Schwartz (1977) argues that social norms “add little to the explanation of individual differences in helping behaviour provided by internalised, personal norms”, and both Schwartz (1977) and Stern et al (1999) argue that personal norms have more power over changing behaviour than social norms. For example, Schwartz (1977) found that items relating to personal norms were more strongly correlated with helping behaviour as opposed to items relating to social norms (for example their friends or families expectations of them). Schwartz (1977) states that this is because an individual is more motivated to act when they realise for themselves what the consequences of action or inaction are (for example, environmental destruction). This is in contrast to being told by others how they ought to behave or by having their attention directed to social norms. Schwartz (1977) goes on to highlight that if social norms were in fact important, then they would have already been built into a person’s moral norms. Stern et al (1999) therefore states that the only social norms that are important to measure for their influence on behaviour, are those that have not been adopted by an actor as their own.

Despite some divergence in opinion of leading theorists, it seems likely that homeowners’ decisions towards sustainability will be both influenced and motivated by social contexts and the need to conform to social norms. There appears to be no significant reason why people as homeowners would be exempt from these social influences for sustainability decisions. Regardless of whether or not social factors are currently influencing an *apparent disconnect*, they will still play an important role in facilitating the introduction of an innovation into the majority (as is discussed in chapter 10). This is especially illustrated when considering the emphasis that diffusion theory gives communication and interactions between individuals (Morrison, 2006).

This section has highlighted the numerous ways that social psychological factors can influence a homeowner’s attitudes or good intentions to engage in pro-environmental behaviour. Norms centred on conformity (for example participation in recycling programmes) and fairness (for example knowing that one’s neighbours also recycle) have been of particular interest to previous researchers measuring environmental issues (Swim et al, 2009). However, this research also considered social (other-self) comparisons,

perceptions of futility and fatalism, and the acceptance of a green identity to be important to measure.

Many of the situational biases could not be measured directly in the experimental design (see chapter 7). However, this was not to say that they were not considered important. For example, an *apparent disconnect* towards housing-sustainability could actually be viewed as a situation of pluralistic ignorance. That is, while homeowners privately value sustainability innovations (as evidenced from their stated preferences), it appears that they may not be adopting these innovations because they are averse to going against the perceived norm. It was assumed that if such biases had a significant impact on homeowners' adoption decisions, then they would be reflected through the mixed methods research approach as described in chapter 6.

3. Behavioural Economic Factors

The numerous observations of human decision-making and behaviour deviating from the *Homo-Economicus* model, prompted researchers from the 1950's to provide alternative models and explanations to this 'myth of the rational man'. As the standard economic model could be challenged by its inability to account for individual decision-making, researchers soon realised that certain aspects of cognitive-behavioural psychology could help explain the seemingly irrational yet systematic phenomena of people not maximising their economic utility. As Herbert Simon said in 1957, "the theory of decision making has become a natural meeting ground for psychological and economic theory (Simon, 1957)". This field of work became known as 'behavioural economics' as it applied cognitive psychology to economic reasoning.

The basic idea behind cognitive explanations for why humans display 'imperfect' behaviour is that the brain uses simplification processes or tools to reduce the level of effort needed to make decisions, or, when specific information is lacking (Ashcraft, 1998; Carroll and Johnson, 1990; Simon, 1957). While these strategies have the intended aim of making decisions easier, they often have a negative affect resulting in various biases or mental traps (Ashcraft, 1998).

3.1. *Bounded Rationality*

Despite approaching the problem from a machine-learning perspective, Herbert Simon was the first to bring the concept of uncertainty in human decision-making into public awareness. Simon's argument was that people face uncertainty about the future and that it is impossible for them to have complete and perfect information on a decision at any given time (Simon, 1957). In 1957, Simon coined the term *bounded rationality* to describe the belief that because people have limits in their knowledge, they have developed cognitive and behavioural 'short-cuts' to save on mental effort and to avoid finding potential inconsistencies (Simon, 1957). Imperfect and complex information was believed to encourage subjective interpretations which often disproved the assumption that "we are capable of making the right decisions for ourselves (Ariely, 2008)". Bounded rationality was therefore a realistic model of behaviour to explain why optimal decision-making under neoclassical economic principles was an unattainable ideal due to the cognitive and information-processing constraints we face in complex environments (Kahneman, 2003; Tyson, 2001). For example, a homeowner may fail to weigh the relevant variables properly when considering in summer how large their power bill will be in winter, or, they may fail to take account of rising fuel costs and consequently may miscalculate (underestimate) cost-benefit analyses when considering the installation of energy-efficiency innovations (Oxera, 2006; Yates and Aronson, 1983).

Due to people possessing bounded rationality, Simon proposed that people must make decisions by a process he termed *satisficing* - a portmanteau of 'satisfy' and 'suffice' (Simon, Egidi, Marris and Viale, 1992). This describes the belief that people do not maximise or optimise their existence and instead make do with what is adequate.

These two general concepts put forward by Simon essentially laid the foundations for other researchers, most notably Daniel Kahneman, Amos Tversky, Richard Thaler, Jack Knetsch and George Loewenstein. From here, these other researchers investigated more specific explanations as to why human behaviour was often inconsistent with logic: that is, why people showed bounded rationality and displayed satisficing behaviour. These explanations included numerous heuristics, biases and framing effects (Gilad et al, 1987) as the following sections illustrate.

While economic decisions were the original focus of behavioural economists, more recently these concepts have been extended to contemporary everyday contexts (for example buying coffee), and to other areas such as social- or neuro-psychology. This has seen an explosion

of books including: *'Predictably Irrational'* (Ariely, 2008), *'The Undercover Economist'* and *'The Logic of Life'* (Harford, 2006; 2008), *'Exotic Preferences'* (Loewenstein, 2007), *'Freakonomics'* (Levitt and Dubner, 2006), *'Sway'* (Brafman and Brafman, 2008), *'Nudge'* (Thaler and Sunstein, 2009), *'The Decisive Moment'* (Lehrer, 2009), and *'The Tipping Point'* and *'Blink'* (Gladwell, 2000; 2005).

3.2. Aversions to Loss

Kahneman and Tversky coined the term *loss aversion* to describe the observation that people over-react to potential losses more than potential gains: “the disutility of giving up an object is greater than the utility associated with acquiring it (Kahneman et al, 1991)”. This apparent cognitive asymmetry, results in people holding on to a loss despite it being economically, emotionally or otherwise beneficial not to. The main implication from these aversions to loss is that “foregone gains are less painful than perceived losses (Kahneman et al, 1991)”.

The *endowment effect* is one example of how this aversion to loss is manifested in behaviour. It describes how people value an object more when they perceive ownership. Thus, loss aversion is more pronounced when the loss is personally more meaningful (Kahneman et al, 1991). The endowment effect was first demonstrated by Richard Thaler in 1980 when he found that contrary to standard economic assumptions, people demand more to give up an object than they are willing-to-pay to acquire it (Kahneman, 2003; Samuelson and Zeckhauser, 1988). An example of the endowment effect within the housing industry is in real-estate prices, where sellers often perceive a price for their property that exceeds what buyers' are willing to pay.

Tversky and Kahneman (2004) also found that whether a problem is framed as a gain or loss can affect how people respond. This became known as the *framing effect* and it demonstrated how our preferences are not stable as traditional rational economic theory would assume, but instead, are highly susceptible to variations of framing. In particular, the *framing effect* shows that people will be more risk-averse if something is framed as a gain than when it is framed as the equivalent loss. From this perspective, a homeowner is more likely to buy a heat pump that advertises that they will lose a potential 33% saving in heating costs if they do not install it, as opposed to one that just advertises that they will save 33% in heating costs. As Yates and Aronson (1983) reiterate, “the typical campaign strategy with its

great emphasis on savings inadvertently may be discouraging people from changing their energy use habits.”

To encompass the above biases relating to reference dependence and loss aversion, Kahneman and Tversky developed *prospect theory* as an alternative to ‘expected utility theory’ from the rational economic model of decision-making (Kahneman and Tversky, 1979). This theory describes how in decisions involving risks, people place different weights on gains, losses, and different ranges of probability, relative to a neutral reference point (Kahneman, 2003; Kahneman and Tversky, 1979; Tversky and Kahneman, 2004).

Another manifestation of this aversion to loss anomaly is the *status quo bias* (Thaler and Sunstein, 2009). This was originally demonstrated by Samuelson and Zeckhauser in 1988 when they showed through a series of decision-making experiments that “individuals disproportionately stick with the status quo (Samuelson and Zeckhauser, 1988)” even when this current condition is not optimum (Thaler and Sunstein, 2009). The status quo bias generally states that people prefer situations to remain unchanged, unless the incentive to change is compelling, as change has elements of risk and causes unease. It is believed that the status quo bias is related to prospect theory in that the aversion to loss is not due to the state of either owning or not owning the energy-efficiency innovation for example, but rather in the change process involved with either adopting the innovation or giving it up (Kahneman et al, 1991).

A cognitive misrepresentation related to the framing of gains and losses is not the only reason suspected to cause a status quo bias however. Other explanations include the presence of transition costs, a perception of sunk costs, anchoring and other psychological commitments (such as regret avoidance), or the need to maintain an identity or picture of decision consistency to oneself and others (Samuelson and Zeckhauser, 1988). A status quo bias may therefore not necessarily be attributed to loss aversion. For example, a common example of a status quo bias is in the electricity market where homeowners, as electricity consumers, do not change suppliers to take advantage of cheaper prices (Hunter, 2009; Samuelson and Zeckhauser, 1988). Given that this status quo bias was also noted by Samuelson and Zeckhauser in 1988, it is unlikely that the recent recommendations by the New Zealand Electricity Commission to improve customer activism through increased marketing of the ‘powerswitch’ website (Hunter, 2009), will be successful. As Samuelson and Zeckhauser (1988) suggest, this is because consumers’ inaction towards switching suppliers is probably motivated by the psychological need to avoid decision regret or sunk

costs, and not necessarily an aversion to loss - which the 'powerswitch' website is effectively promoting. This status quo bias is also similar to the banking industry conundrum in which bank customers too are notorious for being reluctant to switch banks despite large sums of money being spent by banks in an effort to convince customers to switch (Hunter, 2009).

Some have started to question these biases however (Gal, 2006; Kermer, Driver-Linn, Wilson and Gilbert, 2006; Vendrik and Woltjer, 2007). For example, while loss aversion was built on the belief that people will always become risk-taking when faced with a certain loss, Vendrik and Woltjer (2007) have disproved this assumption with the finding that people can also be risk-averse when faced with a prospective loss. Kermer et al (2006) also show that while people emotionally believe losses will have a greater impact than gains, the impact of a loss in actual experience is not as strong as they thought it would be. Kermer et al (2006) suggest that this is because people have adopted coping mechanisms to recover from negative events. Ariely, Huber and Wertenbroch (2005) further discuss how an approach based on emotional attachment and duration of ownership can be used instead to explain the phenomenon the endowment effect was coined to describe. Ariely et al (2005) also demonstrate how the endowment effect does not take into account changes in cognitive perspectives (what they term a 'differential perspective account'). For example, a person will have a different frame of mind depending on whether their goal is to sell or buy the good. While Kermer et al (2006) still acknowledge the existence of loss aversion, albeit as an emotional belief and not as an actual experience, Gal (2006) argues that the loss aversion principle is superfluous and that our tendency to favour the status quo is sufficient to explain this phenomenon. The lack of a comprehensive explanation and the controversy surrounding the biases prospect theory was coined to encompass, suggests that if homeowners *disconnected* behaviour is the result of an apparent aversion to loss, then this behaviour may not be best represented as an anomaly of prospect theory. This is especially when considering that research demonstrating these effects has generally been limited to somewhat small and trivial goods (Ariely et al, 2005) - unlike investments in housing-sustainability.

While these anomalies of prospect theory as they have been traditionally applied may not relate to this research, the underlying principle behind these cognitive biases – an aversion to risk – may still play a role in explaining any *apparent disconnect*. That is, while it is likely that homeowners perceive a financial loss, they may also perceive a loss or risk in terms of other factors such as the need to maintain a social identity or a picture of cognitive

consistency (as discussed in the previous sections). For example, while the endowment effect is only believed by some to apply to actual objects and not abstract concepts (Kahneman et al, 1991), Ariely (2008) demonstrates how ownership is not limited to material things through the example of how ‘ideologies’ are effectively the result of an endowment effect on ideas and opinions (whether about politics, sports, music, or religion for example). It is therefore possible that homeowners could perceive a loss through some change in an intangible, like social identity or their current routine for example. Given the numerous factors aside from loss aversion that can motivate a tendency to stick to the status quo, this assumption seems further likely. For example, as the following section will demonstrate, an apparent need to display or feel consistency in opinion, behaviours, and identity, is also a disincentive to change.

3.3. Anchoring and Commitment

Commitment is defined as when an individual feels bound to certain behaviours (Grafteo, Savadori, Tentori, Bonini and Rumiati, 2009). Commitment arises from our need for consistency and certainty in decisions (Gladwin et al, 1997). Subsequently, this means that people tend to “avoid behaviours that contradict their initial commitment [...] and take actions coherent with their commitment, even when they are aware of the cost inherent in this course of action (Grafteo et al, 2009).”

The need for psychological consistency and commitment can affect behaviour in numerous ways. These include (but are not limited to), habits, competing priorities and prior commitments, regret avoidance, cognitive dissonance, and the anchoring-and-adjustment heuristic.

Habits, or habitual behaviours, are believed by many to be a significant barrier to change (Defra, 2008; Stern, 2000; Swim et al, 2009). One of the most important causal factors in Stern’s (2000) model is habits and the ability for someone to break an old habit and establish a new one. For example, to many homeowners, switching off appliances at the wall when they are not in use or using cold instead of hot water for clothes washing would involve the conscious act of breaking the existing habit until the new one is established.

Another influence found to be a barrier to uptake is the presence of *competing priorities*, particularly when they are already *prior commitments* (Swim et al, 2009; Trotman, 2007).

For example, Trotman (2007) notes that concerns over budget and competing priorities for spending are likely barriers to homeowners adopting sustainability innovations.

The desire to stick to prior commitments can be viewed as a need to maintain a picture of decision consistency to others. This is believed to be one potential cause for a status quo bias (Samuelson and Zeckhauser, 1988). Prior commitments have also been noted as strong motivational factors in consumer decisions. Graffeo et al (2009) demonstrate this with respect to the purchase of food products that could be potentially contaminated. They found that people who had already been consuming a food product before information regarding a food hazard was reported were less likely to be discouraged from eating it than those who did not already eat the product. The main issue with prior commitments is that negative information is often *inappropriately discounted* which means that we disregard negative information about a prior commitment and subsequently fail to see the better alternatives (Brafman and Brafman, 2008; Gilad et al, 1987). This is also closely related to the *prior hypothesis bias* (or 'diagnosis bias'), where "a prior belief regarding the state of the world leads to ignoring disconfirming information (Gilad et al, 1987)." This bias also results in *value attribution* - our tendency to label things/people/ideas based on our initial opinions (Brafman and Brafman, 2008).

Consistency, while a key characteristic of rationality (Elster, 1989; Maital, 2004), has also been demonstrated to create psychological commitment when a person is faced with competing priorities (Samuelson and Zeckhauser, 1988). When cognitions are inconsistent, this is most commonly known to cause a state of *cognitive dissonance* (Gilad et al, 1987). In order to minimise the discomfort caused from cognitive dissonance, individuals will change which ever cognition is the least resistant (Gilad et al, 1987). Often this means choosing the most familiar path and discarding the one that involves change (Samuelson and Zeckhauser, 1988)¹³. The need for decision consistency to reduce cognitive dissonance can therefore be viewed as another way through which a commitment to current beliefs, or a status quo bias, is caused.

Regret avoidance is another form of psychological commitment that influences decision-making (Samuelson and Zeckhauser, 1988). Regret avoidance also shows characteristics of loss aversion in that individuals show stronger regret for bad outcomes that result from action compared to those same bad outcomes resulting from inaction (Samuelson and

¹³ Note that this is closely related to *self-perception theory* in that people will tend to stick to actions they knew worked for them in the past (Samuelson and Zeckhauser, 1988).

Zeckhauser, 1988). Regret avoidance can also be viewed as a social influence in that it encourages conformity to norms and maintaining identity. Avoidance of decision regret is therefore another potential cause of the status quo bias in that it favours inaction or sticking to current behaviour at the expense of change.

Psychological anchors are another way through which new decisions are influenced by our previous commitments. The *anchoring-and-adjustment* heuristic describes our tendency to base initial estimates and decisions on familiar positions (known as anchors) and then adjust this initial value until an acceptable value is reached (Scott and Koger, 2005; Thaler and Sunstein, 2009). This is also known as *coherent arbitrariness* or a *starting point bias*. The problem is that often our consequent adjustments do not consider new information appropriately and we subsequently can under- or over- estimate future decisions (Gilad et al, 1987; Thaler and Sunstein, 2009). The observation of this phenomenon directly disproves the assumption of rational choice theory that people have well-defined and stable preferences, and further demonstrates that prices are not reflections of underlying values but a product of both normative and non-normative influences (Ariely 2008; Loewenstein, 2007).

Many examples of this heuristic have been provided. For example, George Loewenstein found that when people move to a new city they generally remain anchored to the prices they paid for housing in their previous location (Loewenstein, 2007; Ariely, 2008). The effects of arbitrary coherence can also be seen for example in the ‘take-back’ effect that is often observed with regards to efficiency improvements or electricity price increases (as discussed in chapter 2, section 1). For example, our previous levels of energy consumption or power bills represent our old ‘anchors’ that become replaced by our new levels of energy consumption or power bills. Consequently, our consumption levels slowly start to increase relative to this new anchor as we become used to these new consumption levels and forget what our old anchors used to be.

Similar to the numerous anomalies of loss aversion and the status quo bias, the biases discussed in this section illustrate how homeowners’ adoption decisions could be affected by the need for decision consistency and the influence of previous and new commitments. The following section provides further examples of how an *apparent disconnect* could be influenced by inconsistencies or discrepancies in beliefs - this time due to the dimension of time.

3.4. Time Inconsistencies

Our tendency to focus on the immediate future and underestimate time delays provides another explanation for why homeowners do not behave in a pro-environmental way (Gladwin et al, 1997; Hannant, 2007). That is, as investments in sustainability are inherently long-term with future outcomes, decisions pertaining to them are prime targets for inter-temporal influences.

The broad concept of time inconsistencies was first introduced by R. H. Strotz in 1955 (Tyson, 2001). Since then, numerous studies have shown that when given the choice people prefer to have less today as opposed to more tomorrow - even when it would be in their own best interests not to do so (Loewenstein, 2007; Tyson, 2001). The self-control field draws heavily on this literature of how the preferences of our present and future selves can differ (Loewenstein, 2007). It appears homeowners' decisions around sustainability issues may also be susceptible to this mental trap. For example, Ronald Wright's, *'A Short History of Progress'*, (2004) illustrates the nature and impact our short-term focus can have with examples of tragic events through-out history. These examples also illustrate how temporal conflicts, between short- and long-term interests, are considered one cause of 'social dilemmas' (alongside conflicts between individual versus collective interests) (Milfont and Gouveia, 2006). Kollmuss and Agyeman (2002) also believe that influences from temporary discrepancies in beliefs are a likely explanation for why the attitude-behaviour gap exists for environmental actions. When questioning homeowners about the reasons they installed SWH panels, Scotts and Saville-Smith (2007) found immediate environmental concerns rather than future environmental concerns to be a common motivator. Further, only a small minority cited future concerns around the cost or security of energy supplies as a reason for installing SWH. A United Kingdom study (Oxera, 2006) also found that while the upfront price was an important influence on householders' decisions to install insulation, future energy savings did not even feature in their considerations. Trotman (2007) also found many homeowners to be affected by this bias as they preferred to take an ad-hoc 'focus on today' approach: "we live for today, I don't care if I get the savings in the long run, I've got to see the savings now... in the pocket (participant quote from Trotman (2007) study)". This problem is further complicated by the fact that people are more transient today and less likely to stay in the same home for more than 7 years (Maher, 2008; Palmer, 2007).

These disparities in preferences over time are due to our natural tendency to discount as was alluded to in Chapter 2 when discussing the *energy-efficiency gap*. *Discounting*

describes our “tendency to reduce the importance of an outcome with greater ‘distance’ (temporally, socially, geographically, and probabilistically) (Swim et al, 2009).” As Hare (1981) reiterates, discounting is “our tendency to give less weight to future preferences, because they are future.” *Hyperbolic discounting* refers to the observation that people generally prefer smaller, sooner payments or payoffs as opposed to larger, later payoffs (Loewenstein, 2007). Note that this is only true when the smaller payments happen first. This is because an individual’s discount rate declines over time so that if the same situation of payoffs were happening later in time, then the larger payoffs would be preferred. Therefore, hyperbolic discounting is also considered a time inconsistency because the decision maker’s different selves appear to have different choices. For example, homeowners may overemphasise the initial cost at the expense of future benefits, or, the energy savings may be considered too small relative to the initial cost to have enough importance in their decision (Sanstad and Howarth, 1994; Sanstad et al, 2006). The Oxera Consulting Company found support for this when they found that up-front costs were a much more important determinant of behaviour than the subsequent benefits were (Oxera, 2006). A survey conducted by the New Zealand Business Council for Sustainable Development (NBCSD) found that most respondents assumed the cost to build sustainably to be much more and the benefits to be much less than they actually are (NZBCSD, 2008).

One explanation for our biased discounting is that people are poor at predicting their *experience utility* - how they will feel in future experiences (Loewenstein and Frederick, 1997). Loewenstein and Frederick’s (1997) results suggest that people tend to over-estimate the impact a change in their circumstance will have on their quality of life and that they under-estimate their own ability to adapt to this change. This is referred to as a *projection bias* (Loewenstein, 2007). This bias arises due to the difficulty in predicting how our current decisions will affect our future preferences, especially when our current tastes often differ from our future ones (Loewenstein, 2007). Loewenstein (2007) argues that people mispredict their future preferences because they think their current preferences are more valid and underestimate the extent to which these current preferences will change. For example, we tend to forget that factors such as habits, day-to-day mood fluctuations, social influences, maturation, and changes in the environment or our personal circumstances may have an influence (Loewenstein, 2007). As a homeowner needs to predict numerous future events, it is easy to see how decisions around housing-sustainability could be affected by a projection bias. These future unknowns include for example how much the price of power will increase by, how cold the next few winters will be, whether better solutions will be

developed during this time, how much longer they will be in their house, and, whether the market will recognise these features when they sell. In other words, housing-sustainability investments are generally large decisions packed with a lot of uncertainty that requires 'unbiased' foresight.

How homeowners pay for electricity is one example of how a projection bias could occur. Because payment is monthly and spread over time, the effects of energy consuming (or reducing) goods are made less salient - especially as they are combined with other pre-existing electrical charges. This makes it difficult to distinguish the energy one specific good is using (Loewenstein, 2007). Tools that have been introduced in New Zealand to help homeowners as consumers overcome this problem include labelling standards such as the 'Minimum Energy Performance Standards (MEPS)', 'Home Energy Rating Scheme (HERS)', and the 'Rightcar' fuel efficiency rating. Home energy meters also present a way to make energy use more salient.

Another example of this projection bias is when people focus on what is termed the *sunk cost* (what they have already paid) instead of on the *opportunity cost* - which is what the good could be worth at a different time. Loss aversion (or prospect theory) can be viewed as a contributor towards this sunk cost effect (Kahneman, 2003). Adam Smith (1976) demonstrates the commonality of this bias through his actors in '*The Theory of Moral Sentiments*'. They weigh their out-of-pocket costs more than their opportunity costs. It appears that homeowners may be no different to Smith's actors. For example, homeowners may be focussing on the upfront cost (that is, the sunk costs) rather than the energy savings and increased market appeal sustainability innovations are likely to have on their property (that is, the opportunity costs). Whether housing-sustainability innovations actually present an opportunity cost (aside from the non-energy benefits) will need to be explored (see chapter 5). In other words, a homeowner could be justified in considering an investment in sustainability as a sunk cost because it is not valued in the traditional market sense.

Risk is the other factor, aside from the opportunity cost, used to calculate the hurdle rate (minimum acceptable rate of return) (Sanstad and Howarth, 1994). That is, one of the reasons homeowners demonstrate a high implicit discount rate (as discussed in chapter 2, section 2.3) may be because they perceive energy-efficiency innovations to be high risk due to the uncertainty of the future benefits. For example, in terms of increasing their homes value, homeowners may perceive less risk and higher opportunity costs from kitchen and bathroom renovations compared to investments in energy performance. However, this risk

may not necessarily be financial or due to the unknown nature of future variables. For example, as section 2 suggested, this risk may also be social in nature.

No matter what model is used however to describe this observation, the underlying fact of the inter-temporal biases discussed in this section is that people prefer to have something now as opposed to something later: “tomorrow is less important (Futerra, 2005).” For example, a homeowner may plan to retrofit their house with insulation to make the house warmer but the easiest option at the time might be to turn on or up a heater. As Syme et al (2006) summarise this problem: “in psychological terms, maintaining the motivation to achieve long-term goals in the face of short-term interests is notoriously difficult.” Many of the cognitive biases discussed previously are also influenced by, or are influences themselves on decisions that involve a time element. For example, loss aversion (our tendency to avoid the pain of losses) has been demonstrated by Brafman and Brafman (2008) to distort our judgments when we place too much importance on short-term goals. When a long-term outlook is taken however, immediate potential losses do not seem as ominous.

The evidence presented in this section indicates that time inconsistencies are a likely contributor towards an *apparent disconnect*. For example, despite many benefits of sustainability innovations being instant (for example warmth and comfort), homeowners could consider these to have delayed rewards due to the length of time needed to ‘recoup’ the initial financial investment through energy savings. Regardless of whether homeowners are taking a short-term focus and what is causing this, the uncertainty of future benefits from efficiency investments appears to be a barrier to up-take (Sanstad and Howarth, 1994).

3.5. Summary: Behavioural Economic Factors

This section demonstrated the many anomalies of human decision-making that have been observed to violate the assumptions of neoclassical economics and the model of man as *Homo-Economicus*. While most are considered a result of our cognitive limitations, they also illustrate our desire to maintain a picture of decision consistency and an aversion to change, particularly when there is a perceived risk from unknown future variables.

The adoption of sustainability innovations is inherently an economic decision with many unknown future outcomes. This suggests that behavioural economic factors are likely to be a significant reason for why homeowners are apparently not adopting sustainability

innovations when it appears to make rational sense. The decision was therefore made to measure many of the biases discussed in this section through experimental manipulations or by controlling for their unintended influence (see chapter 7, section 1.2.1).

4. Neuroscience and Emotion

The behavioural economic perspective on the *apparent disconnect* is mainly focused on the underlying cognitive and emotion-based mechanisms affecting decision-making. More recently, advances in neuroscience have also been used to help explain decision behaviour and departures from rationality (Bonini, Ranyard and Mittone, 2009). For example, the nature of time inconsistent preferences has been shown through brain scans to involve an internal struggle between emotion and reason (Etzioni, 1986; Lehrer, 2009; Loewenstein, 2007). These scans show that decisions that provide pleasure today activate emotional regions of the brain (for example the midbrain dopamine system, amygdala and the nucleus accumbens) as opposed to areas associated with rational planning (such as the prefrontal cortex and insular cortex) (Lehrer, 2009; Loewenstein, 2007).

Neuroscientists have also shown that when people think about losing something, the brain area activated is the amygdala - the area responsible for evoking negative feelings (Lehrer, 2009). Further, when studying unfair behaviour, the anterior insula, another area linked to emotion, is activated (Sanfey, 2009). Biases relating to loss and fairness could therefore be thought of as biases from emotional attachment (Ariely et al, 2005) and not, as economists originally thought, as being motivated by profit (Kahneman, 2003). The general rule seems to be that when we desire something, the dopamine reward system regulated by the nucleus accumbens, is activated. When the cost of an item is considered however the prefrontal cortex and insula are activated (Lehrer, 2009). If the emotional brain is more frequently relied on, then the implications from these studies are that homeowners are more influenced by the amount of pleasure versus pain they could receive from the decision to buy a SWH panel for example, as opposed to performing an explicit cost-benefit analysis to weigh the relative advantages. Lehrer (2009) also emphasises however that both areas of the brain - emotional and rational - are important and can work well together.

Explanations at the neural level were considered beyond the scope of this thesis. However they are worthy of future consideration as they could physically demonstrate the cause of these biases.

5. Characteristics of the Innovation and Context

This section discusses the characteristics of the innovation, dwelling and household contexts that, whether real or perceived, can deter a homeowner from adopting sustainability innovations.

5.1. *Characteristics of the Innovation*

As introduced in chapter 2 (section 2.1) when discussing diffusion theory, there are five important characteristics that can influence an innovation's rate of adoption: *relative advantage*, *compatibility*, *complexity*, *trial-ability*, and *observability* (Rogers, 2003). It is important to note that whether an innovation fulfils these criteria is ultimately determined by the 'subjective' perceptions of the homeowner, regardless of how 'objectively' beneficial the innovation actually is (Rogers, 2003).

Relative advantage is not only measured in terms of the economic and performance advantages an innovation may provide, but also in terms of convenience, social prestige and satisfaction for example (Rogers, 2003). For some sustainability innovations such as SWH panels, while they may have economic and environmental benefits, other factors such as convenience may still present potential barriers to their adoption.

How *compatible* an innovation is with existing values, norms, needs or behaviours is also an important variable in determining its adoption success (Rogers, 2003). For example, McGee et al (2006) found consumers to believe that sustainability innovations might compromise their existing lifestyles. However, the Defra (2008) study found that lifestyle fit and self-identity can function as either a motivator or barrier to pro-environmental behaviour thus emphasising the subjective nature of how an innovation's characteristics are perceived.

Complexity, defined as "the degree to which an innovation is perceived as difficult to understand and use (Rogers, 2003)", is perhaps the greatest weakness of sustainability innovations. For example, the New Zealand 'Household Sustainability Benchmark Survey' (Fryer, Kalafatelis and Lee, 2008) found the features of alternative products associated with heating or energy requirements to be a major barrier to sustainable behaviour, and the Trotman (2007) study found participants to view sustainability innovations as 'technological lifestyle accessories' that are hard-to-understand.

Rogers (2003) states that the *ability to trial* an innovation is an important factor for encouraging adoption as it reduces the perception of risk through uncertainty. At present, unless homeowners experience the innovation at another's home, they cannot trial sustainability innovations on a partial basis before they take the risk and invest in the innovation. While the show homes mentioned in chapter 2 (section 1) present a step forward in this direction, this inability to trial sustainability innovations may still be a significant cause of an *apparent disconnect*.

The final characteristic, how *visible* the innovation is or how observable the results are, varies across innovations. For example, SWH panels are a very visible innovation (and as such are often found in neighbourhood clusters (Rogers, 2003)), whereas other innovations such as insulation or double glazing (DG) are not very visible. When considering reactions to *green identities* (as discussed in section 2.1), visibility may not always be perceived as a positive attribute to homeowners. For example, McGee et al (2006) note that a predominant barrier to uptake was the perception that housing-sustainability innovations 'might look bad'.

Rogers (2003) innovation characteristics highlight how the adoption of sustainability innovations can also be influenced by non-environmental attitudes or by the non-energy benefits. Many studies have identified what these other non-environmental or non-energy motivations are (Christie, 2005; Defra, 2008; Stern et al, 1999; Stern, 2000; Stonyer (NZBCD), 2007; Trotman, 2007) and some have even tried to quantify the value of these non-energy benefits (Chapman, Howden-Chapman and O'Dea, 2004; Howden-Chapman et al, 2007; (Stoecklein, Zhao, Christie and Skumatz, 2005). For example, Trotman (2007) found warmth and health improvements, self-sufficiency and improved quality of housing to be key benefits associated with housing-sustainability by New Zealand residents. Other characteristics dominant in consumers' decision-making criteria for housing purchases have been found to include 'looks', comfort and lifestyle (Christie, 2005; Defra, 2008; Stonyer¹⁴, 2007) and not the energy savings (Oxera, 2006). Despite these findings, it seems that direct environmental and energy benefits are still important in homeowners reasoning. For example, Scotts and Saville-Smith (2007) found 'saving money' as the most commonly cited reason homeowners gave why they installed SWH panels. This was followed by environmental concerns, future energy costs and security of supply.

¹⁴ Reference quotes information from the TNS 'A & A' Home Survey, 2006 (In 'Traffic').

In terms of quantifying the perceived value of these non-energy (or non-market) benefits, the 'Zero and Low Energy House' (ZALEH) project found the non-energy benefits from superior insulation to be perceived by household occupants as having almost twice as much monetary value associated with them than what the actual energy savings are (Stoecklein et al, 2005). The large body of work conducted by the 'Wellington School of Medicine and Health Sciences' has also quantified the health benefits that arise from increased insulation, for example in terms of reduced visits to the doctors, hospitalisations, and days off work or school (Chapman et al, 2004; Howden-Chapman et al, 2007).

What these findings suggest is that the different 'types' of benefits that arise from housing-sustainability innovations are all important in homeowners' considerations. This knowledge, of what consumers' value in sustainability innovations, is consequently used by businesses to advertise their products. For example, energy-efficiency lighting advertisements emphasise the style, size and safety of their bulbs (for example MAREXIM Energy Saver Safety Bulbs®)¹⁵, heat pump manufacturers highlight the comfort, ease and quiet performance of their systems, and Pink® Batts® (a brand of insulation), emphasise the improvements in warmth or 'snuggliness' that come from installing their insulation¹⁶.

These numerous benefits will be questioned about directly in the main research experiment and explored further in chapter 5 (the preliminary study) as they also have implications for the choice of research method.

5.2. Contextual Factors

Contextual factors include for example *personal capabilities, characteristics of the dwelling and household, external and financial constraints, and future commitments*.

Personal capabilities have been shown by previous research to be one of the more predominant influences on homeowners' motivations (Christie, 2005; Stern et al, 1999). Personal capabilities relate to the individual and include experience, knowledge and ability. Whether these constraints are real or not, the perception of personal capability is an important factor that will ultimately influence whether attitudes and normative beliefs

¹⁵ See Marexim Energy Saver Safety Bulbs® brochure (CFL Safety Energy Saver Bulbs) <http://www.marexim.com/www/index.php?id=6> (Retrieved January 31, 2010 from the World Wide Web)

¹⁶ See <http://www.pinkbatts.co.nz/view-our-tv-ads/> (Retrieved January 31, 2010 from the World Wide Web)

translate into the corresponding behaviour. Ajzen's 'TPB' recognises this and subsequently assesses both perceived ability and actual ability (Ajzen, 1991). For example, although a homeowner may actually have an adequate level of knowledge and ability to make sustainability improvements to their house, unless they perceive themselves to have this ability they are unlikely to make the changes.

Personal capabilities are highly influenced by context as the influence they have on action varies between situations. Stern (2000) illustrates how more expensive or difficult behaviours (for example putting a SWH panel on the roof or retrofitting insulation into walls) are more likely to be predicted by contextual and personal capabilities. This is in contrast to behaviours that are not strongly constrained by context or personal capabilities (for example replacing a normal incandescent light-bulb with an energy-efficient compact fluorescent), which are more likely to be predicted by other factors, such as attitudinal or social influences. This finding is also supported by Trotman (2007) as they found New Zealand residents to perceive the following sustainability changes, which can be considered both costly and difficult, to be the hardest to make (from highest to lowest): DG, large budget items, water recycling, solar energy (PV and SWH), and structural changes. These findings also have implications for the choice of innovations to study as will be further discussed in chapter 4.

Kollmuss and Agyeman (2002) believe that the 'type' of experience (direct versus indirect) an individual has is an explanation for why attitude-behaviour discrepancies are observed. Namely, an indirect experience (for example learning about the problem) is believed to have a weaker correlation with behaviour as opposed to a direct experience of it.

Lack of knowledge about which actions to take is also believed to be a psychological barrier to adoption (Swim et al, 2009). However, as reported in chapter 2, findings from numerous studies would suggest that the majority of homeowners do already have an adequate understanding of sustainability and that further educational approaches aimed at increasing consumer knowledge are somewhat redundant. It has also been established that simply providing consumers with information on the benefits and characteristics of these technologies is not sufficient to motivate change (Sanstad et al, 2006). However, despite homeowners appearing to be relatively knowledgeable about sustainability issues, many still report that they feel they lack knowledge about what more they can do and what sustainability innovations can actually achieve (Fryer et al, 2008). As described in section 2.4, Ajzen recognises this in his 'TPB' and subsequently shows perceived behavioural control

to have two aspects, the second of which is the level of confidence a person feels in their own ability (Francis et al, 2004).

The claimed effectiveness of many sustainability innovations depends on the *characteristics of the dwelling and household* in which they are installed. Dwelling characteristics include for example the type of house (for example detached or joined) and physical characteristics of the house such as current insulation levels, construction features and its orientation and geographic location (McChesney et al, 2006). Characteristics of the household that may influence adoption decisions include the tenure (whether they own or rent the house and whether they have a mortgage), the household size, the household income, and their current living situation (for example family or friends) (McChesney et al, 2006; Swim et al, 2009). These factors can be thought to influence decisions through the amount of disposable income they have available to make retrofit improvements or pay for utility bills, through their heating or energy needs, and through whether they will benefit from the improvements in the case of landlord-tenant relationships.

The *length of time* an individual plans to stay in their house could also be a strong motivator or inhibitor for a homeowner to make changes. This factor is closely linked to whether homeowners perceive sustainability improvements to add market value to their house. For example, if a homeowner plans to move before the benefits have paid back the initial investment, then unless they perceive this sunk cost as an opportunity cost that they will recoup through resale then it does not appear to be a rationally economic decision (unless for example they value the other non-monetary benefits or moral good). Given that 57.7% of New Zealanders moved homes at least once in the last 5 years (Palmer, 2007) and that the average length of time New Zealand residents stay in their house for is 6.8-years (Maher, 2008; Statistics New Zealand, 2006b), it is no wonder that this short turnover period favours “fashion-induced investments geared towards selling (Maher, 2008)”. To make matters worse, as chapter 5 further explores, it appears that sustainability innovations are currently not valued by the market (Maher, 2008; Neilson, 2008).

Financial and external constraints (such as infrastructure, cost, and demands on time), are often cited as a common barrier to pro-environmental action (Defra, 2008; Stern, 2000). For example, the up-front cost of housing-sustainability innovations is often found to be their most predominant barrier to uptake (McGee et al, 2006), and, Fryer et al (2008) found the amount of time and inconvenience perceived to be involved with sustainability behaviours was a major barrier to action. The effects of financial and external constraints are further

illustrated through Valente and Schuster's (2002) critique of Rogers' 'adoption diffusion' model: "the theory works best when potential adopters can afford and have easy access to the innovations being promoted, and works less well when purely economic considerations influence adoption decisions (Valente and Schuster, 2002)."

Other external constraints include political and legal considerations. One example of these may be the consent processes and regulations around installing SWH panels. For example, the cost to get just consent to install a SWH panel in the Wellington region is approximately \$500¹⁷. While some councils have taken the initiative to reduce or remove these barriers (for example Waitakere and Nelson City Council's), these may still be viewed by homeowners as an extra-cost and significant barrier.

5.3. Summary: Innovation and Contextual Characteristics

Similar to the other factors reviewed in this chapter, there appears to be a lack of unified agreement over how the characteristics of the innovation or how homeowners' situations can be either a motivation or barrier to uptake. For example while McGee et al (2006) found cost to be the most important driver over lifestyle, Stoecklein et al's (2005) results suggested that homeowners placed more importance on the lifestyle benefits than the energy savings.

Despite these discrepancies in research findings, all these variables were considered important to measure in this research as such contextual factors could be a legitimate reason for why a homeowner would show an *apparent disconnect*. On the other hand, they could also be used as an 'excuse' to either themselves or to others for why they show apparent inconsistencies. Further, even if the innovation is beneficial for their situation, their subjective perceptions of the suitability of their situation and the relative confidence in their own capability to use the innovation will ultimately determine their adoption decisions.

¹⁷ Based on the cost for a minor works building consent:
www.wellington.govt.nz/services/buildserv/buildcon/fees.html (Retrieved February 1, 2010 from the World Wide Web)

6. Chapter Conclusion

The various factors that could be influencing homeowners' *apparent disconnect* towards housing-sustainability innovations were presented in this chapter through a review of the different disciplines. The psychological position suggests that homeowners as individuals are motivated to act because of their own internal attitudes, value orientations, morals, or demographic characteristics. In addition, the social psychological position suggests that homeowners' behaviours might be the result of the need for social approval or due to biases in collective action. In contrast to the psychological constructs discussed, the behavioural economic position describes why homeowners do not appear to epitomise *Homo-Economicus* because they are affected by unconscious cognitive influences causing them to make errors in their judgements. The final theoretical position discussed the characteristics of the innovation and context. This suggested that homeowners are not adopting sustainability-innovations because they perceive their personal capability, dwelling or household context to be unsuitable to the characteristics of the innovation.

After reviewing most of the explanations and factors, it appears that no single explanation or discipline has the breadth necessary to account for this complex phenomenon. For example, methods traditionally used by the social psychological disciplines do not consider how homeowners assess the costs and benefits involved in a decision, which rational economic theory would suggest is an important factor in homeowners' decisions to invest in sustainability innovations. On the other hand, while behavioural economic explanations can and have been applied to a wide range of behaviours (for example dating, job hiring and house buying), traditionally they tend to focus on economic or consumption oriented decisions. It is entirely possible however that this phenomenon is not influenced through purely economic motivations or best explained in terms of rational decision-making. Furthermore, self-interest (egoistic value orientations) or rational choice theory cannot account for the full explanation as to the origins of norms and a homeowner's rationale for following these (Elster, 1989). As Scott (2000) reminds us, "if actions are self-interested, how is social life possible?"

While some view rationality and social norms as opposing measures, others try to combine them (Chai, 2004; Elster, 1989). Similarly, while differences between the approaches were particularly salient, common themes were also evident. For example, the idea of conflict or inconsistency was a recurring theme in most sections: within an individual's beliefs (cognitive dissonance), between individual versus collective interests (social dilemma),

between different 'selves' at different times (inter-temporal choice), and between different norms (social or non-market norms versus market norms). It was also demonstrated how homeowners could relieve this conflict through adopting numerous beliefs or biases.

Few studies appear to have proposed such a mixture or fusion of factors to explain the existence of this apparently complex *disconnect*. Those who have include Etzioni (1986), who proposed an explanation to the limits to rational decision-making that not only included cognition but also personality and societal foundations as well as maintenance and adaptation requirements. While Kollmuss and Agyeman (2002) provided a diagram to aid understanding of this problem, they also admitted that the development of a model to incorporate the various factors might not even be useful or feasible. After trying to develop such a model, Stern (2000) also relinquished the idea that no single theory or causal factor can explain the "dauntingly complex" nature of pro-environmental behaviours.

In order to test this hypothesis, a research approach that bridges these various disciplines (economic, technological/contextual, individual, behavioural and social psychological) was needed. This position of 'cutting across disciplinary boundaries' was also held by Sanstad and Howarth in 1994 and Yates and Aronson in 1983. These researchers argued for a methodological pluralism approach to understanding whether homeowners behave rationally or not when making decisions regarding energy use and energy efficiency. In particular, they believed that in order to account for the nature of this phenomenon and to design effective interventions, the individual, social, cognitive, economic and technological factors that could be influencing this situation, need to be understood. The development of such a research approach that considers these differing explanations is discussed in the following chapters.

Chapter 4. Research Focus

“An insightful and innovative market segmentation scheme is often the key to marketing breakthroughs.”

(Walker et al, 2003)

The previous chapters presented the idea that there is an *apparent disconnect* towards housing-sustainability and that a number of factors could be influencing this. The purpose of this chapter is to delimit the scope of this research and to provide criteria for 1 - identifying which innovations to study and, 2 - for when homeowners' decisions can be classified as *disconnected*. The goal of this careful definition of the research parameters is to ensure that the output of this thesis will reliably identify why New Zealand homeowners show an *apparent disconnect*.

Sustainability is a broad field, filled with many definitions. In order to avoid making the thesis topic the definition of sustainability, the scope is limited to energy-efficiency innovations as one aspect of housing-sustainability. Energy-efficiency innovations were chosen because their benefits are predominantly private. It was assumed private benefits are more salient to this study because it is harder to understand why a homeowner would show *disconnected* behaviour in the face of innovations offering direct private benefits compared to innovations with public benefits.

Even within this tightly constrained scope, a few unknowns remain that need to be determined before any of the factors reviewed in chapter 3 can be either ruled-out or considered important for increasing majority adoption. These unknowns can be summarised by the following questions:

- When can homeowners' decisions be classified as *disconnected*?
- What innovations are currently affected by an *apparent disconnect*?

For this research, the test of behaviour demonstrating an *apparent disconnect* is the departure from rationality, where homeowners are not acting consistently with their beliefs. The selection of innovations to study is defined as those common within homeowners' awareness but not present in the early majority of households.

1. Housing-Sustainability

Despite the history surrounding sustainability, a lack of unified agreement over a definition of 'sustainability' is still apparent (Robinson, 2004). Consequently, most avoid trying to define its meaning and instead settle for variants of the Brundtland definition (Bartlett, 1998; WCED, 1987). While Robinson (2004) may argue that this lack of definitional precision

is important for initiating discursive, particularly political, debate on the issue, a focus was needed for this research in order to measure any *apparent disconnect*.

One of the reasons why a lack of consensus exists is the multiple applications of the concept. Sustainability is a broad concept that is believed to comprise three components: social, economic and environmental (Crocker, 2002; Jacquelyn, 2000; Pitts, 2004). These components can further be applied to many disciplines ranging from, for example, the built environment, transport and emission reductions, to water-use and waste minimisation. It was viewed unrealistic to measure the extent of any *apparent disconnect* at such a broad level and so this research took a building science focus: particularly, at the level of residential housing.

1.1. Private and Public Benefits

Housing-sustainability innovations can have two types of benefits: ones that reward the homeowner directly (for example reducing power bills) (private benefits), and ones that have a public benefit but no direct benefit to the individual homeowner (for example reducing CO₂ emissions). Most innovations provide a mix of both private and public benefits.

From a rational perspective, it would be in a homeowner's self-interest to adopt sustainability innovations that bring them private gains. Ironically, given the statistics (Karlik-Neale, 2008; Page, 2008) it appears that the majority choose not to. To measure *disconnected* behaviour more appropriately, the decision was made to focus on instances where the private benefits are more significant as these were believed to be harder to understand. That is, given our current consumer (and some would say egoistic) society, it makes more sense for homeowners to adopt sustainability innovations which benefit them personally. This is in comparison to instances where no private benefit is gained. In these latter cases, the motivation to engage in *disconnected* behaviour is more understandable as there is less personal incentive unless the moral good is desired (see chapter 3, section 1.3). Ultimately, if the motivations for the less understandable behaviour can be understood (that is, the lack of uptake for innovations with private benefits), then the findings are likely to be more transferable to actions with a public benefit.

Due to the inherently public nature of sustainability, most housing-sustainability innovations do not contain exclusively private benefits. However, some can be considered more

dominant in private benefits than others can. One aspect of housing-sustainability with salient private benefits is energy-efficiency improvements.

1.2. Focus on Energy Efficiency

Energy efficiency is typically regarded as a reduction in energy use from improved performance. In the context of this thesis however, the term ‘energy efficiency’ is used in a broader sense to imply any technology or behaviour that reduces a household’s overall purchased energy. It is acknowledged that this is not a technically correct use of the term efficiency, as some innovations do not improve efficiency but rather conserve energy by reducing demand or produce it from renewable sources. For example, in comparison to double glazing (DG) which improves the heating or cooling efficiency of a house, solar water heating (SWH) panels do not improve efficiency but rather provide energy to heat water through a renewable source as an alternative to purchased electricity or gas. However, in order to simplify the amount and complexity of terminology used within this thesis, all innovations that can reduce a household’s need to purchase energy, will be broadly lumped under the ‘energy efficiency’ title.

Energy efficiency was chosen over other aspects of housing-sustainability with salient private benefits because energy is one of the more important issues pertinent to the housing sector with vital links to other areas such as health, energy security, environmental protection, economic, and social development (as demonstrated in chapter 2, section 1). Finally, energy efficiency is more specific with less implied complexities than the overarching concept of sustainability (which has for example value and moral-laden characteristics (Gladwin et al, 1997)). This makes energy efficiency easier to define, communicate, and measure homeowners’ actions and beliefs towards.

In order to assess any *apparent disconnect* homeowners display towards energy efficiency, the decision was made to focus on specific innovations that improve household energy-use as opposed to taking a whole-of-house energy consumption approach. This was not only because of the alignment with the ‘adoption diffusion’ model which tends to relate to one specific innovation at a time (Rogers, 2003), but also because there is no agreed target of what constitutes an ‘energy-efficient house’ in New Zealand.

Like sustainability, numerous definitions and targets for energy efficiency exist. The New Zealand Energy Efficiency and Conservation Act provide a definition of energy efficiency as

“a change to energy use that results in an increase in net benefits per unit of energy (McChesney et al, 2006; New Zealand Government, 2007a)”. However, some believe that this definition is incomplete, as it does not include the other benefits such as environmental protection, improved economic performance, and health, social and private benefits (McChesney et al, 2006). Other definitions have a more economic slant. For example, the Allen Consulting Group (2004) defines energy efficiency as “maintaining or increasing the level of useful economic output delivered per unit of energy consumption.” Still others (DEFRA and DTI, 2001) believe a definition for energy efficiency should give consideration to recommended indoor temperatures for health purposes (18°C-24°C as defined by the World Health Organisation (WHO, 1985)) while simultaneously meeting fuel poverty or energy affordability criteria (no more than 10% of total household income should be spent on total energy costs¹⁸). This is to decrease the chance that unhealthy living conditions will be encouraged because of the need to conserve energy.

Numerous standards, reports and documents outline target levels of energy consumption for a ‘typical’ New Zealand home. These include targets set by: Clause H1 of the New Zealand Building Code (DBH, 2006), the ‘best practice’ standard SNZ PAS NZ 4244 (Standards New Zealand, 2003), organisations such as Beacon Pathways Ltd (Easton, 2007), and independent researchers such as Alcorn (forthcoming) and Callau and Lloyd (2008). Discrepancies exist between these figures however, and the level a homeowner could choose to reach could range from meeting the minimum requirements stipulated by the building code to a completely self-sufficient zero-energy house. These discrepancies create confusion because it becomes difficult to know which ‘target’ is feasible to achieve while still making a significant difference. Further, taking a whole-of-house approach means there are numerous ways a homeowner could achieve such a target. Again, clear definitions over the most effective way to achieve this target were not apparent when this research began¹⁹.

The *embedding effect* (see chapter 7, section 1.2.1) also suggests that a homeowner’s valuation of the more inclusive whole-of-house efficiency improvements would not be substantially different to the value given to each single innovation if valued on their own (Kahneman and Knetsch, 1992). As Richard Thaler showed through numerous experiments, because the brain engages in mental accounting shortcuts to speed up decisions and make

¹⁸ Note that this is the United Kingdom (UK) definition for ‘fuel poverty’. A New Zealand inter-agency working group is currently developing standards and definitions around what ‘fuel poverty’ (also known as ‘energy affordability’) constitutes in New Zealand.

¹⁹ Note that work has since progressed towards identifying the most appropriate upgrade path to achieve a practical yet effective energy level (Callau and Lloyd, 2008).

them more manageable, monetary amounts are often bundled together: subsequently, ‘a dollar is not always a dollar’ (Lehrer, 2009).

Given the above considerations, the decision was made to focus on specific innovations as opposed to overall whole-of-house energy targets and consumption. This also meant that preferences towards specific energy-efficiency innovations could be more accurately measured and controlled. That is, a whole-of-house approach would not distinguish if a homeowner values improved energy efficiency in general but has some reason against adopting a specific innovation to achieve this. For example, as discussed in chapter 3 (section 5.2), their house or household situation may not be compatible to the characteristics of the innovation.

1.3. Energy-Efficiency Innovations

Which innovations to measure presented a problem because in order to capture any *apparent disconnect* as it presently exists, innovations currently affected by a *disconnect* needed to be studied. That is, as discussed in chapter 2 (section 2.1), the adoption or diffusion of innovations is a continuous process – not a one-off event (Valente and Schuster, 2002).

Two criteria were therefore established that a technology must meet for it to be classified as energy-efficiency innovations affected by an *apparent disconnect*:

1. It has not been adopted by the early majority; but,
2. It is common within homeowners’ awareness and language.

From the perspective of the ‘adoption diffusion’ model, an innovation is believed to be on track to mainstream diffusion when it reaches the beginning of the early majority; the point at which it has passed across the chasm from the early adopters to the early majority (Moore, 1991). Using Rogers’ (2003) approximate representation of the size of the different adopter groups (see chapter 2, section 2.1), this can be defined as being when greater than 16% of the population (Innovators + Early Adopters) have adopted the innovation. An energy-efficiency innovation could therefore be defined as a technology that is present in less than 16% of houses. Any technology that has already penetrated the mainstream market could then be disregarded from this research. For example, space-heating heat pumps are one example of an energy-efficiency technology that has successfully crossed this

chasm into the mainstream market. These are now within the early majority with approximately 19% ($\pm 3\%$) of New Zealand houses as of 2007 having one (French, 2008). This number has only continued to rise with an increase in sales of 41% from the year 2007 to 2008 (average of 34% over the last 5 years) (EECA, 2009). Efficient lighting is another energy-efficiency technology starting to gain market share, now present in 30% of households (Page, 2008)²⁰.

The second part of the criteria for an innovation to be considered as affected by an *apparent disconnect*, was that while it has not been adopted, homeowners are aware of it and see benefit in it. Indications of awareness can then be compared to adoption statistics to establish whether they are logically connected or not. Awareness in this research was defined as the innovations most commonly mentioned. This is because the *availability heuristic* and the biases associated with it (see chapter 3, section 2.3) would indicate that those most commonly mentioned reflect homeowners or the markets most available beliefs (Ashcraft, 1998).

Selecting energy-efficiency innovations homeowners were most familiar with (if at least only in concept and not experience), also helped reduce any communication barrier that may otherwise undermine the results. As Humphreys (2008) illustrates, the effects from such a communication barrier will mean, “at best something is lost in translation and at worst quite the wrong impression is given.” Findings like McGee et al’s (2006) that show a discrepancy between what consumers say they think with what industry says consumers think, illustrate why it is necessary to prevent any bias that could be induced in the results because of a communication barrier. Further, forcing respondents to value a good they have little or no subjective experience with is believed to induce biases such as the *endowment effect* (Kahneman and Knetsch, 1992).

Space-heating (34%) and water-heating (29%) are the two most significant end-uses of energy in New Zealand households (Howden-Chapman et al, 2009; Isaacs, Camilleri, French, Pollard, Saville-Smith, Fraser and Rossouw, 2005; Isaacs et al, 2006; CCANZ and EECA, 2001). Innovations that improve performance in these two areas therefore represent important target areas for New Zealand households (Lloyd and Callau, 2006). Consequently, given the urgency to improve energy efficiency in New Zealand (see chapter 2, section 1) (New Zealand Government, 2007b), innovations that improve space- or water-heating

²⁰ See the BRANZ Materials Survey (2007) for further information.

performance were of greater priority to this research than other energy-efficiency innovations.

As alluded to in Chapter 2, for an idea or technology to be viewed as an innovation, it must be perceived to involve a change (Rogers, 2003). Innovations that necessitate a change in current behaviour are referred to as *discontinuous innovations* (Moore, 1991). From this perspective, systems that replace already existing ones (for example replacing an open fire with a heat pump or pellet burner) can not be considered 'true' innovations. However, this criterion can be considered questionable given that what counts as a change in behaviour is largely subjective. For example, to some homeowners, using thermal curtains may be a new behaviour, but to others, this action of opening and closing curtains may already be an existing habit.

The level of change required was therefore viewed as a better classification for this research. It was noted in chapter 3 (section 5.2) that large and more expensive changes are considered harder to make (Stern, 2000; Trotman, 2007). Innovations involving a large change in behaviour in terms of effort, habits or expenditure (for example retrofitting insulation or DG), would therefore be selected over those considered not as difficult (for example installing a low-flow shower head). Similar to the argument of choosing innovations with private benefits over those with public benefits (section 1.1), this decision was made on the basis that if innovations that are perceived to involve a larger change in behaviour can be understood, then the findings would be applicable to innovations where the change in behaviour is not considered as significant.

To summarise this section, energy-efficiency innovations affected by an *apparent disconnect* were defined as ones not present in at least 16% of houses despite homeowners showing an apparent knowledge and awareness of them. Of these, innovations viewed as more important to understand were those that involved a large change in behaviour and improved either space- or water-heating efficiency. However, as innovations are continuously being diffused into society, for the research to be representative of any *apparent disconnect*, it was necessary that these innovations were affected by an *apparent disconnect* when the research was being conducted. To identify such innovations, a preliminary study was necessary (see the following chapter 5).

2. Defining a Disconnect

To identify when and why a homeowner is showing an *apparent disconnect* towards the adoption of energy-efficiency innovations, criteria needed to be set that defined when behaviour was *disconnected* or not.

The *attitude-behaviour* and *energy-efficiency gaps* described in chapter 2 can be viewed as matters of consistency in that homeowner's behaviours are not consistent with his or her preferences or with economic behaviour. These gaps can also be viewed as non-rational behaviour in that homeowners are not doing what would appear to be objectively rational - from either an economic or a psychological perspective. Thus, two important criteria for when behaviour is *disconnected* are that it appears to be non-rational AND inconsistent with their beliefs²¹.

While rational behaviour is most commonly associated with economic rationality and *Homo-Economicus*, it has had many meanings over the years (Heukelom, 2006; Maital, 2004; Vatn, 2004). For example, when the concept first originated, rationality was associated with the use of logic (Lehrer, 2009). Over time, Daniel Bernoulli provided the idea of *expected-utility* to describe findings that showed the value of an item to be dependent on the individual's state of wealth rather than the objective financial gain (Heukelom, 2006; Kahneman, 2003). In the 1850's it then became associated with Gustave Fechner's stimulus-response paradigm. This resulted in the 'Benthamite' notion of hedonic utility, measured on a one-dimensional scale from hedonic pleasure seeking to pain avoidance (Heukelom, 2006; Loewenstein, 2007). Finally, because of Von Neumann and Morgenstern's influential work on game theory, the concept of economic rationality arose where it became described in purely monetary terms (Heukelom, 2006; Maital, 2004). At this same time, neoclassical economic theories of rational behaviour, in which it was assumed that people were perfectly rational and striving to optimise economic outcomes, were predominant (Leahey, 2003). During this period, utility was considered to be equivalent to 'energy' in physics (Nadeau, 2006) and a rational individual therefore became characterised as achieving satisfaction (utility) through the consumption of goods and services (Loewenstein, 2007). More recently, rationality has returned to its original associations with logic. Likewise, utility (subjective rationality) has returned to being a broader psychological conception. For example, the moral philosopher Hare takes into account our nature to discount the future in his definition

²¹ Note that 'rationality' and 'consistency' are already inextricably linked in that consistency is believed to be one condition for behaviour to be referred to as rational (Etzioni, 1986).

of rational behaviour, describing it as “what is preferred when our *present* preferences have been exposed to facts and logic (italics author’s own) (Hare, 1981)”. Further, the notion of *experience utility* appears to reflect the early Benthamite notion of utility as hedonic (Loewenstein, 2007; Loewenstein and Frederick, 1997), and *prospect theory* builds on Bernoulli’s view of utility (Heukelom, 2006; Kahneman, 2003). Some also view individual rationality as being socially constructed in that either the individual considers others (Loewenstein, 2007) or that it is a product of social processes (Vatn, 2004).

The purpose of this brief history was to show that there is little consensus over what defines rational behaviour (Etzioni, 1986). Even amongst recent behavioural economists a divide is apparent over what constitutes rational behaviour and how it should be conceptualised and measured (Heukelom, 2006). For example, while Thaler and Sunstein (2009) view humans as constantly making mistakes, Harford (2008) views all decisions as being rational. Furthermore, if asked, most homeowners would genuinely perceive their own actions to be rational (Rogers, 2003). This is the notion of *subjective rationality* as used by Herbert Simon to describe the observation that an individual can believe that their behaviour is rational even though it is ‘objectively’ wrong (Simon et al, 1992). He, Florkowski and Jordan (2002) further illustrate the complexity inherent in defining rational behaviour when apparently misunderstood responses are taken into account. That is, whether these responses should be viewed as irrational or subjectively rational is debatable when it is considered that responses are based on the individual’s perception of the situation. To side-step these debates, ‘rationality’ was used in this research in a broad sense (similar to Ariely (2008) and Harford (2008)) to describe the idea that homeowners will make the right decisions for themselves to achieve their objectives. ‘Rational behaviour’ was therefore defined as when a homeowner acts consistently with their preferences to either adopt or not adopt the energy-efficiency innovation.

Disconnected behaviour cannot be referred to as subjective rationality because of the consistency criteria for rationality (Carroll and Johnson, 1990; Elster, 1989; Etzioni, 1986; Maital, 2004). That is, given the numerous instances where homeowners say they value housing-sustainability, it would appear that they are not acting in accordance with their preferences – in either a subjective or objective sense.

For this *disconnect* to be a true problem it cannot be a ‘mistake’ or misunderstanding because rational behaviour is thought to be conscious and calculative (Etzioni, 1986). Concepts of building science and housing-sustainability are inherently complex and it could

simply be that the problem is still an issue of communication or information asymmetry for example. As discussed in chapter 3 (section 3.1), Simon (1957) referred to such instances where information was too complex and subsequently causing mistakes in reasoning, as situations of *bounded rationality* (Thaler and Sunstein, 2009). Therefore, to ensure that any observation of an *apparent disconnect* was not due to bounded rationality, it was important to distinguish cognitive errors from considered responses. One way to do this is by asking homeowners if they are aware of their responses. Thus an *apparent disconnect* is illustrated because it would seem that homeowners are aware of their decision to not act consistently with their beliefs – that is, to not maximize their preferences.

As highlighted through section 5 in chapter 3, it could be that a homeowner has a valid reason not to install the innovation in their house. For example, it might not be compatible with the construction of their house or it may not fit their current living situation. If it is found that homeowners demonstrate an *apparent disconnect* over a number of innovations however, it can be inferred that their *disconnected* behaviour is due to some ‘other factor’ and not due to the characteristics of a specific innovation. Because there may be rational reasons for such inconsistent responses (He et al, 2002), whether homeowners show an *apparent disconnect* towards a specific innovation (but not both), could have important implications about that innovation’s characteristics. However, such inconsistency in responses may also be due to a methodological error. The cause of inconsistent responses was beyond the scope of this thesis however.

Disconnected behaviour was therefore defined as when a homeowner gives an indication that they want the innovation but they do not adopt it. This can be referred to as a departure from rationality in that they are not acting consistently with their beliefs. Further, for this to be a robust phenomenon, homeowners must demonstrate that they are aware of the *disconnect* they show (that is, that their decision is not a ‘mistake’) and that it is not specific to only one innovation. This criteria was established as it is more understandable if homeowners are not adopting energy-efficiency innovations because they misunderstand or have incomplete information on some aspect (bounded rationality), or, because they have a valid reason for not adopting a specific innovation. However, if homeowners know that they are not making a ‘mistake’ and that it is not because of the characteristics of one particular innovation, then this behaviour becomes more of an anomaly.

To summarise this section, this research identified *disconnected* behaviour as:

- A departure from rational behaviour in that homeowners are not acting consistently with their beliefs;
- It cannot be described as a ‘mistake’ affected by bounded rationality or irrational behaviour because homeowners are aware of their decisions; and,
- That while homeowners are not acting consistently with their preferences, they are consistent in showing *disconnected* behaviour across different energy-efficiency innovations.

2.1. Target Group

The definition of *disconnected* behaviour as a departure from rationality also provided a way to identify the target group - homeowners demonstrating an *apparent disconnect*.

For effective communications, it is important to identify which homeowners show an *apparent disconnect* so that their unique motivations can be understood and targeted (Defra, 2008; Ereaut and Segnit, 2006; Futerra, 2005; McChesney et al, 2006). This process, of grouping people by similar needs and behaviours, is typically referred to within the marketing literature as ‘segmentation’ (Walker et al, 2003). It is now widely accepted that specific interventions targeted at specific groups or individuals are more successful than a ‘one-tactic applies to all’ approach (Crompton, 2008; Rogers, 2003; Swim et al, 2009).

Markets can be segmented in numerous ways (Walker et al, 2003). Commonly used approaches include psychological motivations (for example ‘values-modes analysis’), by traditional demographics or socio-economic criteria (American Environics, 2006; Crompton, 2008; Johnson et al, 2008; McChesney et al, 2006), by geographic descriptors (UMR and Consultus New Zealand, 2005), or, through behavioural descriptors by looking at how people behave towards an innovation (Walker et al, 2003). Pure approximation of likely population segments (Frame, 2004) may also be used in some cases. Many studies, such as the longitudinal ‘New Zealand Consumers Lifestyles Study’ (Lawson, Todd and Evans, 2006) and the environmental segmentation model of the United Kingdom’s population (Defra, 2008; NCC et al, 2006), use a mixture of these psychographic and behavioural indicators.

The ‘adoption diffusion’ model also represented one way to identify the different market segments based on differences in socioeconomic status, personality variables and

communication behaviour (Rogers, 2003). Using this framework to identify *disconnected* behaviour was considered unsuitable as it was unknown whether homeowners who showed an *apparent disconnect* also represented the early majority in adoption theory. Further, there appears to be no true way to identify these adoption groups other than by vaguely categorising them on the psychographic profiles that past diffusion research has established (Moore, 1991; Rogers, 2003). For example, Morrison (2006) applied these adoption categorisations to identify the different market segments within farmers' willingness to adopt an irrigation system. While he found some predictors of the adoption diffusion model to compare to the characteristics of the farmers he studied, he concluded that the appropriateness of using this 'adoption diffusion' model was more dependent on the characteristics of the innovation itself rather than the psychographic profiles of the adoption groups. This was because the innovation may not appeal to all adopter groups.

None of the above approaches were therefore considered more suitable than the previously mentioned segmentation approach that is specific to the problem this research was studying. That is, an *apparent disconnect* towards the adoption of energy-efficiency innovations. When investigating how homeowners engage with sustainability solutions, Trotman (2007) also developed a segmentation approach specific to her research question by segmenting New Zealand households on their reasons for renovating their homes. Therefore, the 'departure from rationality' approach was considered most appropriate as it was specific to energy-efficiency innovations and not limited by previously determined conceptions of segments within the market. That is, this segmented measure provided a way to group homeowners with similar reactions to investments in energy efficiency.

3. Research Objectives and Hypotheses

To summarise the material presented in this thesis so far, the overall objectives of this research were to:

1. **Understand the extent of any *apparent disconnect* towards the adoption of energy-efficiency innovations:**

Are homeowners demonstrating an *apparent disconnect* and how many show this?

2. **Understand whether *disconnected* behaviour is a robust and consistent phenomenon:**

Can it be replicated across different samples and innovations?

3. **Understand what factors may be influencing *disconnected* behaviour:**

Why are homeowners behaving this way?

More specifically, as the evidence reviewed in chapters 2, 3 and 4 has demonstrated, this research hypothesised that:

H1: A large proportion of New Zealand homeowners are showing an *apparent disconnect* towards the adoption of energy-efficiency innovations by not acting consistently with their beliefs or with an opportunity for individual benefit.

H2: *Disconnected* behaviour is a robust phenomenon in that it can be observed in two different samples and for two different energy-efficiency innovations.

H3: No single explanation or discipline can explain homeowners *apparent disconnect*.

These objectives and hypotheses were tested through two experimental studies as described in chapters 6, 7 and 8. Objectives and research questions specific to each study are described in the relevant chapter.

4. Chapter Conclusion

This chapter described an approach to focus this research in order to produce a robust picture and understanding of any *apparent disconnect*.

Disconnected behaviour was defined as when a homeowner gives an indication that they want the innovation but they do not adopt it. This was viewed as a departure from

rationality in that homeowners were not acting in accordance with their preferences. This definition was important as it provided a way to segment homeowners and identify those showing an *apparent disconnect* towards the adoption of energy-efficiency innovations.

Energy-efficiency improvements to residential housing were chosen as the particular actions of focus for this research. These were chosen on the basis that they have many private benefits to the homeowner. Therefore, in comparison to other sustainability behaviours where there is less opportunity for private benefit, a lack of adoption of these innovations becomes less understandable.

This chapter also identified that there was a need to study innovations currently affected by an *apparent disconnect* at the time of research. These were defined as being common within homeowners' awareness but not present within the early majority of households as suggested through Rogers' 'adoption diffusion' model. The following chapter presents a preliminary market analysis ('study 1') designed to identify such innovations. This preliminary study also aids the choice of research methods suitable to measure *disconnected* behaviour towards the adoption of energy-efficiency innovations.

Chapter 5. Study 1: Preliminary Market Analysis

“... and a whole lot of other delightful features including security system, centralised air-conditioning, kwila ceilings, double glazing and a great outlook.”

(Wellington Real Estate Advertisement, April 2008)

The previous chapters established that: 1 - surveys say homeowners value housing-sustainability; 2 - rational choice theory says they should adopt it; but 3 - the statistics say homeowners are not adopting it. Another way to establish the importance homeowners place on energy efficiency is through the market.

While energy-efficiency innovations are objectively private market goods, the evidence suggests that they are not valued through such openly traded markets. Further clarification of the market or non-market value placed on energy-efficient housing was therefore needed before a suitable research method could be chosen. This preliminary market analysis (referred to as 'study 1') presented a way to provide such direction.

Using an approach based on revealed preferences, an indication of the implied priority given to energy efficiency is gained through an analysis of real-estate advertisements. It is found that when there is an implied pressure to reduce the number of words in advertisements, references to energy-efficiency innovations are likely to be dropped.

Chapter 4 established the requirements for appropriate innovations to study. By looking to the market as a reflection of homeowners' awareness, the results from this study indicate that double glazing (DG) and solar water heating (SWH) panels are currently the most common innovations within the language of homeowners that also according to statistics, have not yet been adopted by the majority of households.

1. Objectives

The purpose of this study was to gather a preliminary understanding of the current market for energy-efficiency innovations without any influence that could result from experimental designs. In particular, the objectives were two-fold:

1. To understand whether energy-efficiency innovations are valued by the market through the implied priority they are given.
2. To identify energy-efficiency innovations suitable for further study in that they appear to be affected by an *apparent disconnect*.

The first objective was important to understand for a number of reasons as will be further highlighted in the following section. For example, if it is found that energy-efficiency innovations are not valued by the market then this not only provides more evidence that an

apparent disconnect exists, but it also suggests that an evaluation of the market alone will not demonstrate the oddities of why homeowners are apparently not adopting energy-efficiency innovations. If values for energy-efficiency innovations are not revealed through the market, then this suggests that there is some non-market characteristic or factor influencing their adoption. This finding would also have implications for the type of research techniques that can be employed to identify and understand the motivations behind an *apparent disconnect*. It is hypothesised that energy-efficiency innovations are not given priority in the market, indicating that there must be some non-market characteristic influencing their adoption.

As introduced in the previous chapter, the second objective of this study was to inform the development of the main research experiments by identifying which innovations were apparently affected by a *disconnect*. This was established by identifying innovations that are most common within homeowners' language but that have not yet been adopted by the majority.

2. Market Value

Existing markets are commonly used to determine the value of a good to people (Kahneman, Ritov, Jacowitz and Grant, 1993; Posavac, 2001). This is because as Seabrook (1991) points out, "the markets are [believed to be] the most reliable expression of what people want."

Goods and services traded in the market are referred to as 'market goods'. When traded in a free market economy, the price and number of sales they receive is a reflection of the value or utility the good provides to the people willing-to-pay for them (Harford, 2006). However, some goods (for example new, public, and most environmental goods) are not valued by the market in the traditional sense (Guagnano, 2001; Kahneman et al, 1993; Ritov and Kahneman, 1997). These are referred to as 'non-market goods' and this has implications as to how their value can be measured (Posavac, 2001). When non-market characteristics are present, it becomes difficult to identify the real reasons for people's purchasing decisions. For example, if energy-efficiency innovations are market goods, then the value they provide could be directly observed through market prices, and standard economic techniques could be used. However, if they are influenced by some non-market characteristic, then the truth about values, costs and benefits is not revealed through market transactions (Harford, 2006).

While energy-efficiency innovations are inherently private market goods, the evidence to date would suggest that they are not valued in the traditional market sense. For example, although based in Canada, Roberts (2007) found that two adjacent houses which are similar, except for one having sustainable features, are typically valued at the same price. The research described in chapter 3 (section 5.2) further suggests that the benefits not valued by the market, the non-energy benefits, are valued more than the actual monetary benefits (Stoecklein et al, 2005a; 2005b). There is an indication that this is changing however. For example, a study conducted in the United States found that property values increase by \$20-\$24 for every \$1 reduction in annual fuel bills (Nevin, Bender and Gazen, 1999). While upgrading to increase the value of a home has been found by Trotman (2007) to be a key driver for New Zealand homeowners to make changes to their home, overall, it appears that the real estate market does not currently value improved performance or 'invisible' improvements like insulation (Maher, 2008; Neilson, 2008). This results in investments in energy efficiency being viewed as an over-capitalising risk. This is understandable however because why would a 'rational' homeowner retrofit for energy performance when upgrades to the visual appeal of kitchens or bathrooms do present marketable benefits with a return on investment? This is reflected in the concern raised by the 'Vancouver Valuation Accord', that "there is currently no standard for determining the 'value of sustainability' (VVA, 2008)."

When taken in consideration with the positive views homeowners apparently show towards housing-sustainability (as illustrated in chapter 2, section 2.2), this lack of market value again suggests an *apparent disconnect*. Rating schemes, such as the 'Home Energy Rating Scheme' (HERS) recently implemented by EECA, are attempts at providing such an indication of value to overcome what currently appears to be a market *disconnect*. Evidence from overseas is that these are proving successful. For example, a study conducted in Australia showed a 2% increase in house value with each additional energy-rating star (Soriano, 2006). Canberra's mandatory disclosure energy-efficiency performance star rating system not only found the energy-performance rating to be the second most important influencer on buyers' decisions (behind location), but also that high performing houses achieved higher market prices with a good return on investment (Berry, Marker and Chevalier, 2008). Statistics from a Seattle home rating system support the Canberra findings showing a 5% added premium to sale prices and a cut in selling time by 25% (Neilson, 2008). Other statistics suggest an increase in property value by 8.9% and a reduced time to sell by 24% when energy-performance ratings are displayed (NBCSD, 2009).

While these statistics suggest a relationship between energy efficiency and house price may be establishing, the extent to which such improvements are valued by the market in New Zealand appears dubious. Therefore, a further analysis of the current market for energy-efficiency innovations was needed. As discussed before, this was important to establish as it had implications for whether an *apparent disconnect* can be understood through existing markets or whether a non-market technique was needed.

3. Method

As will be further illustrated in the following chapter 6 (section 1), a method was needed for this study that did not impose the limitations that asking people to state their preferences can have. For example, if people have a vested interest in a topic they will (rationally) exaggerate (Harford, 2008). Therefore, a way to gather this evidence without introducing bias from respondents was needed. Looking to the real-life context of the market was viewed as a way to gather such distilled perceptions.

3.1. Revealed Preferences

The joke presented at the beginning of chapter 2 illustrates the revealed preferences perspective which is based on the idea that real-world situations provide sources of information about our actions: “what you want is revealed by what you do, not by what you say (Economist.com, 2008).” Interpreting this joke from a revealed preferences perspective, the lack of inaction the first homeowner shows implies that if they had really wanted a solar water heating (SWH) panel, they would have already tried to buy one. The revealed preferences approach was chosen as a method for this study as it provided a way to understand the current market for energy efficiency without any experimental manipulations.

Revealed preferences theory was initiated by an economist named Paul Samuelson as a way to test theories of economic rationality (Varian, 2006). That is, the premise behind revealed preferences theory is that peoples’ preferences are revealed by the choices they make (Harford, 2006; LWA, 2005). For example, if a homeowner bought a non-efficient fridge when they also had the opportunity and money to buy an energy-efficient fridge, then this

would indicate that there is some characteristic of the non-efficient fridge that they value more.

Preferences can be revealed through numerous mediums. These include observational studies, analyses of sales trends or purchasing patterns, or through the prices consumers will pay. Traditionally, the revealed preferences approach involves identifying situations where people trade-off income or wealth against some risk or benefit (Chilton, Covey, Jones-Lee, Loomes and Metcalf, 2004). Due to the embedded nature of house prices or sale statistics (Harford, 2006), these were not appropriate sources of preference information. While house prices are great sources of information “of everything potential buyers think is likely to make them happy or miserable (Harford, 2008)”, they “contain embedded in them information about the value people place on all kinds of amenities: shops, greenery, low crime, quiet, the sun through the window in the morning and so on (Harford, 2006).” For example, while a house with energy-efficiency features may achieve a higher sale price than one without, other factors such as location or size may also be influencing this higher sale price. It would therefore be unwise to assume that any difference in cost was due to a ‘sustainability premium’, unless the two houses were identical in all other respects.

3.1.1. Implied Priority

Another method to study revealed preferences is through the messages communicated to the public. Mass communications are considered one of the most powerful manipulators of public opinion (NCC et al, 2006; Potter, Douglas and Selby-Neal, 2005). These mass communications, whether they are in the form of news media, product marketing or housing advertisements, not only influence our views of houses and how we think and behave in and towards them (Perkins, 1990; Perkins and Thoms, 2001) but also our perceptions of environmental images (Rapoport, 2001). One form of media particularly significant to the housing market is real estate advertising.

Real estate advertising can be considered to both cause and reflect homeowners’ preferences in that while they can establish new values, they can also re-iterate existing values and the meanings associated with housing (Perkins, 1989). Advertisements make statements that emphasise and maintain existing social norms and relations; at the same time that they function to sell a product, they also reinforce mythologies (Bell, 2004; Eyles, 1987). In this sense, housing advertisements not only influence what homeowners want, but they also can be viewed as a representation of what they, the market, is demanding

(Seabrook, 1991). Regardless however of the direction that housing advertisements function, either way they are expressions of the values placed by homeowners during buying decisions. The use of real estate advertising was therefore considered a suitable way to study the priority implicitly placed on energy-efficiency innovations.

The use of real estate advertisements relies on two assumptions however: that the role of the real estate agent is to interpret and be responsive to the housing market, and, that the priority placed on a particular good or service can be indicated by the level of media coverage it receives.

It is in a real estate agent's interest to portray features of a house that will attract the most buyers to ensure a quick and easy sale. That is, a real estate agent is more concerned about appealing to the largest majority than trying to go against the mainstream to encourage social change. In order to be a successful salesperson they therefore need to have a better sense of their local housing market than the buyers and sellers do (Levitt and Dubner, 2006; Gladwell, 2005). This *information asymmetry*, in that "experts use their informational advantage to serve their own agenda (Levitt and Dubner, 2006)", implies that real estate agents have a good understanding of the most important and common criteria that homeowners have when looking for a new home. While this information asymmetry may not be as pronounced as it used to be, due to increased availability of housing information to homeowners (Heyworth, 2008) and the increased scepticism homeowners have towards estate agents (Ball, 2002), it is still believed that what is advertised is an implicit reflection of potential buyers' priorities. As the 'Vancouver Valuation Accord' states, real estate agents primary responsibility is "to reflect market sentiment, in which value and sustainability may be at variance (VVA, 2007)."

This second assumption - that value is reflected through media attention - has been used in a similar vein before by Gavin (2007) who showed how public awareness of global warming could be indicated from the relative amount of media attention the environment received when ranked against other media topics such as national security. This study also found that media reporting of global warming in newspapers seemed to drive the salience of the environment to readers. Johnson, Hershey, Maszaros and Kunreuther (1993) also demonstrate how the level of media coverage can affect behaviour through the *salience and vividness bias* as discussed in chapter 3 (section 2.3). Given the *availability heuristic*, it is therefore inferred that more salient or frequent features indicate those most recently given priority.

Reviewing these findings, the assumption appears warranted that real estate advertisements both influence and reflect homeowners' current views towards energy-efficiency innovations. Looking to the real-life context of the market was therefore seen as a way to reveal distilled perceptions of the priority currently given to energy-efficiency innovations.

3.2. Study Design

This study did not use a typical revealed preferences approach in the sense that it was not studying what people buy but rather the priority implied through the words used to advertise housing. These descriptions can also contain embedded information however due to the number of characteristics that are often described. For this reason, a design was needed to compare whether energy efficiency was believed to be one of the more important characteristics when there was an implied pressure to prioritise what features to communicate.

To measure this implied pressure, two different mediums displaying the same advertisement were used. This decision was based on the assumption that different mediums will have different constraints in terms of the marketing space available to catch potential buyers' interests. Therefore, by comparing two versions of the same advertisement, identical in all other regards except for space restrictions, an indication of the perceived priority given to energy-efficiency features in the market is gained by whether these features are kept or dropped in the limited space version.

To ensure that advertisements containing references to energy-efficiency features were not significantly longer than 'typical' housing advertisements, a case-control design was used. The case group contained advertisements with 'energy-efficiency' features²² and the control comparison group was a random sample of 'typical' houses as represented by the market at the time of data collection.

Real estate can be advertised through a number of mediums. These range from magazines, billboards and other outdoor signage, to radio, television, direct mail, and internet and newspaper advertisements (Bayne, 2006; Open Polytechnic of New Zealand, 2007). The following criteria (developed from Open Polytechnic, 2007) were established to select the

²² Note that energy-efficiency 'features' is used here as opposed to 'innovations' because references to terms that could be used to describe energy efficiency were also included as well as actual technologies.

two most appropriate sources of real estate advertisements to study. These criteria were used so that the sample can be considered representative of the New Zealand housing market at the time of data collection:

- Contains advertisements from a selection of real estate agents;
- A reputable source that home buyers and sellers will refer to;
- Contains a representative selection of house types across different locations (for example not just 'sustainable' homes or mortgagee sales);
- Wide target audience and geographic exposure (for example, the target audience is not just developers or higher income brackets and advertises nationally).

From these criteria, the 'Property Press' and the 'Real Estate New Zealand' website (www.realestate.co.nz) were chosen as suitable sources based on the fact that: 1 - they contain advertisements from different agents; 2 - they contain a wide range of property types and values across different locations; and 3 - they have a wide readership and demographic audience²³. The Property Press is considered New Zealand's foremost property magazine published nationally with a weekly readership of 723,000²⁴. 'Realestate.co.nz' is the site of the Real Estate Institute of New Zealand (REINZ) and is considered New Zealand's official real estate website. At the time of data collection, 100% of licence holders were members of the REINZ²⁵, thus reducing any coverage bias from the sampling frame.

While there may be a number of other websites and booklets available, the 'Property Press' and 'Realestate.co.nz' were considered the largest and most comprehensive sources. It was believed that no new information would be collected from any other source than what would be gained from a sample from these two sources. Further, due to time and resource restrictions it was inefficient to sample from all possible sources. It was also believed that most buyers would look at this website and magazine (whether in addition to others or not) as they are the most salient. For example, Realestate.co.nz appears first when a web search for 'real estate' is conducted, and the 'Property Press' is easily found and freely accessible in most town centre streets where it is published. Further, at the time of data collection, the

²³ See Bayne (2006) for a further discussion on the benefits of real estate websites.

²⁴ Nielsen Media Research: September 2007. Retrieved May 27, 2009 from the World Wide Web: <http://www.acpmedia.co.nz/PropertyMagazines/PropertyPress/tabid/150/Default.aspx>

²⁵ Personal correspondence with Alison Lawson (Regional Manager, REINZ) on September 13, 2009

Property Press was the top real estate advertising source in New Zealand, representing 51% of the market²⁶.

This comparison between online and printed advertisements was based on the assumption that online advertisements allow sellers to give larger descriptions of their properties compared to the word and space limit that occurs for a printed advertisement. Selecting these two mediums therefore provided a way to test the first objective – the priority placed on energy-efficiency innovations. The hypothesis here was that when space is limited, characteristics viewed as less important would be dropped.

3.3. Data Collection

Two samples were taken: a case group of housing advertisements with ‘energy-efficiency’ features and a control group of ‘typical’ houses. The following regions were sampled as dictated by the distribution of the ‘Property Press’: Auckland, Bay of Plenty, Rotorua, Manawatu, Wellington, Canterbury, Otago, and the Central Otago Lakes District.

Sampling occurred from the 22nd of April to the 11th of July 2008. The website (realestate.co.nz) was used as the initial sampling frame to collect advertisements for analysis. The sample size for each region in the case group varied as some regions were found to have a higher frequency of advertisements with energy-efficiency features than others did. For example, 57 advertisements mentioning energy-efficiency features were found in Canterbury compared to only 13 in Otago. It was unknown whether this was a regional effect or whether it reflected a larger number of properties for sale in Canterbury or some other unknown factor.

Advertisements for the energy-efficiency sample were selected from a list of previously defined keywords. Some words not primarily associated with energy performance were also included (such as rain-water recycling) as were more descriptive words (such as eco-friendly and self-sufficient) to ensure a complete picture of the current market was gained. This list was not considered exhaustive and it was added to as additional terms appeared in the advertisements. The final list of key words can be viewed in table 2 (section 4.3).

²⁶ National Research Bureau (NRB). (2007). “NRB: Top 5 Sources of Information (2007)”. Located as an advertisement in the Property Press (North Shore, May 2, 2008)

As discussed in chapter 4 (section 1.3), innovations considered to already be in the early majority and gaining market share (for example 'heat pumps' and 'efficient lighting' (Page, 2008)), were not included. Many advertisements in the control sample were found to mention heat pumps, further supporting the statistics and the decision that heat-pumps were an unsuitable innovation to study.

The advertisements found under these searches were then subjectively screened. For example, in the electronic search the term 'double glazing' often returned 'double garaging', and 'thermal mass' often turned up 'thermal power' in the Rotorua/Taupo region.

A systematic linear quota sampling method was used to select the control group of 'typical' houses where the first 20 advertisements for each region that appeared on the screen were selected. This method was chosen as it was considered representative of what a potential homebuyer would see if they were searching without typing in any specific key words. Note that no screening was conducted on this control group because the intention was to get a random sample of 'typical' real-estate ads for comparison to the case group. Therefore, even if some of these control ads contained energy-efficiency features or keywords, they were kept in the sample as it needed to be representative of what is considered standard or 'typical' by the market. Note however, that only 4 houses (2%) in the control sample were found to mention energy-efficiency features. While this finding in itself could illustrate the lack of priority the market gives to energy efficiency, it must be tempered by the fact that the majority of New Zealand houses do not contain such features largely because they were built before any semi-reasonable standards were established (as discussed in chapter 2).

The print versions of these online advertisements were then located through a manual search of 'Property Press' magazines. Any advertisements that were found to appear both online and in physical (printed) form were then included in the final sample and analysed in terms of the content that was portrayed in the different media forms. Only 15% of all online advertisements were located in printed versions (13% of the energy-efficient sample and 20% of the control sample). This still gave a sample of 64 advertisements overall (33 'energy efficient' and 31 'typical'), sufficient to meet what is generally considered the minimum cell size (30) (Salkind, 2007). One reason observed for the inability to locate all online advertisements in the property press was because some agents had their own publications. While this inability to locate all online advertisements may have implications for the representativeness of the final sample, the fact that a similar number was found for the case and control groups reduced the impact that this bias may have had.

4. Results

4.1. An Implied Space Pressure

To identify the priority given to energy-efficiency innovations in the market, it was necessary to establish whether the online advertisements had significantly more words than their printed versions.

Paired samples t-test's, to test whether the numbers of words in the online and print versions were statistically different to each other, confirmed the initial criteria: online advertisements contain more information than their printed counterparts do. A significant difference was found for both the case ($t(32)=5.30, p<.01$) (Mean (M)=134 (*online*), $M=66$ (*print*)) and control group ($t(30)=2.80, p<.01$) ($M=77$ (*online*), $M=50$ (*print*)). A similar finding was also apparent for the number of images in the case ($t(32)=7.17, p<.01$) ($M=10$ (*online*), $M=2$ (*print*)) and the control group ($t(30)=6.61, p<.01$) ($M=7$ (*online*), $M=2$ (*print*)).

Online advertisements in the case sample were found to have on average 68 more words and 9 more photos compared to the hard-copy printed versions as demonstrated in table 1. Online advertisements in the control sample however only had on average 27 more words and 5 more photos than the printed versions.

Table 1: Sample Statistics

		Case Sample (Energy Efficiency) ($N=33$)	Control Sample (Typical) ($N=31$)
# Words Online	<i>M</i>	134.82	77.48
	<i>SD</i>	86.88	56.69
# Words Print	<i>M</i>	66.15	49.84
	<i>SD</i>	44.03	31.38
# Pictures Online	<i>M</i>	10.91	7.39
	<i>SD</i>	7.35	5.16
# Pictures Print	<i>M</i>	1.76	1.77
	<i>SD</i>	1.17	1.02

The assumption that space restrictions would be apparent in the printed form was proved demonstrating that there was an implied pressure to prioritise what is communicated in advertisements in the property press; that is, the printed versions. Further, the fact that the case group had significantly more words ($t(62)=3.10, p<.01$) and images ($t(57.5)=2.23, p<.05$) online than the control group, not only suggested that energy-efficiency features are 'added

extras' over-and-above the 'usual' features, but also that there is more implied pressure for the energy-efficiency advertisements to drop words.

4.2. An Implied Lack of Priority

It was hypothesised that if there was a pressure to reduce the number of words in an advertisement, then references to energy efficiency would be dropped.

It was found that energy-efficiency words were dropped by 49% of advertisements in the case sample when going from their online to print version. To see whether this was related to an implied space pressure through a reduced word limit, a new variable (*'likelihood to drop'*) was created. This variable categorised the difference in words between the online and print versions as being either above or below the sample average. So that the case and control groups were comparable, the mean difference of the overall sample (48.8 words) was used as the cut-point. Each advertisement was then coded as dropping either more words than the sample average (>48.8 words), or as dropping less words than the sample average (<48.8 words) when going from the online to print versions. As demonstrated in the previous section (section 4.1), the trend was for words to be dropped when going from the online to print version.

Non-parametric tests were found to be significant (Chi-square: $\chi^2(1, N=33)=6.86, p=.01$; Odds-ratio's (Mantel-Haenszel Common): $OR=7.20 \pm 95\% CI: 1.5-33.5$), demonstrating that advertisements that lose relatively more words than average favour removing energy-efficiency words by 7.2 times the odds of not removing the energy-efficiency words. Alternatively, the odds of a reference to energy efficiency being retained when the number of words is not reduced, is 7.2 times the odds of this reference not being retained when the number of words is not largely reduced (relative to the sample average). Note however that this second interpretation is against the trend, as the previous results demonstrated that it is rare for words to be retained when going from the online to print version.

Although the case group was found to have significantly more words online than the control group, these additional words were also more likely to be dropped. Compared to the control sample, an advertisement featuring an energy-efficiency word was 4.4 times more likely than the control sample to drop words ($\chi^2(1, N=64)=7.18, p=.01$; $OR=4.4 \pm 95\% CI: 1.44-13.6$). No significant difference between the case and control group was found for the number of words in the print version.

This lack of priority given to energy-efficiency features was also reflected in a UK survey (Green Building Press, 2007) that found ‘environmentally friendly’ features to be ranked seventh (out of ten) in overall priority. The only features that were less popular were ‘dressing room’, ‘fully wireless technology’ and ‘home gym’.

As the following quote from one real estate advertisement highlights, the findings presented in this and the previous section suggest that energy-efficiency features are not viewed as a priority but rather as an ‘extra feature’ in a property’s description. Consequently, when there is an implied pressure to reduce words, these features will be dropped.

“There are many extra features including double glazing throughout, wine cellar and economic solar heating.”

(Wellington Real Estate Advertisement, April 2008)

4.3. Innovations Affected by an Apparent Disconnect

To identify energy-efficiency innovations suitable for further study in that they appear to be affected by an *apparent disconnect*, a frequency count was performed to see which energy-efficiency innovations were most commonly mentioned. All online advertisements from the full case (energy efficiency) sample were analysed regardless of whether they were also found in the print form or not. Each feature was only counted once regardless of how many times it was mentioned within an advertisement.

‘Solar water heating’ (SWH) and ‘double glazing’ (DG) were most commonly mentioned, found in approximately 59% and 48% of the 278 advertisements studied. The next highest was ‘insulation’ at 10%. The following table demonstrates the results.

When comparing those advertisements that kept energy-efficiency features to those that dropped them, DG followed by SWH were found to be retained the most (kept in 82% and 69% of cases respectively). The descriptive term ‘eco-friendly’ (kept in 67% of cases) was next.

Table 2: Frequency Keywords Mentioned

Keyword	Frequency Count	Percentage
<i>energy efficiency</i>	10	3.6%
<i>energy</i>	0	0.0%
<i>environmental</i>	0	0.0%
<i>sustainable</i>	0	0.0%
<i>eco-friendly</i>	16	5.8%
<i>self-sufficient</i>	1	0.4%
<i>thermal mass</i>	3	1.1%
<i>passive</i>	22	7.9%
<i>solar</i>	0	0.0%
<i>healthy</i>	0	0.0%
<i>future-proofed</i>	5	1.8%
<i>double glazing</i>	133	47.8%
<i>solar water heating</i>	164	59.0%
<i>solar panels (PV)</i>	1	0.4%
<i>micro-generation (wind)</i>	3	1.1%
<i>insulation</i>	29	10.4%
<i>rain water recycling</i>	2	0.7%
<i>waste systems</i>	1	0.4%
<i>hot water heat pump</i>	1	0.4%
<i>chip or pellet burner</i>	3	1.1%
<i>wetback</i>	18	6.5%
<i>low VOC</i>	2	0.7%
<i>materials</i>	10	3.6%
<i>heat exchange system</i>	10	3.6%
<i>thermal heating</i>	6	0.0%

In support of the first requirement for an innovation to be classified as affected by a *disconnect*, the statistics demonstrate that DG and SWH are both not in the mainstream market as they are only installed in an estimated 4% (DG) and 1 - 2%²⁷ (SWH) of houses at present²⁸. The findings from this study suggest that DG and SWH also fulfil the second requirement in that they are more common within homeowners' awareness. Because they were most commonly mentioned, it could also be inferred that they are perceived to have a larger market potential than the other energy-efficiency terms mentioned. Further, DG and SWH are 'discontinuous innovations' that improve space-heating and water-heating performance; two important target areas for New Zealand households (as discussed in chapter 4, section 1.3). Taken together, these findings suggest that both DG and SWH are

²⁷ Source of figures: Palmer (2006) and personal correspondence with Roman Jacques at BRANZ Ltd (email November 11, 2008) and Verney Ryan at Beacon Pathway (email November 19, 2008)

²⁸ Note that these figures are largely educated guesses, as an exact record is currently not kept. Further, since this research began double glazing has now become mandatory in all new houses. Therefore, the % of new houses with double glazing can be expected to be close to 100%.

appropriate innovations to study as they are on the verge of penetrating the mainstream market. For example, they are more common than hot-water heat-pumps or photo-voltaic (PV) panels but not as common as space-heating heat-pumps. These two technologies therefore represent innovations suitable to study in order to capture any *apparent disconnect* as it presently exists.

The fact that the majority (approximately 92%) of words mentioned were all part of the ‘energy efficiency’ subset supported the decision to focus on the uptake of energy-efficiency innovations as opposed to innovations associated with other aspects of housing-sustainability such as water, waste, or materials. Ironically, no occurrences of the word ‘sustainable’ were found.

Regional differences were observed particularly between the two largest samples: the Auckland and Canterbury regions. While SWH was more commonly mentioned in advertisements from the Auckland region (12%) than it was in advertisements from the Canterbury region (6%), the opposite trend was found for DG being more common in Canterbury (8%) than Auckland (5%). Although not statistically quantified, this trend suggests that a technology effect by region could occur in the main experimental studies. For example, it could be that DG is considered a rational investment in the South Island particularly from a warmth perspective:

“Modern spaces kept cosy in winter by a heat pump and double glazing.”
(Canterbury Real Estate Advertisement, April 2008)

In comparison, the warmer Auckland climate could mean SWH is considered a more beneficial investment there, especially for heating pools:

“Keep an eye on the kids in the solar heated pool from the lounge or one of two secluded decks.”
(Auckland Real Estate Advertisement, May 2008)

5. Chapter Conclusion

While the value of a good is traditionally determined through the market and the prices it acquires, the evidence reviewed in this chapter suggests that there is a market *disconnect* in that homeowners stated preferences and the benefits of energy-efficiency investments are not accurately reflected in the market. However, as will be discussed in the following

chapter, the way homeowners' preferences are measured or reported can result in a misrepresentation of their true values.

The purpose of this study (study 1) was therefore to gather a preliminary understanding of the market context that New Zealand homeowners' behaviours exist within, without imposing the limitations that asking homeowners to state their preferences can have. Based on revealed preferences theory, real estate advertisements were chosen as a way to indicate the implied priority given to energy-efficiency innovations as they were believed to be a distilled representation of homeowners' preferences.

The premise was that if energy-efficient housing matters to homeowners, then the market (real estate agents) would reflect this. It was believed that such an analysis would reveal the current consensus for whether there is a market for energy-efficiency innovations. The results showed that when there was a need to prioritise words due to space restrictions, the tendency was for energy-efficiency features to be dropped from the description. In other words, they were not considered a priority.

This lack of implied priority also suggested that they are currently not valued as private market goods that can be traded in the market. Thus, this study further demonstrated that an evaluation of the market would not reveal the oddities of why a *disconnect* appears to be occurring. This finding suggests that energy-efficiency innovations are in an 'unusual' position at present in that the market does not appear to value them despite effectively being a private market good. This implies that a non-market technique needs to be used if an increased understanding of these unknown factors is to be made.

The results from this study also determined which innovations to use in the main experimental studies. These were identified to be double glazing (DG) and solar hot water heating (SWH) on the basis that they were the two most commonly mentioned innovations that according to statistics were not present in the early majority of homes. Using innovations that were commonly mentioned would also reduce the chance of a communication gap between 'expert' and 'lay-person'.

Informed by the findings from this preliminary study, the following chapter outlines the development of a non-market research approach designed to achieve the research objectives as outlined in chapter 4 (section 3).

Chapter 6. Method

“Quantitative methods of data collection must be successfully combined with more qualitative research methods, if we are to expand our understanding of the social and cultural influences on domestic energy consumption.”

(Crosbie, 2006)

This chapter outlines the development of a mixed methods research approach designed to achieve the research objectives and to overcome the limitations and systematic biases specific to each method.

In addition to the revealed preferences preliminary study described in the previous chapter ('study 1'), two other studies are introduced. The first is a survey designed to gather the mass quantitative data and identify *disconnected* behaviour utilising contingent valuation (CV) scenarios and the willingness-to-pay (WTP) tool as a non-market technique. This survey of homeowners is referred to as 'study 2'. The second is a qualitative application to this survey using the verbal report (VR) tool to uncover the thought processes respondents go through when considering whether to adopt the energy-efficiency innovations or not. These think-aloud interviews are referred to as 'study 3'.

These three methods were not only chosen so that the limitations inherent in each could be compensated by the others, but also because of their compatibility in that they were all based in a real or simulated market for household energy-efficiency. By having three separate studies this meant that an indication could be gained of how robust any *apparent disconnect* is.

1. Influences from Method

While Chapter 3 demonstrated the strong influence that individual and social psychological forces can have on our ability to think logically, the possibility also exists that the approaches used to elicit homeowners' beliefs may have unintended influences. The concern reflected here, as shared by Holland (2006) and LaPiere (1934), is that methodological weaknesses or flaws could be leading to an 'untrue' reflection of the extent of any *apparent disconnect* in reality²⁹. Even back in 1934 when LaPiere first documented the *attitude-behaviour gap*, he queried whether the use of surveys or questionnaires was the cause for this observed discrepancy. He suggested that while they were useful, they could also be extremely misleading. He instead thought that if social attitudes were to be conceptualised, then they should be "derived from a study of humans behaving in actual social situations. They must not be imputed on the basis of questionnaire data (LaPiere, 1934)".

²⁹ As each method has their own specific weaknesses and potential biases, only a general comment on the influence of method will be discussed in this section. Limitations specific to each method will be discussed in the relevant chapter.

The reliability of asking homeowners to describe their preferences is susceptible to many confounding factors. These include those of the task and context, socially desirable responding, and rationalisations of behaviour.

The main issue with experimental research is its hypothetical nature. The artificiality of answering a survey removes the contextual factors that may otherwise surround the reception of a message or decision problem in reality. This poses issues of generalisability to real-world contexts, especially as the extent and intensity to which emotion and reason occur is unknown and can largely not be simulated to the same degree in surveys. For example, one reason why the 'motivation to comply' variable in the 'Theory of Planned Behaviour' (TPB) has been found to lack explanatory power on the subjective norm (Ajzen, 1999), is that this model is often applied in highly experimental settings completely removed from the contextual factors that often influence how a message is received (Dutta-Bergman, 2005). That is, when answering a survey, participants are usually removed from their usual social settings and subsequently do not feel the same need to comply with what is 'socially approved'. The hypothetical nature of surveys also means that some participants may misunderstand the questions or not take them seriously. As such, these are often labelled (incorrectly) as irrational responses (He et al, 2002).

Another concern is the issue of *over-claim*, *socially desirable responding* or *yea-saying* (He et al, 2002). Commonly found in surveys and similar market research techniques, this bias occurs when people alter their answers in order to give a favourable impression, to please the researcher, or because they have a vested interest in the topic (Carroll and Johnson, 1990; Harford, 2008). This is particularly problematic when such 'over-exaggerated' responses are aggregated and taken as accurate representations of beliefs and behaviours (Holland, 2006). While responses may be influenced by such biases, as Loewenstein (2007) illustrates, behaviour is also influenced in real-world settings by normative beliefs. The issue though is that it is unclear whether the influence of these norms in both settings is similar or whether it is greater in either the experimental or the real-world setting. Again, this demonstrates the difficulty inherent in replicating reality and the extent that findings from experimental settings can be extrapolated to real-world contexts.

Rationalisations (or counterfactual reasoning) are a tool commonly used to either justify one's self-interest (Elster, 1989) or irrational impulses (Nadeau, 2006), or to minimise cognitive dissonance that may arise when one's actions do not match expectations or beliefs (Knetsch, 1997). The following quote, taken from course material used to train real estate

agents, illustrates this: “people buy on emotion and justify by logic (Open Polytechnic, 2007).” Examples of this occurring in research include the findings from a longitudinal pilot study (Christie, 2005), and the Zero and Low Energy Homes (ZALEH) project conducted by BRANZ (Stoecklein et al, 2005a; 2005b). Taken together these results showed a lack of clarity and confusion within responses. It appeared as though the responses participants gave were rationalisations for the decisions they had made to account for discrepancies between their actions and beliefs. This lack of clarity also suggested that homeowners were not consciously aware of what was actually influencing their decisions or belief systems. For example, while both these studies showed a tendency for homeowners to stay away from discussions about eco-friendly practices (preferring instead to leave such decisions up to their designer or builder), at the same time, these homeowners stated that their architects or designers really had little influence over what their final decisions would be. Instead, they said that personal influences, for example their experiences, lifestyle choices and preferences, were what influenced them the most. Another study conducted by Griskevicius, Cialdini and Goldstein (2008) in a New York subway station also illustrated this psychological point; that in general, people are poor at recognising why they behave as they do. Griskevicius et al (2008) found that passer-bys who saw another person give a donation to a busker, were eight times more likely to contribute also. While this finding not only demonstrates the power of situational biases (see chapter 3, section 2.3), the point to take at present is that not one passer-by attributed their decision to donate money to the real reason for their behaviour (that is, seeing someone else give money) when they were interviewed after. Findings like these suggest that responses given in surveys are likely to be a mixture of how respondents would like to think they would act, and, of rationalisations for decisions already made that were not based on reason.

Many of the commonly used scales to measure environmental behaviour (as discussed in chapter 3, section 1.1) (for example, NEP, EC, AC, FV, CERl and Roper) have been shown to suffer an inability to predict accurately environmental behaviours (Tarrant and Cordell, 1997). Some therefore believe that one explanation for the attitude-behaviour gap’s existence is that these scales measure attitudinal-factors on a very broad level compared to the more narrowly-targeted actions they are intended to correlate with (Kollmuss and Agyeman, 2002; Tarrant and Cordell, 1997). Further, specific beliefs as opposed to general beliefs are believed to be better predictors of behaviour (De Groot, 2008; Eagly and Kulesa, 1997; Tarrant and Cordell, 1997). Given that previous research has found no clear distinction between which scale is the most valid indicator of pro-environmental behaviour

(Tarrant and Cordell, 1997; Walton et al, 2004), it appears that all of these commonly-used scales suffer from these problems. It therefore seems fruitless to repeat the studies of previous researchers by using the same measures and finding the same discrepancies to self-reported behaviours.

The issues discussed in this section demonstrate that a different way of measuring homeowners' behaviours is needed, rather than direct attitude-behaviour questions, if an unbiased account of any *disconnected* behaviour is to be made.

2. Requirements for a Research Approach

The previous section and chapters demonstrated the numerous and varied requirements that need to be addressed if a true account of an *apparent disconnect* towards energy-efficiency innovations is to be made.

In particular, **chapter 3** highlighted some of the numerous factors or explanations that could provide a plausible account of any *disconnect*. It was not feasible to measure all of these factors in a single study; nor could they all be measured through traditional survey approaches. Subsequently, a research approach was needed that could measure as many factors as possible while also allowing any biases or influences not directly measured to 'come through' in participants' responses. This suggested the need for a quantitative and qualitative approach. Further, so that the cause of *disconnected* behaviour could be directly related to these influencing 'other factors', a method was needed that could simultaneously identify when a homeowner showed *disconnected* behaviour and what the reasons were for this behaviour.

Chapter 4 defined an *apparent disconnect* for the purposes of this research as a 'departure from rationality' in that homeowners are not acting consistently with their beliefs. Therefore, a method that could measure 'rational' behaviour was needed. It was also established in this chapter that for *disconnected* behaviour to be a robust phenomenon, then it must be shown to exist over different samples and across different energy-efficiency innovations. This indicated the need for multiple studies and scenarios in order to establish whether *disconnected* behaviour was simply an anomaly of a single measurement method or innovation.

Chapter 5 illustrated that energy-efficiency features do not appear to be valued in the traditional market sense at present despite having private monetary benefits. This complexity, over whether energy-efficiency innovations function as market or non-market goods, meant that an approach based on the market was unlikely to capture the unknown factors influencing homeowners' adoption rates. This suggested that a method outside of standard economic techniques was needed that could measure non-market values and translate these subjective values into a form that is objectively comparable.

Finally, the findings presented at the start of this chapter (**chapter 6**) suggested that a different and more robust way of measuring an *apparent disconnect* was needed as there was a chance that any observation of *disconnected* behaviour could be a reflection of the questioning process or methodology and not a true reflection of reality. Similar to chapter 3, this again suggested the need for multiple methods or studies as it was acknowledged that no one method was without its weaknesses. Further, given the evidence presented in chapter 3 that demonstrated how humans can be influenced by numerous cognitive biases and social influences, it seemed unwise to use a single approach to understand *disconnected* behaviour.

3. Mixed Methods Research Approach

One way to achieve these requirements was to take a mixed methods approach. This refers to a research design that 'brings together' different research techniques to address a single research problem (Teddlie and Tashakkori, 2003). Such an approach has the benefit of providing a stronger and more legitimate argument (Onwuegbuzie and Teddlie, 2003) as the different methods provide different insights and illustrate where results support or contradict each other (Teddlie and Tashakkori, 2003). Further, given that no two techniques have the same combination of limitations and strengths, taking a mixed methods approach meant that it was possible to select methods that compensated for where another fell short.

"In theory, mixed methods inquiry can be a means for exploring differences; a forum for dialogue; or an opportunity to better understand different ways of seeing, knowing, and valuing."

(Greene and Caracelli, 2003)

Such a mixed methods approach for studying energy-use in households was also supported by Crosbie (2006) who argued that “quantitative methods of data collection must be successfully combined with more qualitative research methods, if we are to expand our understanding of the social and cultural influences on domestic energy consumption.” When reviewing how well the characteristics of the adoption groups from Rogers’ (2003) ‘adoption diffusion’ model apply to other innovations, Morrison (2006) also concluded that when developing a marketing strategy, a mixture of quantitative and qualitative research to understand who the innovation appeals to was preferable to a single approach.

A concurrent strategy (as opposed to a sequential design) was used in that the studies were conducted simultaneously. While the methods were chosen in order to offset the limitations of one method against the strengths of another, the approach was not true ‘triangulation’ because studies 2 and 3 used the same survey instrument. That is, the criterion for independence was not met (Creswell, Plano Clark, Gutmann and Hanson, 2003). This approach may instead be interpreted as a ‘concurrent nested design’ (Creswell et al, 2003).

3.1. Study 2: Survey of Homeowners

As described in the previous chapter, study 1 highlighted that energy-efficiency innovations do not appear to be valued by the market at present. This lack of available data from actual markets suggested that a research method was needed that could assess *disconnected* behaviour (departures from rationality) through a non-market technique.

Numerous approaches can be used to translate subjective non-market values into a form that is objectively comparable. These include game theory techniques (Nadeau, 2006) and revealed preference (or indirect) techniques such as hedonic pricing, the production function and travel cost method (Bennett, 2003; LWA, 2005; Nadeau, 2006). In comparison to revealed preference techniques that can only measure the ‘use’ value a good provides, stated preference (or direct) techniques can measure both ‘use’ and ‘non-use’ value (LWA, 2005). Stated preference techniques include contingent valuation (CV), contingent ranking, trade-off games, conjoint analysis, and discrete choice modelling (Lusk, Nilsson and Foster, 2007; LWA, 2005; Nadeau, 2006).

Contingent valuation methodology (CVM) was considered most suited to meet the criteria for a non-market valuation technique to measure departures from rationality (as

summarised in section 2). Aside from being able to measure 'non-use' values, this method was considered more appropriate than a hedonic pricing approach for example because respondents do not already have to understand the value of the innovations (Vujcich, 2008). Hedonic pricing was further considered inappropriate given the high potential for confounding factors (Berry, Marker and Chevalier, 2008; Soriano, 2006). As discussed in chapter 4, this conscious departure from rationality was considered crucial as it identified homeowners who were aware of their unreasonable behaviour. The travel cost method was not appropriate in that there were no travel or visitation aspects for home energy-efficiency (Bennett, 2003). Compared to all revealed preferences techniques, CV was more able to capture non-market characteristics that may be influencing homeowners decisions (LWA, 2005). The numerous game-theory approaches (Nadeau, 2006) were also ruled out as energy-efficiency decisions at the individual household level were assumed to be independent of the amount other homeowners paid (with the exception of influences from social contexts). Compared to other stated preference techniques, CV allowed respondents to make a conscious and public departure from rationality, often referred to as a 'protest bid' or 'strategic bidding' (Awatere and Walton, 2005). Most importantly however, CV was thought to most closely reflect how energy-efficiency decisions would occur in a real market setting - that is, the act of purchasing or not purchasing the energy-efficiency innovation. This is in comparison to the other stated preference approaches where respondents indicate value by either ranking options or choosing between alternatives.

The basic idea behind CVM is that people are asked to indicate how much they value a certain outcome in monetary terms. This is done by asking them to specify the maximum amount they would be willing-to-pay (WTP) to obtain the outcome in a hypothetical market scenario with specified contingencies (that is, the conditions specified in the simulated market) (Guagnano, Dietz and Stern, 1994; Kahneman and Knetsch, 1992; LWA, 2005; Nadeau, 2006). CVM assumes that the act of placing a monetary amount on something will make people rationalise their thoughts and values (Vatn, 2004). Normally the costs and benefits involved in a decision are subjectively interpreted and it becomes hard to compare between different homeowners. Monetising is therefore seen as a common indicator through which values are rationalised and placed in a format that is universally and objectively comparable between different homeowners (Vatn, 2004).

This rational economic model of decision-making has been criticised in the past because of this emphasis on money and because people do not always behave in what could be

considered the most rationally advantageous way (as demonstrated in chapters 2 and 3). However, as this *apparent disconnect* appears to be a departure from rationality in a personal investment decision, the emphasis on rationality and money was not considered a limitation for this research. Given the consumer society and market economy the majority of homeowners are unavoidably familiar with, it was believed that most homeowners would be able to relate to this simulated market approach that utilises the concept of money. It is also now widely accepted that, fortunately or unfortunately, economic and environmental issues are inextricably linked (VVA, 2007). Further, as Harford (2006) states, whether it occurs consciously or not, “every individual choice you make implies that a valuation has been made”.

In many researchers’ work with CVM (for example Jones-Lee and Loomes, 2004; Vujcich, 2008), the responses provide an overall indication of monetary value. However, this WTP amount should not be taken as a true representation of the economic value or as data for policy decisions, but rather, as an expression of subjective preference (Kahneman et al, 1993; Sagoff, 1988; 2003). This is because what is actually being valued will vary between individuals, and the extent that these WTP values represent a use-, exchange- or sign-value for example, is largely unknown unless several follow-up questions are asked (Kahneman and Knetsch, 1992). For example, one homeowner may base a high proportion of their WTP value on the power savings they will achieve whilst another may place more value on having a reduced reliance on the national grid. Kahneman and colleagues (1991; 1992; 1993; 1999) also provide evidence that WTP values are a reflection of an individual’s attitudes rather than indications of economic preferences. Although Kahneman and Knetsch (1992) primarily believe these attitude expressions are reflections of moral satisfaction, they show how WTP values also correlate with other measures of attitudes such as ratings of importance and statements of political support (Kahneman et al, 1999). Given these findings (and the other anomalies of CVM discussed in chapter 7, section 1.2.1), the WTP measure was only used as a tool in this research to categorise and identify homeowners showing *disconnected* behaviour. Price was therefore used as an econometric measure to highlight whether there was resistance to energy-efficiency innovations and to permit an analysis of why resistance exists. The values respondents provide are not, and should not, be interpreted as an indication of what the energy-efficiency innovations should be priced at in the real-world market.

These attitudinal expressions can be measured through either the amount respondents are willing-to-pay (WTP) to obtain the innovation or willing-to-accept (WTA) to retain it. Issues arise however when WTP and WTA responses are compared, as WTA responses have been found to elicit higher valuations than WTP responses (Kahneman et al, 1991; Knetsch, 1997). This discrepancy led Richard Thaler to discover the *endowment effect* (Kahneman, 2003) as discussed in Chapter 3 (section 3.2). Despite Vujcich (2008) not finding a significant difference between WTP and WTA values for energy-efficient space-heating options, only WTP responses were assessed in this research as household energy-efficiency was viewed as a gain to homeowners that did not involve any tangible or objective loss. As the majority of New Zealand homeowners do not have the energy-efficiency innovations being valued, to ask respondents to imagine their home with these innovations and provide a valuation of their home without it (as a WTA approach would require), was considered unrealistic. This line of reasoning appears common amongst other researchers' choice of WTP over WTA (Knetsch, 1997).

WTP is traditionally measured through a survey format (Nadeau, 2006). This meant that the various influences (as discussed in chapter 3) that could be contributing to the cause of any *disconnect* could be measured at the same time. The fact that the WTP tool could be placed in a survey format in combination with these other measures also contributed towards the decision to use this approach. For example, if a game theory approach was used, the other variables could not have been measured at the same time necessitating another study and introducing further complexity and potential to compound error. A survey format was preferred over focus groups or citizen jury approaches so that respondents' answers were not affected by the additional situational bias of how others respond: as famously demonstrated by Solomon Asch and Muzafer Sherif (see Hogg and Reid, 2006; McKenzie-Mohr and Smith, 1999; Sherif, 1936; Thaler and Sunstein, 2009).

The CV scenarios, WTP questions, and the survey format used for study 2, are not without their weaknesses or limitations. For example, on its own, study 2 could not allow for an examination of bias induced through method, as the hypothetical nature of the survey posed issues of insight and generalisability. It was also impractical to measure all the factors that could be contributing to *disconnected* behaviour. This was because some were not feasible to measure given the survey format (for example the situational biases as discussed in chapter 3, section 2.6) and because it was unreasonable to expect respondents to answer a long survey. Given that a survey only elicits answers to the questions asked, this meant that

there was a high risk of missing factors that while not directly measured were actually responsible for respondents' answers. Therefore, a method was needed that could uncover the considerations respondents went through when forming their survey responses.

3.2. Study 3: Think-Aloud Interviews

Qualitative approaches provide a way to understand these 'why-type' questions: to understand how preferences were pursued, rather than just a report of the product. As Svedsater (2003) argues, without a qualitative examination, the nature of what is being elicited through responses and the psychological processes used to produce these responses remains unknown.

Few studies have conducted qualitative analyses of how people respond to WTP questions. Baker et al (2008) conducted a comprehensive literature review of qualitative research on WTP instruments. Their review revealed a need for further research in this field with only 39 instances of previous research found. The scope of this previous research was across a variety of contexts ranging from environmental studies, health and transport safety to agricultural economics. There were no reported instances of previous research relating to the built environment though there was one from a New Zealand context: Vadrjal and O'Connor (1994). Within these studies a variety of qualitative techniques were used: some used interviews or focus groups, while others used written responses (Baker et al, 2008).

Qualitative data collection methods include qualitative interviews, focus groups, open-ended written responses and process-tracing techniques. Compared to the other approaches, process-tracing methods provide a way to observe the thought processes underlying respondents' decisions (Carroll and Johnson, 1990). The most commonly used process-tracing method is the verbal report (VR) method (also referred to as a 'think-aloud' interview, 'verbal protocol', or 'cognitive testing') (Carroll and Johnson, 1990). This method asks respondents to verbalise their thoughts and considerations while making decisions. By doing this additional 'think-aloud' task, it is believed that respondents' short-term or working memory's are captured (Baker et al, 2008)³⁰. Therefore, in comparison to interview or focus-group approaches where the verbalisations occur retrospectively, this means that

³⁰ Note that VRs differ to introspection in that participants are not trained or required to be experts in the content area (Carroll and Johnson, 1990; Crutcher, 1994).

the mechanisms behind respondents' decisions have more opportunity to be 'captured' through the VR approach (Baker et al, 2008).

The decision to use this method was further motivated by the fact that it could be applied to the same survey instrument used in study 2. That is, the WTP tool, survey format, and VR tool were compatible with each other. This permitted the VR method to be used as a technique to delve directly into the motivations behind the responses elicited through study 2.

Qualitative approaches also have their limitations highlighting the benefit of the mixed methods approach. For example, while qualitative approaches provide depth and insight that is often not gathered from quantitative approaches such as surveys, they are also more time consuming and expensive to conduct (Crosbie, 2006). Survey based data collection methods have the benefit over qualitative studies in that they enable large amounts of data to be gathered more easily allowing for statistical generalisations. As such, it is often difficult to treat qualitative approaches as anything other than an insight into the motivations of a particular small group of people. Further, while the VR application can help understand participants' responses and the extent to which the task and context affect these, like study 2 it was based in an experimental context in that respondents were presented with a hypothetical scenario. One way to overcome the problems inherent with using an experimental setting is to examine behaviours as they occur in the market. This was how study 1 contributed to the mixed methods research approach.

3.3. Study 1: Preliminary Market Analysis

Study 1 contributed to the mixed methods approach as it added a 'real-world' perspective to the research. This method also revealed the 'true' values of the market that may have otherwise been wrongly interpreted if only data from stated preferences, for which reliability is often unknown, was relied on. As shown at the beginning of this chapter and throughout chapter 3, such stated preferences are susceptible to many influences and people are generally poor at recognising why they behave as they do (Griskevicius et al, 2008; Swim et al, 2009).

This approach, of using real-world data in conjunction with experimental data, has been used by others before. For example, Nevin et al (1999) compared their statistical results to real estate agents judgements "to demonstrate the 'real-world' validity of [their] research",

and Rapaport (2001) describes his use of newspapers as a way “to show that much data are outside the [typical] research literature”.

Revealed preference studies are great sources of unbiased and uninfluenced information. However, they too have limitations if the conclusions are interpreted on their own. For example, conclusions cannot be made about the benefits homeowners were actually interested in and why they valued them (Harford, 2006). For example, one homeowner might buy a house with a SWH panel because of the identity it could provide them whereas another might buy this same house because of the increased independence from power supply companies the SWH panel could provide them. The benefit of the mixed methods approach is again highlighted.

The embedded nature of the information sources used for this study also meant that it was hard to attribute a direct cause-and-effect relationship. This could be for a number of reasons. For example, while there was a tendency for energy-efficiency features to be dropped from the sale description when limited words were available, so too were other features (for example ‘a large workshop and garage’ or proximity to amenities). Further, unknown confounding variables, such as the seller’s income, could have been present. This may have affected the amount sellers were willing to spend on advertising space for example. Finally, the case and control groups could have been systematically different on some unknown measure such as household income or house value. For these reasons, the case-control method used can at best only suggest an association (Spitalnic, 2006).

While study 1 could have been improved to accommodate these limitations, (for example a hedonic regression approach similar to Berry et al (2008) could have also been used to account for other variables), this was considered beyond the essential requirements for this research: that is, to inform the appropriate choice of energy-efficiency innovations and research methods for the follow-up experimental studies. These limitations and opportunities for future research are discussed further in chapter 10 (section 2.3) however.

4. Chapter Conclusion

This chapter presented the requirements for a research approach to understand why New Zealand homeowners are not apparently adopting energy-efficiency innovations. The resulting mixed methods approach was designed with the intention that it could identify the

extent and nature of an *apparent disconnect* in a manner considered far more robust than if a single method or discipline had been used. It is acknowledged that it is not known whether this was the best possible way to do this research, but rather that it was a pragmatic approach to use in order to gain an understanding of why a *disconnect* is apparently occurring.

The research methods chosen included a revealed preferences analysis of the market ('study 1'), a quantitative survey employing CV scenarios and the WTP tool ('study 2'), and a verbal report (VR) application to provide a qualitative insight ('study 3'). These methods were chosen on their particular strengths that helped overcome where another study fell short.

The lack of priority given to energy-efficiency innovations in study 1 suggested that a non-market technique was needed if an increased understanding was to be made of why homeowners are not apparently adopting sustainability innovations. A review of available methods demonstrated an approach based on CVM most suitable to measure any *apparent disconnect* and thus to identify the target group of homeowners who show *disconnected* behaviour in that they are consistently aware of their departure from the baseline measure of rationality. Its compatibility with the survey format, the various psychological constructs that could be contributing towards an *apparent disconnect*, and the VR application used in study 3, made it the preferred choice.

The data provided through such a quantitative survey lacks depth in that it does not allow an understanding of how responses are produced. The nature of the thought processes respondents go through when making their decisions would therefore remain unknown if just a standard quantitative examination was undertaken. The verbal report (VR) method was thus chosen as a way to gather a more in-depth understanding of the considerations and thought processes motivating any *apparent disconnect*.

These three techniques were also chosen because while they assess an *apparent disconnect* in three different ways (in order to satisfy hypothesis H2), they still complement each other in that they use the same dialogue base of the market and monetary transactions as a way to understand the cause of any *apparent disconnect*. That is, the preliminary market analysis conducted in study 1 used the existing market to reveal current preferences for energy efficiency, as they exist, without any influence from experimental manipulations or potentially unreliable stated preferences. In contrast, study 2 uses simulated (hypothetical) markets in a survey format to measure the extent of any *apparent disconnect*. Finally, study

3 uses VR interviews as a way to enable a deeper more informed interpretation of why homeowners may be demonstrating an *apparent disconnect* within these simulated markets.

A detailed discussion of the two experimental studies follows. While these are presented separately in the following chapters, chapter 9 contains an overall consideration that ‘stitches’ together the results from the three individual studies to develop a more robust understanding of why New Zealand homeowners are showing an *apparent disconnect* towards the adoption of energy-efficiency innovations.

Chapter 7. Study 2: Survey of Homeowners

“Well you know basically I don’t want to have to pay anything for anything.”

(Research Participant: *Jimmy* #23)

The previous chapter demonstrated the need for a mixed methods research approach in order to address adequately the research objectives and hypotheses. Contingent Valuation Methodology (CVM) was identified as the first method suitable to use as a means to classify respondents. This was due to its characteristic ability to assess departures from what is understood to be rational (economic) behaviour in a way that is universally and objectively comparable between different homeowners.

This chapter reports the design and results of the first experimental study (referred to as 'study 2') that utilised this CVM within a larger survey document to segment the responding population and identify homeowners showing *disconnected* behaviour. This was achieved by presenting respondents with a simulated scenario (designed to reflect a real market setting) that they were expected to engage with by indicating their willingness-to-pay (WTP) for either DG or SWH. Homeowners displaying *disconnected* behaviour were identified as those who were consistent and aware of their decision to pay less than the full price.

The results from this study suggest that the motivations for this group of homeowners *disconnected* behaviour is not due to some demographic or technological factor such as income, power consumption or the length they were planning to stay before resale. In other words, these homeowners do not appear to have significantly different circumstances to homeowners who do not display *disconnected* behaviour. It is also found that this group of homeowners thought that most other homeowners were either 'just like them' (59%) in that they would also not be prepared to pay full price for the innovation, or, that they were 'worse' than them (33%) in that they would be WTP even less than they had.

1. Study 2: Survey of Homeowners

1.1. Survey Objectives

The purpose of this study was to identify whether homeowners are showing an *apparent disconnect* as per the criteria defined in chapter 4 (section 2). If homeowners did show *disconnected* behaviour, then this study sought to determine the extent (the percentage of homeowners who showed an *apparent disconnect*) and nature of this problem (why they were behaving this way).

The objectives of study 2 therefore were to:

1. Categorise respondents in an objectively comparable way in order to identify those engaging in apparently *disconnected* behaviour;
2. Identify what factors distinguish homeowners who show *disconnected* behaviour from those who do not.

This provided a way to test hypotheses H1 and H3 (see chapter 4, section 3) that:

H1: A large proportion of New Zealand homeowners are showing an *apparent disconnect* towards the adoption of energy-efficiency innovations by not acting consistently with their beliefs or with an opportunity for individual benefit.

H3: No single explanation or discipline can explain homeowners *apparent disconnect*.

1.2. Survey Design

As determined in chapter 6, CVM and the WTP tool were chosen as the most appropriate method to identify homeowners showing *disconnected* behaviour. Through this approach, both within- and between-subject responses were rationalised and placed in a format that was comparable (this was the process of ‘monetisation’ as discussed in Chapter 6). The WTP question was used to elicit the strength of homeowners’ attitudes towards the energy-efficiency innovations described in the CV scenario. A repeated measures design was used in order to satisfy the criteria that *disconnected* behaviour is not related to one specific innovation, and numerous technological, psychological and social variables were included to identify the motivations behind those engaging in behaviour revealing an *apparent disconnect*.

The following sections discuss the development of this survey design. A copy of the survey can be found in Appendix A.

1.2.1. Contingent Valuation Scenarios

The purpose of the CV scenarios and WTP questions was to measure departures from economic rationality. Where feasible, these scenarios were designed to control or measure the numerous biases thought by behavioural economists to occur on people’s decisions (see chapter 3, section 3).

As well as these cognitive biases, a number of potential weaknesses associated with CVM also needed to be controlled or compensated for. These have been well documented by previous researchers (for example Carson and Mitchell, 1993; Harrison, 1992; Jones-Lee and Loomes, 2004; Kahneman and Knetsch, 1992; Sagoff, 1988). The mistakes and insights from previous CV studies highlight the importance of properly setting up the contingent market that respondents are expected to engage in. Many of the biases mentioned in this section provide further evidence for why WTP values should not be taken as an overall indication of monetary value (as discussed in chapter 6, section 3.1). These potential biases and weaknesses are discussed alongside the development of the CV scenarios and follow-up questions.

The *embedding effect* is probably the most pervasive and commonly reported limitation found in WTP studies (Jones-Lee and Loomes, 2004). It describes the tendency for WTP responses to be similar regardless of whether the good is valued on its own or as part of a more inclusive category (Kahneman et al, 1993; Kahneman and Knetsch, 1992; Schkade and Payne, 1994). While there are numerous explanations for this anomaly (see Carson and Mitchell, 1993; Jones-Lee and Loomes, 2004; Kahneman and Knetsch, 1992; Kahneman et al, 1999; Schkade and Payne, 1994), the underlying fact is that WTP responses appear to be insensitive to the scope and scale of the good being provided (Carson and Mitchell, 1993). For example, an embedding effect would be said to occur if similar WTP responses were found for a retrofit involving just double glazing (DG) compared to one that included wall, ceiling and under-floor insulation as well as DG. As discussed in chapter 4 (section 1.2), this was one reason why single energy-efficiency innovations (as opposed to a package) were chosen for this research.

It was defined in chapter 4 (section 2 and hypothesis H2) that for *disconnected* behaviour to be a true and robust phenomenon, it must be demonstrated consistently across different energy-efficiency innovations. To test this, a repeated measures design was employed. If a respondent's answer was not consistent across the two innovations then this could imply that there was some characteristic of the innovation that they valued more over the other (for example visibility, convenience or suitability to their house), or that a methodological error or systematic bias occurred in their answering for example.

Study 1 (chapter 5) showed double glazing (DG) and solar water heating (SWH) to be the two most suitable energy-efficiency innovations to create CV scenarios around as they were, at the time of research, currently affected by an *apparent disconnect*. This was based on the

criteria that they were commonly mentioned energy-efficiency innovations but not present in the majority of households. That is, like heat pumps, they represent a language that is comprehensible to the majority of New Zealand homeowners, however, unlike heat pumps, DG and SWH have barely penetrated the market (Page, 2008).

Smith (2007) found that the reliability of a WTP value is improved in instances calling for a high WTP value. That is, because a significant proportion of the respondent's income must be compromised, they tend to take their responses more 'seriously'. The fact that both DG and SWH require a significant investment or compromise in income (ranging from \$2,500 to \$10,000), suggests that the WTP values this research elicited were relatively stable.

While DG and SWH both improve energy performance, they can also be considered different to each other in that:

- SWH is a 'visible' innovation and DG is an 'invisible' innovation. This may affect homeowners' decisions in that they may want a visible innovation as a way of making a statement or expressing an identity to others, or vice versa, they may not want to be associated with such an identity or not like the aesthetic appearance of SWH panels.
- SWH is associated with renewable energy and water-heating whereas DG is associated with an increased performance of the building fabric which is generally translated into better heat retention and noise protection. For example, some homeowners may already have a relatively efficient form of water-heating (for example, instant gas water-heating or an electric hot-water heat-pump). Alternatively, there may be features of their house which mean that one or both of the innovations are not appropriate. For example, stained glass (or leadlight) windows can not be double glazed without some impact on the visual aspect, and plumbing issues (compatibility) may arise for SWH.

The choice of two comparably different energy-efficiency innovations (DG and SWH) therefore meant that respondents whose *disconnected* behaviour was the result of one innovation's characteristics were more likely to be identified.

The order of the scenarios was reversed in each version to control for potential order effects. For example, Kahneman and Knetsch (1992) have shown how the value of the second good may be affected by the valuation given to the first good.

Various payment vehicles can be used as the response mechanism for WTP values. These include payment cards, bidding, dichotomous choice, random card-sorting procedures, taxation or rates, contribution to a public fund, out-of-own-pocket, higher prices, or a referendum, scale, or open-ended format. The type of payment vehicle used can impact the WTP valuation. For example, taxation or public fund payment vehicles tend to confuse respondents about the relationship between what they are WTP and the provision of the good (Baker et al, 2008). Chilton et al (2004) further found that because some respondents were sceptical of the taxation payment vehicle used, they were consequently unwilling-to-pay anything for the health benefits presented to them. This was because there was a lack of trust that the improvements would actually be delivered and a “feeling that existing taxes should be better used and/or redirected to address the problems.” It is recommended that the payment vehicle which best reflects how the good would be funded or bought in reality is the one that should be chosen (Baker et al, 2008). In relation to energy-efficiency innovations for private households, an open-ended out-of-own pocket approach was considered most suitable. This payment vehicle was also chosen over a referendum or payment card format as they have been shown to influence respondents’ answers by providing a guide or indication as to what they should be paying (Jones-Lee and Loomes, 2004). In other words, when using referendum-type approaches, responses appear to be affected by a *starting point bias* (see chapter 3, section 3.3). A study by Jim and Chen (2008) on park-users WTP for environmental improvements to public green-spaces further confirmed this decision to use an open-ended payment vehicle. They tested three different payment vehicles (tax, donation, and an entrance fee) and allowed respondents to choose which payment method they preferred. They found an open-ended ‘donation’ to be the most preferred payment option (49%), followed by a tax (29%) or entrance fee (22%).

The success of the CV approach relies on successfully simulating the hypothetical market respondents are expected to engage in. The importance of providing a credible market that respondents will take seriously, has been demonstrated by many (Carson and Mitchell, 1993; Svedsater, 2003; Posavac, 2001). For example, Svedsater (2003) found that when respondents were asked if they believed that their responses would be treated as binding agreements, a large proportion (approximately 70%) considered the situation hypothetical and believed that they would not actually have to pay for the amount they stated. Few even admitted that their stated WTP values might not represent a ‘true’ value (Svedsater, 2003). While Posavac (2001) demonstrated that the amount respondents provided was influenced by whether they knew if they actually had to pay their stated WTP price, he also found

respondents to demonstrate strategic answering or overbidding in order to influence the outcome. As Carroll and Johnson (1990) reinforce, while the quality of responses ultimately comes down to the attitude of the participant, 'experimental (and mundane) realism'³¹, presents one way to facilitate these 'right' attitudes.

The amount of information participants receive is another factor that needs to be considered as WTP values appear to be deeply influenced by this information (Sagoff, 1988). For example, too much information can enable more rational decision-making than would be expected in a realistic market situation as respondents will considerably weigh up the problem and solution (Sagoff, 1988). On the other hand, respondents have been found to reject scenarios that provide too little information because the payoffs and opportunity costs are unknown (Sagoff, 1988). Providing too little information may therefore be one reason why respondents enter protest bids or show an unwillingness to participate (Sagoff, 1988). These two approaches illustrate the inherent problem for CV scenarios: how to encourage respondents' to express their true preferences without deliberating decisions more than they would in reality.

With the above considerations in mind, it was concluded that the best approach to elicit true preferences would be to emulate the type and amount of information a homeowner would receive in reality. While largely subjective, it was assumed that homeowners would educate themselves and consider a sizeable amount of information given that this type of decision involves a large monetary investment. Participants were therefore presented with a scenario that described the benefits and disadvantages (in terms of the cost, maintenance requirements, and expected life) for each of the innovations that was intended to replicate the amount of information a homeowner would gather if they were serious about installing the innovation in reality. This information was based on realistic figures from the current market and building science literature.

Three levels of cost (\$-cost) and two levels of energy-savings (%-benefit) were used to test whether the cost or level of private benefit had an impact on homeowners' apparent behaviours. The highest cost (\$10,000) that a respondent could receive represented the typical cost to a homeowner if they were purchasing and installing DG themselves in the

³¹ 'Experimental Realism' refers to whether the experiment involves the participant and makes them take the experiment seriously. 'Mundane Realism' is when the experiment is similar to the real world (Cozby, 2001).

current market. Numerous sources³² were reviewed, and while there was some variation, the average cost for DG was found to be around \$363 per sqm (including new frames and installation costs at \$50 per sqm). Note that the cost to retrofit as opposed to the additional cost above installing single glazing was used. A glazing-to-wall ratio of approximately 20% (or 25m²) was assumed as per the average for existing houses (Isaacs et al, 2006). The average cost for SWH was found to be around \$7,000-\$8,000 including installation costs and a new hot water cylinder³³. Although the cost of SWH was cheaper than DG, the same three cost levels were used, as it was more important that the scenarios were comparable. This average cost (\$7,000) for SWH did inform the middle cost given in the survey versions however. The lowest cost (\$2,500) that an individual could receive was the expected true cost if economies of scale (bulk purchasing) were taken into account³⁴ as would happen if a government scheme, such as the one described in the CV scenario, was in place.

Savings to the power bill (%-savings) in the form of reduced space- or water-heating costs were given at either 10% or 20%. Like the costs, these figures were derived from various sources³⁵ which found averages around 22% for SWH and 7% for DG. These figures were rounded to the nearest 10% in order to make calculations easier for respondents.

A between-subjects design was employed which meant that there were 6 different versions of the survey as both the cost and benefit were kept constant. That is, while every respondent answered both CV scenarios (DG and SWH), they each only received one cost and benefit level. For example if the cost to install DG was \$7,000 with a 10% power bill benefit, then the same cost and benefit occurred for the SWH scenario. Table3 demonstrates these 6 versions.

Table 3: Description of Survey Versions

		Cost (\$-cost)		
		\$2,500	\$7,000	\$10,000
Benefit	10%	<i>Version 1</i>	<i>Version 2</i>	<i>Version 3</i>
(%-saving)	20%	<i>Version 4</i>	<i>Version 5</i>	<i>Version 6</i>

³² Sources included computer software packages (for example the 'HOMES' programme developed by Otago University), and personal correspondence with Ian Page, John Burgess (July 30, 2008), and Lisa French (August 4, 2008) at BRANZ Ltd, and Karl Rigalsford at Metro GlassTech (July 23, 2008).

³³ Sources included 'Solar Water Heating Guide' (2007) produced by the Consumer Institute and EECA, and personal correspondence with Adrian Kerr at Project Solar Ltd (June 23, 2008).

³⁴ Personal correspondence with Roger Hopkins (Principal Compliance and Monitoring Advisor), Housing New Zealand Corporation (HNZC)

³⁵ Sources included Consumer Institute, Energy Saving Trust (UK), EECA, and Adrian Kerr at Project Solar Ltd (June 23, 2008).

These variations were also used to identify the impact that psychological anchors (see chapter 3, section 3.3) may have on participants' valuations (Thaler and Sunstein, 2009) (as introduced above when discussing payment vehicles). That is, Loewenstein (2007) and Chilton et al (2004) demonstrate how respondents can be insensitive to the scope and scale by displaying an element of *coherent arbitrariness* in their responses to CV scenarios. While it has been found that these effects are more sensitive in a between-subjects design (as used in this research) as opposed to a within-subjects design (Kahneman et al, 1999; Loewenstein, 2007), Jones-Lee and Loomes (2004) have been unable to prevent such starting-point biases despite testing various approaches to minimise the impact of these. Instead of trying to eliminate this bias, it was decided that the best approach was a survey design that could illustrate whether this bias was occurring in participants' responses. That is, by providing different levels of cost.

The possibility of having randomised versions was also considered, however, because WTP values were not taken at face value, this problem was believed to be of lesser importance compared to the large number of versions and increased sample size that would otherwise be needed. This decision was supported given that *disconnected* behaviour and an assessment of consistency was adequately tested through simpler manipulations.

To summarise, this research varied the design of the CV scenarios in two ways:

1. Variations across scenarios (repeated measures within subjects)
2. Variations within scenarios (between subjects)

That is, the design of the CV aspect was a mixed design ANOVA (analysis of variance).

To gather an indication of respondents' prior knowledge of the innovations and how credible they thought the hypothetical contingent markets were, they were asked whether the cost and benefit presented to them seemed 'about right', 'too high', or 'too low'. As will be discussed in the following study (chapter 8), this question also provided an indication of how much homeowners *trust* the information 'experts' provide them.

To help ensure responses were realistic, typical expenditures were provided as a reminder of the budget constraints that would occur in reality. These included \$150 per week on food, \$135 per week on transport, and about \$100 per week on recreation and cultural activities (Statistics New Zealand, 2007). Other examples of typical household bills (for example internet and phone connections) were also given. Similar to Schkade and Payne (1994),

respondents were told to keep in mind their household income and budget(s), their monthly power bill(s), and the views of other household occupants when answering the survey.

Below is one example of the CV scenarios respondents received. This not only informed respondents of the financial benefit from reduced power savings they would receive, but it also informed them of the other benefits they would also receive (for example, reduced reliance of power companies, increased comfort, and reduced CO₂ emissions).

Double glazing can reduce space heating costs. This can result in savings to the power bill of 20% for a typical New Zealand house. Some people say that the benefits of double glazing include:

- Energy savings up to 2,290 kWh/year. This is equivalent to running 5½ spa pools for a year.
- Reductions in carbon dioxide (CO₂) emissions up to 850 kg CO₂/year. This is equivalent to a one-way flight from Auckland to Melbourne.
- Improved comfort and warmth
- Reduced noise levels
- Reduced condensation and dampness
- Increased security

The cost to retrofit double glazing for a typical NZ house is \$7,000 including the frame and all other costs (e.g. installation and finance costs). The expected lifetime of double glazing is around 25 years and they require no more maintenance than standard windows.

Suppose that it costs \$7,000 to get your house retrofitted with double glazing by a government scheme. There is no initial upfront cost to your household, but to help recover the costs the scheme would require you to contribute an amount of money each month (interest-free) towards having the double glazing in your home.

Figure 3: Example Contingent Valuation (CV) Scenario

In a similar approach to Awatere and Walton (2005), respondents were asked what their 'usual' monthly power bill was (averaged over winter and summer) and to calculate what a 10% or 20% saving on this would be (as per the version they received). The purpose of this was to ensure that they were aware of the benefit they were personally receiving from the energy-efficiency innovation. Respondents were then asked how much they were WTP to have the innovation installed in their house (note that they were told how much it would actually cost as per the version they received). To ensure that respondents could 'see' the direct comparison to the financial benefit they were getting through their power savings per month, respondents were asked to state this WTP amount as a per monthly amount (as opposed to an overall WTP amount). If a homeowner gave a higher WTP amount than the

amount they were saving in power, then they were effectively giving back the benefit they received in power consumption to attain the other benefits of the innovation. However, if a homeowner gave a WTP value that was lower than the financial benefit they would receive, then it was assumed that the contingency was taken and they were showing unreasonable behaviour (or a 'proper protest' or 'strategic bidding' as Awatere and Walton (2005) describe). That is, they wanted the benefits the innovation provided but they were not WTP for them.

Further, as Awatere and Walton (2005) state, "a prerequisite for a strategic bid, as opposed to an emotive rejection of the method itself, is recognition of a benefit that is rejected." This was achieved by asking respondents whether they realised that the amount they were WTP was about the same, more, or less than what it was going to cost to have the innovation installed in their home so that they could receive all of the combined benefits. By asking respondents to first calculate the benefit they were receiving and to demonstrate that they understood how much they were WTP in relation to the installation cost and their savings, it meant that the arguments that respondents do not realise the private gains they are receiving or that they are influenced by *bounded rationality*, could be ruled out.

These manipulations to the CV scenarios, in terms of ensuring respondents clearly understood the benefits they were getting, checking whether they found the characteristics described in the scenario plausible, and whether they answered the questions in a meaningful manner (that is, were aware), were also recommended by Carson and Mitchell (1993) as a way to ensure valid CV responses.

Inconsistencies over time were noted in chapter 3 (section 3.4) as likely reasons for why homeowners are not adopting energy-efficiency innovations. To estimate the influence that time had on homeowners' decisions, respondents were asked how long they would be WTP their monthly stated amount. The CV scenario was also designed so that many of the issues that may cause time biases were removed. That is, respondents were told that repayments were interest-free and that they would receive the benefits straight away for no upfront cost, thus removing the effects from delayed gratification.

Disconnected behaviour was therefore demonstrated by homeowners who were not WTP the full amount for the energy-efficiency innovations but who consistently showed across both CV scenarios (DG and SWH) that they realised and wanted the benefits of the innovations. To understand the reasoning behind these homeowners' *disconnected*

behaviour (as per objective 3, hypothesis H3), numerous variables to measure psychological, demographic, social psychological and contextual influences were included in the survey instrument alongside the CV scenarios.

1.2.2. Potential Influences on Behaviour

Chapter 3 listed numerous factors that could be influencing *disconnected* behaviour. These ranged from value orientations and demographic characteristics, to social comparisons and the physical characteristics of the innovation or household. Table 4 summarises the factors that were measured in this study. A description of the questions designed to measure these follows. Note that not all factors considered as plausible explanations for *disconnected* behaviour were measured in this study due to limitations of the survey format and length. Behavioural economic factors are also not discussed here as many were measured indirectly through the design of the CV scenarios (as discussed in the previous section).

Table 4: Potential Influences on Behaviour Measured in Study 2

Individual Psychological Factors	Demographics	Social Psychological Factors	Characteristics of the Innovation	Contextual Characteristics
<i>attitudinal factors</i>	<i>age</i> <i>gender</i>	<i>social identities (green identity)</i>	<i>co-benefits</i> <i>resale value</i>	<i>personal capabilities</i> <i>habits</i>
<i>value orientations</i>	<i>ethnicity</i> <i>household income</i>	<i>social comparisons (other-self)</i>		<i>characteristics of the household and dwelling</i>
<i>moral norms</i> <i>moral satisfaction</i>	<i>life-stage</i> <i>living situation</i>	<i>behavioural control (futility and fatality)</i>		

1.2.2.1. Individual Psychological Factors

An attitude inventory was included that contained a series of statements relating to *moral norms* and *value orientations* at both the personal and national level. For example, “I feel a moral obligation to reduce the amount of energy my household uses”, and, “All household should be taking steps to reduce their energy consumption”. Respondents were asked to indicate the level that they agreed or disagreed with each of these statements on a 5-point

likert scale ranging from 1-‘strongly disagree’ to 5-‘strongly agree’. In order to prevent response-set answering³⁶, 8 of the total 21 questions in this inventory were reverse scored.

Attitudinal factors in terms of *environmental citizenship* (“I am not interested in signing petitions on an environmental issue”) and the role of *government* or *policy support* (“The government does not have a responsibility to prevent unnecessary energy use from houses”) were also assessed within this inventory. An overall (11-point) scale relating to *environmental concern* was included in the survey to provide a general indication of respondents’ general level of concern towards environmental issues. As discussed in chapter 6 (section 1), some research would suggest that specific beliefs as opposed to general beliefs are better predictors of behaviour (De Groot, 2008; Kollmuss and Agyeman, 2002). As the previous 21 attitudinal and moral statements in the attitude inventory were considered specific, both scopes (broad and specific) were therefore measured in this survey.

To assess whether *moral satisfaction* (as hypothesised by Kahneman and Knetsch (1992)) was prevalent and whether the provision of energy is considered a public good, two additional CV scenarios (other than those described in section 1.2.1) were included. These two scenarios enquired about the level of support respondents would provide to power companies to: 1 - switch to a renewable energy source (such as hydro-electric) from thermal generation, and 2 - restore habitats of New Zealand’s endangered species damaged from the construction of this hydro-electric dam. A different payment vehicle was used for these scenarios as an indirect way to assess perceptions of *trust* towards power companies. That is, instead of the out-of-own pocket approach used in the two private CV scenarios (DG and SWH), the payment method for these two public CV scenarios was through respondents’ power bill to the power company implementing the changes.

1.2.2.2. Demographics

Demographic information collected included *age, gender, ethnicity, household income, life-stage* and *living situation*.

³⁶ ‘Response-set’ answering refers to the “tendency for a respondent to answer a series of questions in a certain direction regardless of their content”. Definition retrieved February 2, 2010 from the World Wide Web: <http://knowledge-base.supersurvey.com/glossary.htm>

1.2.2.3. Social Psychological Factors

It was noted in chapter 3 (section 2) that expressions of membership or social comparisons could influence homeowners' decisions to adopt energy-efficiency innovations. The most common ways social comparisons are measured is through subjective norms, social or sociometric network techniques, or self-other and other-self comparisons.

Subjective norms measure the effect of social comparisons by enquiring about the normative beliefs a person holds about how they think others would like them to behave (Ajzen, 1971; Francis et al, 2004; Valente and Schuster, 2002). This method has attracted criticism however as it is prone to the *projection bias* - where respondents project their beliefs on to others (Valente and Schuster, 2002) (see chapter 3, section 3.4).

The social network and sociometric network techniques were two approaches developed to overcome the projection bias. The social network technique works by asking respondents to name people they discuss personal matters with and whether these people practice the behaviour, would approve of the behaviour, and whether they have talked about that behaviour with them before (Valente and Schuster, 2002). In comparison, the sociometric network method links an individual to a map of their surrounding community to see how many people in their network practice the behaviour (Valente and Schuster, 2002). While these two approaches provide a detailed picture of which friends and relatives may influence an individual's behaviour, the social network technique is still subject to a degree of projection bias (Valente and Schuster, 2002) and the sociometric network method is time consuming as data has to be collected from all community members (Valente and Schuster, 2002).

Self-other and other-self comparisons provide two other ways to measure the effect of social comparisons. While self-other comparisons require the individual to rate themselves compared to others, other-self comparisons require the individual to rate typical others in comparison to themselves (Eiser, Pahl and Prins, 2001). Because of this slight difference, other-self comparisons are typically regarded as the more robust measurement as they are more likely to elicit a comparison to the normative standard and get respondents to explicitly consider how others might think and behave (Eiser et al, 2001). This is in comparison to a self-other focus which tends to produce unrealistic optimism and self-serving biases (Eiser et al, 2001). For example, when using a self-other approach to assess driving speed, Walton and Bathurst (1998) found a *self-enhancement bias* (or 'negative other' bias) where drivers showed a negative perception of others (rather than a 'positive

self' bias). The *availability heuristic* is suggested as an explanation for why this bias occurs, as 'bad' drivers are probably more salient and easier to recall than 'good' drivers are (Walton and Bathurst, 1998).

Other-self comparisons were therefore viewed as the more robust approach to measure social comparisons that was also compatible with the survey format and CV scenarios. A series of other-self questions were included in the survey: for example, "Do you think an average or typical New Zealand household would be WTP the same, more or less than you?" The amount of effort respondents feel they make to reduce their household's energy use compared to this 'average-other' homeowner was also asked. The purpose of these other-self questions was to see whether respondents think they are 'different' for some reason. These questions also allowed respondents either to be openly irrational (through indicating that they know they are doing something that most other homeowners would not) or to use this question as a 'justification' for their behaviour (that is, because everyone else is).

One of the issues with other-self comparisons is that it is unknown what this 'average-other' represents to different individuals: "The average other can create a source of ambiguity in the social comparison process because the average other person is an abstract concept (Spittal, 2003)." It is also acknowledged that the subjective and dynamic nature of social comparisons means that these perceptions of the 'average-other' will always be changing (Walton and Bathurst, 1998). To help prevent these problems, participants were given a detailed description of the key characteristics of this 'average-other' so that it could be presumed that the same comparison base was used by all respondents. For the purposes of this research, a typical New Zealand house was represented as a 3-bedroom (Bates and Kane, 2005) stand-alone dwelling with a floor area around 120m²-130m² and approximately 20% of its total wall area (about 20-30m²) in windows or glazing (Isaacs et al, 2006). This house would have approximately three occupants and an average household power bill (over summer and winter) of \$200 per month (\$2,400 per year) as described in chapter 2 (section 1) (Isaacs et al, 2006). Findings from the 'BRANZ House Condition Survey' and 'HEEP' study indicated that this house would be timber frame construction with a weatherboard or brick veneer cladding and either a corrugated iron or a steel roof (Clark et al, 2005; French et al, 2008).

Respondents' perceptions of *green identities* were included within the attitude inventory: For example, "I like to be associated with being 'green'", and "'Greenies' are unusual people".

Two scales relating to *perceived behavioural control* at the social level were also included within the attitude inventory: *futility* (“There is no point in making changes to reduce my household energy use because the rest of the population will not change their behaviour”) and *fatalism* (“It is too late to rectify the damage we have done to the environment”). The purpose of these questions was to test the extent that homeowners are optimistic and believe their individual actions can collectively make a difference.

1.2.2.4. Characteristics of the Innovation

Whether the *characteristics of the innovation* had an influence on respondents’ decisions was measured through the CV scenarios and repeated measures design described in section 1.2.1. However, another item was also included separate to these scenarios to assess the differing degrees of value placed on the *co-benefits* (or non-energy benefits). This was done by asking respondents to divide \$100 (100%) between the various benefits of each innovation depending on how they and other household members would value them.

To test whether homeowners subjectively perceive energy-efficiency investments as having market value in comparison to what the analysis of the market in study 1 indicated (chapter 5), respondents were asked whether they thought the installation of DG or SWH would increase the *resale price* of their house. To analyse this and to provide a reminder so that answers were realistic, respondents were first asked to give an indication of the current expected sale price for their house. *House value* could also be related to WTP valuations. For example, houses that are more expensive may be larger and have greater potential to save from efficiency gains, or, these homeowners may be higher income earners with a larger proportion of spare income to make the changes.

1.2.2.5. Contextual Factors

Personal capabilities were assessed given that they have been shown to either facilitate or constrain pro-environmental action (see chapter 3, section 5.2). These included respondents perceived ability to change their *habits* (for example “Changing my habits around the house is difficult”), the level of personal pressure they feel to reduce their household’s energy use, and the amount and type of *previous experience* (and hence knowledge) they had for sustainable or energy-efficient housing. In addition, respondents were asked whether any of their previous or current houses had DG or SWH. These questions functioned not only as screening questions but also to see if direct experience influenced subsequent decisions.

Numerous *characteristics of the dwelling and household* were enquired about. These included their monthly power consumption, the number usually resident, the area of glazing in their house, whether insulation was installed, and whether they already had some other form of efficient space- or water-heating. As a check on the sample selection (see the following section 1.3), tenure, region and the approximate population size of their location (for example rural versus city) were enquired about. Similar to respondents life-stage, the tenure of their house (whether it was owned with a mortgage or not) could also indicate the amount of disposable income homeowners have available to make such improvements.

Whether respondents thought there was some aspect of their situation that influenced their ability or suitability to adopt energy-efficiency innovations was also assessed. These included whether they perceived their household to have 'extra-ordinary' heating or energy requirements (such as a baby, sick, or elderly person) and whether they had recently (within the last 12 months) spent a large sum of money (>\$500) to improve the energy performance of their house.

The length of time respondents were planning to stay in their current house was also asked. For example, it could be that respondents were only WTP for 3 years (36 months) as they plan to move after that time.

1.3. Sample Design

1.3.1. Sample Population

The target population were homeowners living in suburban housing areas traditionally characterised by detached houses on privately owned sections; that is, the majority (81.3%) of New Zealand dwellings (Bates and Kane, 2005; Karlik-Neale, 2008). Low and high densities (such as farms and apartments) were not sampled on the basis that they have different needs and priorities influencing their housing decisions. For example, rural housing might not have access to the electricity grid and may be more vulnerable to power cuts. From the other perspective, apartments generally do not have as much heat loss per sqm of floor compared to stand-alone houses, and what an individual apartment owner can do is often restricted by the 'body-corporate'³⁷.

Owner-occupiers were the intended audience. Homeowners were preferred over tenants as they are more likely to be aware of the characteristics of their home, to live there for longer, and have a stronger financial interest and commitment to their homes. These differences were demonstrated by Holland (2006) who subsequently suggested that tenants, landlords and homeowners would differ on their opinions to sustainability. Further, owner-occupiers represent the majority (67%) of all New Zealand houses (Statistics New Zealand, 2006a). This figure ranges from 64% in the Auckland Region to 70% in the Canterbury Region.

The survey targeted the primary homeowner who usually pays the power bills. This was asked on the front of the survey. The reason for this decision was that in order to gather meaningful responses, the respondent needed to be familiar with the concepts discussed - that is, their power bills, household finances and energy use. Svedsater (2003) highlights the importance of this through the example of how a discussion about the European Monetary Union with someone who is not familiar with the Western concept of money-use would be meaningless.

Study 1 suggested that a technology effect by region could occur as a trend was found that suggested that SWH was more common in Auckland and that DG was more common in Canterbury (see chapter 5, section 4.3). Further, while the HEEP study found total energy

³⁷ The term 'body-corporate' refers to a group (usually the property owners) "created to manage common ownership of property (Consumer Affairs Victoria)". Definition retrieved January 31, 2010 from the World Wide Web:
[http://www.consumer.vic.gov.au/CA256902000FE154/Lookup/CAV_Publications_Building_Renovation/\\$file/bodycorpinfo.pdf](http://www.consumer.vic.gov.au/CA256902000FE154/Lookup/CAV_Publications_Building_Renovation/$file/bodycorpinfo.pdf)

and electricity use to vary little by region, the type of end-uses and per occupant energy use were found to differ (Isaacs et al, 2006). To test or control for this, two samples were used: one from the South Island (Canterbury Region) and the other from the North Island (Auckland Region). These two regions were selected on no special grounds other than that they were two large urban settlements in New Zealand that were geographically and climatically dissimilar. While it is recognised that a sample of two regions could not provide a nationally representative sample generalisable to the wider population, comparison with the '2006 Census' (see section 2.2 below) shows the responding sample to be similar to the national population. Despite this, the extension to a wider and more diverse sample presents an opportunity for future research.

1.3.2. Sample Size

The sample size was driven by the survey and sample design (6 versions x 2 regions). The minimum cell size required for meaningful averages and other descriptive statistics is generally considered to be 30 (Salkind, 2007). Due to the large number of variables that could influence the economic WTP measure in this survey, a high chance for odd outliers that would need to be either discarded or analysed separately was presumed. To allow for this, the number mailed out was increased to 50 responses per cell. This meant that for each of the 6 possible versions, 100 surveys were posted to each region (50 with DG scenario first and 50 with SWH scenario first to control for order effects). This resulted in a total sample size of 1,200.

1.3.3. Sample Selection

A 4-stage cluster design sampling process (simple random sample without replacement) was used. This was similar to what other studies in the building industry have used (for example the HEEP study conducted by BRANZ (Stoecklein, Pollard, Camilleri, Amitrano, Isaacs, Pool and Clark, 2001)).

The sample was selected as follows:

1. Dwelling density was first controlled for in order to get the target population of detached suburban housing. Using 'Visual Census'³⁸ data (Statistics New Zealand,

³⁸ 'Visual Census' is an interface package that contains information about the 'meshblocks' taken from the '2006 Census'. This contains aggregate data about the New Zealand population and their households.

2008), dwelling density was determined by dividing the total number of private occupied dwellings in a 'meshblock' by its area (sqkm).

2. Both distributions were positively skewed (Auckland=25; Canterbury=0.91) about the mean (Auckland $M=1,040.79$ houses/sqkm, $SD=2,254.50$; Canterbury $M=675.19$ houses/sqkm, $SD=629.42$). The data was then trimmed of outliers (very high or low density meshblocks such as inner city locations and islands) so that the distributions were closer to normality. That is, so that the skew and kurtosis were within the recommended range ($-1 < 0 < 1$) for an ideal normal distribution (University of Surrey, 2007). After this process, the skew was 0.14 for Auckland and 0.0009 for Canterbury. The final means (M) and standard deviations (SD) used were: Auckland $M=1,081$ houses per sqkm ($SD=419.70$); Canterbury $M=994$ houses per sqkm ($SD=432.78$). Appendix B contains the distributions before and after they were normalised. These means were considered the mid-points for medium density housing in these two regions.
3. Meshblocks that fell within one-tenth of a SD from these means were then selected to gather the final sample of meshblocks. The same SD was used for both regions so that the dwelling density was consistent across regions. This meant that there were 801 valid meshblocks in the Auckland region that had a medium dwelling density that fell in the range of $1,043 < 1,081 < 1,126$ houses per sqkm. Within the Canterbury region 255 valid meshblocks were identified with a dwelling density falling in the $959 < 994 < 1,030$ houses per sqkm criterion.
4. Using data from the '2006 Statistics New Zealand Census', these meshblocks were then mapped onto 'Quick Map' (see figures over page). The address listings were gathered for these meshblocks, and through random number generation, a sample of 1,200 houses (600 from each region) was selected from the 801 valid Auckland meshblocks and the 255 valid Canterbury meshblocks.

The following figures demonstrate the meshblocks (represented as small dots) that the samples were taken from.

Figure 4: Meshblocks Sampled in the Auckland Region

Figure 5: Meshblocks Sampled in the Canterbury Region

1.4. Data Collection and Validation

The survey was in the field from October 24 (2008) until January 7 (2009) when the rate of return had reduced to around one survey per week. The bulk (81%) of responses were returned in the first 3-week period. Non-response was not followed up due to time and resource restraints and because what was considered a satisfactory response rate (34%) in comparison to other research (see also section 2.2) had already been achieved.

Events that happened during or just prior to when the survey was in the field included the government elections and a strong reaction against a large privately owned New Zealand power company whose board were asking for substantial pay increases. These events may have influenced participants' responses. For example, comments were made from participants in the verbal reports (see study 3) which reflected an influence of these recent media events on their decisions. Another event that occurred prior to surveying was the government announcement that they were placing severe restrictions on shower heads and water flow. A large public revolt against this decision occurred with people feeling like the government was turning into a 'nanny-state'. This event may have affected responses to questions that asked about the government's responsibility in facilitating energy-efficient housing. While these events could have had an unintended bias on responses, the fact that sustainability and energy efficiency frequently appear to receive media attention, suggests these particular events are unlikely to have had a large influence on respondents' answers over and above the usual level of media generated awareness.

1.4.1. Pilot and Pre-test

The survey was piloted using the verbal report approach (as in study 3) on six people, sampled at convenience. This process resulted in a number of improvements to how questions were asked and how the CV scenarios were presented. Namely, whether the scheme was provided as a government programme, by a charitable trust or through power companies, and, whether the payment vehicle should be through higher power prices or as a loan repayment situation. The pilot participants' responses and reactions to the different scenarios showed the government scheme with a loan repayment payment vehicle as the most realistic and credible scenario for the DG and SWH scenarios.

Once ethics approval had been obtained from Victoria University's ethics committee, a further pre-test on five homeowners using the same verbal report approach was conducted. The purpose of this exploratory analysis was to highlight language or terminology problems

to ensure the survey was adequately understood by the target population (Carroll and Johnson, 1990). This pre-test was conducted on top of the pilots mentioned above, as a test of the survey on people who are in the target population and not already known by the researcher was needed. That is, there was no prior knowledge of their views and experience with the research topic or methods being used.

What may seem as an arbitrary decision to test on five people was based on research from usability studies that demonstrate a test on five people as the optimum number in terms of efficiency (Nielsen, 2000). After this number, less is learnt as the same findings are repeatedly observed; before this number, new data and observations are still generated (Nielsen, 2000).

No major changes were highlighted from this pre-testing apart from a need to clarify whether the repayment was interest-free or not. This was found to be an important factor for these homeowners pre-tested as it affected how long they were WTP. For example, if there was no interest they were happy to pay over a longer period. To overcome this problem, 'interest-free' was added into the dialogue box to ensure respondents were answering with the same hypothetical conditions in mind. Interest-free was viewed more appropriate to use for the purpose of this survey as it reduced complications that could be induced with different interest (finance) rates and the different amounts of interest that would occur with different pay-back lengths. This decision was further supported by Harford (2006) who illustrates how subsidies, taxes and interest repayments "destroy the information carried by prices" because the "price no longer equals the cost, so cost no longer equals value."

2. Analysis

The statistical software package, SPSS (Version 15.0 for Windows) was used for data analysis.

2.1. Data Entry and Coding

All responses were numerically coded for the purposes of later analysis. Missing and 'don't know' responses were coded as '-999' and '-998' respectively so that they were distinguishable from the responses of interest.

Responses to open-ended questions were grouped into common or reoccurring themes and given a numerical code. For example, responses to 'other forms of efficient home-heating' were coded as:

- 1 = wood-burner
- 2 = heat pump
- 3 = DVS/HRV system
- 4 = gas fire (flued)
- 5 = pellet burner
- 6 = night-store
- 7 = passive solar
- 8 = under-floor / central heating
- 9 = electric resistive heaters
- 10 = open fire
- 11 = hot water cylinder
- 12 = gas heaters (un-flued)
- 13 = 'econo-panels'

An implication from coding responses into numbers was that the relationship between the responses was non-linear in some cases. For example a '2' to represent the second income bracket (\$20,001-\$30,000) did not imply that it was twice as large as the first income bracket (\$20,000 or less) coded as '1'. This had implications for how certain questions were analysed as averages and parametric tests were not appropriate. This did not apply for questions that involved a scale response, as the relationship between these numbers was linear. For example, a '10' on the 'general level of concern for environmental issues' scale indicated that the person was 10 times more concerned than a person who selected '1'.

2.2. Responding Sample

A major limitation of survey methods is non-response and the associated sampling bias it can introduce. It is well known that when responses are voluntary, a self-selection bias or polarising effect can occur where people who are already interested in the research topic or who have strong opinions will respond (Holland, 2006). The most important concern is that the participants who do respond are representative of the survey population; that is, that responders and non-responders do not differ significantly (Burkell, 2003). As this survey was anonymous, there was no way to trace who responded. While non-response could have been reduced through a reminder letter, due to resource restrictions this was not undertaken.

The representativeness of the responding sample to the target population was tested however. Comparison with the '2006 Census' demonstrated that the responding sample was very similar to both the national population and regional (Auckland and Canterbury) statistics in terms of the number of usual residents, gender, and household income. See Appendix C for these comparisons. Slight variations were only found in terms of age (sample was older) and household tenure. It was considered that these differences were due to the criteria for owner-occupiers used in selecting the initial target population. It was therefore considered unnecessary to weight the sample to account for differences between the '2006 Census' population and the resultant sample. Note that some of the demographic data collected (for example ethnicity) could not be directly compared to the Census data due to differences in question format. While this sample is likely to be representative of the target population, inferences about parts of the population are less likely to be as accurate.

As the majority of analyses focused on the difference between the different groups identified in the responding sample (see section 2.4), the impact of non-response was not considered as great as it would have been if a single univariate population was used (Burkell, 2003). In addition, as the results from this survey were considered in combination with studies 1 and 3, the impact from non-response was considered less of a limitation than if the results from this sample survey were considered alone (Burkell, 2003).

A common way to minimise non-response is to provide an incentive for responding. Incentives in the form of a monetary benefit (for example cash or gift voucher) can bias the sample however as often the people who need the money respond. This can result in a sample more representative of lower income brackets. For this reason no incentive to send

in a response was given. Instead, a token gesture in the form of a \$1 'scratch-and-win' lottery was provided to everyone who received the survey in the mail. The other alternative was to have a significant cash prize draw that made it worth more people's time to respond (including those in higher income brackets). Due to resource restrictions this was not feasible.

Other techniques employed to reduce non-response included a personalised cover-letter, a help- or fact-sheet to make answering easier, pre-addressed postage paid return envelopes, and the provision of contact details should respondents wish to check the legitimacy of the survey, ask questions or request feedback. Participants were given the opportunity to make comments on the survey or any aspect of the research itself.

A final response rate of 34% was found (409 responses). Estimates of population values from this sample size (409 out of a population over 100,000) are considered accurate within $\pm 5\%$ given a 95% confidence interval (Cozby, 2001). Although the final response rate was below the 50% designed for, it was considered adequate considering the difficulty and length of the survey. This response rate was comparable to other mail surveys based on environmental issues. For example, Auckland Regional Councils 'Big Clean-Up' questionnaire received a response rate of 20% (Frame, 2004), and the 'Lincoln Envirotown Survey' found only 11-12% of households responded (Lincoln Envirotown Trust and Landcare Research, 2006). Further, the 'NZ Quality of Life' surveys conducted biennially by a large market research company (AC Nielsen), receives response rates ranging from 22% to 37% (AC Nielsen, 2009). This study's response rate was also comparable to the 23% Awatere and Walton (2005) received using a similar CV survey.

A higher response rate was found from the Canterbury sample (40%) compared to the Auckland sample (29%). No significant differences were found on any of the key demographic variables (age, gender, household income, and ethnicity) between these two regions suggesting that these different response rates would not affect results.

Table 5 demonstrates the response rate (cell size) for each version (%-saving or \$-cost) highlighting that the responding sample was evenly split across versions.

Table 5: Cell Size for 'DG WTP Total' Variable (after outliers trimmed)

	Version	Cell Size, 'N'³⁹
%-saving	10%	191
	20%	188
\$-cost	\$2,500	124
	\$7,000	132
	\$10,000	123
Version: 1 to 6	V1 (10%-\$2,500)	61
	V2 (10%-\$7,000)	63
	V3 (10%-\$10,000)	67
	V4 (20%-\$2,500)	63
	V5 (20%-\$7,000)	69
	V6 (20%-\$10,000)	56

2.3. Factor Analysis of Attitudinal Factors

A principal components factor analysis was performed on the attitude items to test the appropriateness of the hypothesised clusters. A 'Bartlett's Test of Sphericity' confirmed that the items were not highly inter-correlated and therefore suitable for factor analysis.

Both the latent root criterion extraction (eigenvalues >1) and scree plot initially suggested that the majority of variance in the data-set was best explained by a 5-factor solution. This 5-factor solution predicted 54% of the total variance. The initial extraction was cleaned by raising the factor loading criteria to 0.5 (orthogonal (varimax) rotation) and removing items that were double-loading (Giles, 2002).

After testing for internal reliability (Cronbach's Alphas, $\alpha > 0.70$) and removing inter-item correlations (>0.60) (Giles, 2002), only three components were considered suitable as scales for further analyses.

These components were labelled as follows to describe the overall idea the group of items suggested (see Appendix D for a description of the individual items loading in each factor):

Component 1: Altruistic Obligation (5 items, $\alpha = 0.75$)

Component 2: Egoistic Protest (6 items, $\alpha = 0.78$)

Component 3: Green Identity (4 items, $\alpha = 0.79$)

³⁹ Note that the cell-sizes presented here are for the variable 'DG WTP Total' after the data was trimmed for outliers (over 2 x SD). See Section 2.4.2 for a further explanation.

The five items loading on 'component 1' were found to be associated with a moral obligation to act in order to reduce energy use and environmental issues surrounding its use. These items related to both the individual and national household level. The items were viewed as a mix of both social and biospheric value orientations and for this reason the overall label 'altruistic' was used to encompass values reflecting both a concern for others and the environment (as described in chapter 3, section 1.2). Component 1 was labelled '*altruistic obligation*'.

'Component 2' had six items loading on it. In direct contrast to component 1, these were found to be associated with the self through actions that affected the individual homeowner personally. This was viewed as an egoistic value orientation (see chapter 3, section 1.2). The items also showed a form of protest against being told by government or others that they should change their lifestyle. This component was labelled '*egoistic-protest*'.

The four items loading on 'component 3' were found to be associated with identity: others perception of oneself, perception of others and factors associated with maintaining that identity. This final component was labelled '*green identity*' (see chapter 3, section 2.1).

2.4. Categorising Respondents

To objectively compare respondents and determine those engaging in behaviour exhibiting an *apparent disconnect*, respondents were segmented into specific subgroups. This categorisation formed the main dependent measure for this study and was determined post hoc to data collection from the combination of three dependent variables (DV): total WTP amount, level of awareness and the degree of consistency across scenarios.

As discussed in chapter 4 (section 2.1), the purpose of segmentation was to enable a more pragmatic and targeted approach to understand New Zealand homeowners' adoption decisions. While it is acknowledged that each individual homeowner constructs their own realities (for example due to different contexts, situations and levels of previous knowledge), it is not feasible or rational to design a different solution tailored to each individual household. This segmented measure can therefore be viewed as an overall expression of the different ways energy-efficiency innovations are valued by the survey population.

2.4.1. Labels

In order to understand the groupings of homeowners produced through the segmentation process, simple labels were needed to manage their otherwise complex descriptions. A paradoxical situation arose however, because at this point in the process, the characteristics of these groupings were not understood in enough detail to produce meaningful descriptions or acronyms. Instead, inspiration was taken from a book titled '*8 Tribes: The Hidden Classes of New Zealand*' in which general groupings of people are described by a suburb in New Zealand (for example Remuera, Balclutha or Cuba Street) that is often typified with having those 'type of people' living in it (Caldwell and Brown, 2007). While it is acknowledged that the authors are popular journalists or social commentators describing people in a light-hearted manner, the approach offered a way to label the groups that was easily memorable and understandable when conducting analyses and communicating findings to others. A similar approach was also taken by American Environics (2006), the New Zealand Household Sustainability Survey (MfE) and the Department for Environment, Food and Rural Affairs (Defra) with their population segments (Johnson et al, 2008).

It is important that these labels are viewed only as notional placeholders for the groupings of homeowners found and that they are not interpreted as having unintended social weightings (for example gender, class or ethnic connotations). If those who protested at energy efficiency were labelled with a masculine name and the group who chose to pay more than the market value were given a feminine name for example, then this could imply a gender bias that females are 'greener' than males are. In order to avoid this risk, only male names viewed by the researcher as common within society are used. Like the decision to use the term '*apparent disconnect*' to describe the research problem, these names represented 'neutral' labels to the researcher to help facilitate an unbiased analysis.

These labels are continued through the remainder of this thesis because they are viewed as easy descriptors that relate the more complex and wider set of characteristics of these groups of homeowners to 'every-day life'. They also ensure less complex language construction because single words instead of complex phrases are used to refer to each group.

To pre-empt the following section, six groups were identified through the segmentation process. These groups (with the exception of the sixth) were given the following labels in the form of common male names:

<i>Jimmys</i>	This label is used to characterise homeowners who were aware and consistent in their decision to pay less than the cost given to have the energy-efficiency innovation installed in their house. This is the key group of interest in this thesis.
<i>Nigels</i>	This label is used to characterise homeowners who were aware and consistent in their decision to pay the same as the cost given to have the energy-efficiency innovation installed in their house.
<i>Garys</i>	This label is used to characterise homeowners who were aware and consistent in their decision to pay more than the cost given to have the energy-efficiency innovation installed in their house.
<i>Derricks</i>	This label is used to characterise homeowners who did not want the energy-efficiency innovation installed in their house. They were not WTP anything.
<i>Waynes</i>	This label is used to characterise homeowners who made a ' mistake ' in their logic or calculations.
<i>Inconsistent</i>	This label is used to characterise homeowners who were inconsistent in their responses to the two energy-efficiency innovations.

2.4.2. Segmentation Process

Four analysis stages were used to cluster respondents with others who showed similar departures from rational decision-making and identify those showing *disconnected* behaviour. These 4-stages were:

1. **Total WTP Variable:** The total amount each respondent was WTP was initially computed through multiplying the amount he or she were WTP per month by the length of time he or she were WTP.

2. **Departure from Cost Level:** Respondents' total WTP values were then classified according to whether they were less than, the same, or greater than the cost level they received.
3. **Awareness Check:** Those who made apparent 'mistakes' in calculation or logic were then distinguished from those who demonstrated that they understood how much they were WTP in relation to the installation cost and their power savings. This step was considered crucial for producing a robust and reliable measure given the complex mathematical and economic nature of the CV scenarios and questions.
4. **Consistency Check:** Respondents were then classified on whether their responses were consistent or whether they changed across scenarios.

The dependent measure that was used to segment respondents was therefore a combined measure of the value placed on the energy-efficiency innovations and the level of effort respondents were prepared to contribute towards working out what this value was worth to them.

2.4.2.1. Stage 1: Total WTP Variable

The amount each respondent was WTP in total was calculated by multiplying the amount he or she were WTP per month by the number of months he or she were WTP. Before responses could be classified into common groups, total WTP distributions were trimmed of outliers and non-responses in order to normalise the distributions so that the skew and kurtosis were within the recommended range ($-1 < 0 < 1$) (University of Surrey, 2007). An outlier was classified as any value that fell outside of 2.5 standard deviations from their particular version and scenario mean ($M \pm 2.5 SD$). Only 16 respondents (4%) were removed from the sample because they were an outlier or did not respond to one of the scenarios.

2.4.2.2. Stage 2: Departure from Cost Level

Respondents were then grouped by whether they were WTP the same, less or more than the cost they were told in the survey. As shown in table 6, an error band was used to account for respondents who made a minor miscalculation or approximation in their contribution. For example, many respondents for the \$7,000 version believed they were paying 'the same' when their WTP-amount was \$300 less (\$6,700). Different margins of error were used for the different cost versions to allow for the slight differences in their frequency distributions.

Table 6: Margins of Error Used to Classify Respondents

	Version	1 = Less <i>Jimmys</i>	2 = Same <i>Nigels</i>	3 = More <i>Garys</i>
\$2,500	DG (+/- \$200)	$\leq \$2,300$	$\$2301 \leq \$2500 \geq \$2,699$	$\geq \$2,700$
	SWH (+/- \$200)	$\leq \$2,300$	$\$2301 \leq \$2500 \geq \$2,699$	$\geq \$2,700$
\$7,000	DG (+/- \$300)	$\leq \$6,700$	$\$6,700 \leq \$7,000 \geq \$7,300$	$\geq \$7,300$
	SWH (+/- \$300)	$\leq \$6,700$	$\$6,700 \leq \$7,000 \geq \$7,300$	$\geq \$7,300$
\$10,000	DG (+/- \$1,000)	$\leq \$9,000$	$\$9,001 \leq \$10,000 \geq \$10,999$	$\geq \$11,000$
	SWH (+/- \$1,000)	$\leq \$9,000$	$\$9,001 \leq \$10,000 \geq \$10,999$	$\geq \$11,000$

Respondents who were not WTP anything (that is, a zero-response) were coded as 4 = (Zero), *Derricks*. While many CV researchers discount zero responses (for example see Awatere and Walton (2005) and Kahneman et al (1993) for a discussion), zero responses were retained in this research as they were presumed to reflect homeowners who were outwardly making a statement or “lodging a protest (Sagoff, 2008)”. That is, they might have a valid reason, like roof orientation, for why they do not want the innovation.

2.4.2.3. Stage 3: Awareness Check

A new variable was then computed to assess whether respondents realised that they were paying less, the same or more than the cost presented to them. This variable was calculated by comparing responses to the question “is the total amount you would be prepared to pay about the same, more or less than the cost to install” with their initial classification of whether they were WTP more, less, the same, or zero (as determined in the previous stage).

Respondents who were incorrect were collapsed and grouped together with the label 5 = Incorrect, *Waynes*. Overall, 75% of the sample was aware and not ‘mistaken’ in the amount they said they were WTP in relation to the actual cost of the innovation.

Similar to zero-responses, most researchers consider such ‘irrational’ responses as a non-sampling respondent error and either correct such routing errors or clean the data-set of them (Assche, 2003; He et al, 2002). However, given that a considerable proportion of the sample (25%) were incorrect, these responses were retained as a separate group because they could contain important information on the characteristics of homeowners who make errors in their underlying logic or ‘mistakes’ due to the complexity of energy-efficiency decisions. As Simon (1957) would suggest through his model of *bounded rationality*, such

errors reflect the ‘real-world’ conditions of uncertainty that decisions occur within. He et al (2002) further demonstrate the importance of retaining these ‘irrational’ responses with the finding that they have a significant impact on mean WTP values.

2.4.2.4. Stage 4: Consistency Check

By having each individual receive two CV-scenarios with the same cost and benefit levels, a consistency check was possible to assess the reliability of responses. As defined in chapter 4 (section 2), consistency was considered key to this research because it allowed an understanding of how robust any observed *disconnect* was.

This repeated measures design meant that a respondent could potentially have two different response sets: one for DG and one for SWH. To assess the extent that responses differed across these two innovations, the scenarios were analysed separately first and then compared to see if similar patterns of results emerged.

Different results were initially found suggesting that either the group sizes were different for the two scenarios or that respondents were changing their WTP-responses across the two scenarios. Table 7 shows that this difference was not due to the group sizes however as similar proportions were found for each group in both the DG and SWH scenarios.

Table 7: Comparison of Group Sizes across CV Scenarios

	DG	SWH
<i>Jimmys (Less)</i>	51%	54%
<i>Nigels (Same)</i>	16%	14%
<i>Garys (More)</i>	2%	2%
<i>Derricks (Zero)</i>	6%	5%
<i>Waynes (Wrong)</i>	25%	25%

This therefore suggested that some respondents were changing their WTP-responses across the two scenarios. For example, a respondent might have been a *Gary* and WTP more than the market value for DG but not WTP anything for SWH and subsequently classified as a *Derrick*. This inconsistency could be the result of some characteristic of the innovation or because of a methodological error (for example a fatigue, learning or order effect). This issue of inconsistency is expanded within the need for further research discussed in chapter 10 (section 2.1).

While a large proportion of respondents were inconsistent (30%, 124 respondents), tests of consistency revealed that overall, responses to DG and SWH were significantly related

(Cohen's Kappa: *Kappa value*=0.57 *N*=370). Therefore, responses to the two scenarios were combined into one variable as opposed to treating them as two separate dependent measures. A variable was therefore computed that measured respondents overall consistency across the two CV scenarios. In order to be considered 'consistent', respondents needed to have the same coding for both scenarios. For example, they needed to be a *Jimmy* for both the DG and SWH scenarios. All who were found to be inconsistent were collapsed, grouped together, and labelled as *Inconsistent* with the numeric coding '6'⁴⁰.

While this stage was important for identifying when *disconnected* behaviour was consistently demonstrated, it did mean that any technology effects were designed out of results. Other variables however showed that they were not affected by the specific innovation even when the consistency grouping was removed. For example, when looking across the whole sample, no significant difference was found for resale value. That is, DG was not perceived to increase a property's value more than SWH, or vice versa. Further, as section 3.5 later illustrates, similar trends were found across the two innovations for the different cost and benefit levels. These results suggest that *disconnected* behaviour was independent of the innovation.

2.4.3. Final Groupings

Six final groups were therefore formed after controlling for awareness and consistency in responses. Table 8 demonstrate the percentage that each group was present in the sample population.

The *Jimmys* were the largest group representing 41% of the total sample population. When considering only respondents who were consistent and aware (those who can be viewed as making reasoned decisions), the *Jimmys* represented the majority at 79%.

⁴⁰ Note that this group was not given a label similar to the other groups because it was viewed as containing a 'mix' of these groups.

Table 8: Distribution of the Sample Population in Study 2

	Frequency	Valid Percent* (Total Sample)	Valid Percent (Consistent and Aware Only**)
<i>Jimmys</i> (Less)	162	41%	79%
<i>Nigels</i> (Same)	35	9%	17%
<i>Garys</i> (More)	3	1%	2%
<i>Derricks</i> (Zero)	6	2%	3%
<i>Waynes</i> (Wrong)	63	16%	-
<i>Inconsistents</i>	124	32%	-
<i>Missing</i>	16	-	-
Total	409	393	206

* Valid Percent does not include 'missing' responses.

** 'Consistent and Aware Only' sample represents 53% of the total valid sample

2.4.4. The '*Jimmys*'

The focus of this research is the *Jimmys* – the large group of homeowners who displayed *disconnected* behaviour. The *Jimmys* were identified as the group engaging in *disconnected* behaviour because their actions or purchasing behaviours did not reflect the value they realised in the energy-efficiency innovations⁴¹. In this sense, the *Jimmys* know they are engaging in what appears to be unreasonable behaviour; they are systematically deciding that the benefits of the energy-efficiency innovations' are not worth the initial investment.

It is important to note that while the other groups are not the main focus of this thesis, they are not ignored either as they serve an important role as comparison points to highlight what is different about the *Jimmys* and the reasons for their *disconnected* behaviour. A larger number of respondents would be needed so that conclusions can be drawn on these other groups' specific motivations. This presents an opportunity for future research as discussed in chapter 10 (section 2.1).

⁴¹ This assumption, that the *Jimmys* value energy efficiency was further substantiated through analyses of their pro-environmental attitudes (see section 3.2 below).

3. Results: Influences on Behaviour

This section describes the results from analyses designed to determine which factors, as captured in the survey, were influencing the *Jimmys disconnected* behaviour.

The motivations behind the *Jimmys* behaviour is explored through comparing them to the other groups identified through the segmentation process. As Vadrnal and O'Connor (1994) state, "it is through careful consideration of 'where the differences lie' that the most insights can be gained." Given the varied sizes of these groups and the large number of them, it was not feasible to compare the *Jimmys* to all groups. The decision was therefore made to compare the *Jimmys* to one key reference group: the *Nigels*.

This group was chosen as it had a substantial cell size (over 30 respondents) and because they represented a good reference point for comparison. That is, the *Nigels* were thought to represent the 'rational actor' that economists theorise humans should strategically behave like (Gilad et al, 1987; Jones-Lee and Loomes, 2004; Loewenstein, 2007). As such, the *Nigels* provided an essential back-curtain against which the fallacies of the *Jimmys disconnected* behaviour could be compared.

While the *Waynes* also represented a sizable group to draw comparisons with, because their responses were assumed to be influenced by numerous biases, they were not considered a 'suitable' comparison base.

From this perspective, the *Garys* and *Derricks* were viewed as appropriate comparison points as they showed reasoned and opposite opinions to the *Jimmys* (for example, they could be conceptualised as representing the extremes of the adoption curve: the innovators and the laggards). However, the small number of *Garys* and *Derricks* meant that this was not statistically possible. While these groups could have been collapsed to increase this cell size, because of the disparities in their opinions, any grouping was found to hide significant effects as the extremes were averaged out. The equal variances assumption was not met when these groups were included in trial analyses further supporting the decision that it was not appropriate to use these groups to identify what was different about the *Jimmys*.

Similarly, because the *Inconsistent*s represented a 'mix' of segmentation groups, no significant differences were found on any of the variables when they were initially included in analyses. This is despite the *Inconsistent*s representing a significant proportion of the sample population.

To identify under what conditions the *Jimmys* differed to the *Nigels* (and *Inconsistents* in the first instance), chi-square (for categorical variables) and one-way ANOVA tests (for continuous variables) were conducted to assess when a statistical difference was present between at least two groups. Missing responses (-999) were not included in analyses.

Post-hoc tests were performed where a significant finding was identified by these omnibus tests to identify which particular groups means were statistically different to each other. As noted above, no differences were found with the *Inconsistents*. For chi-square categorical data, standardised adjusted residuals greater than 1.96 (the 97.5th percentile in a 2-tail standardised distribution) were calculated to see where effects were occurring. Where appropriate, odds ratios were also calculated to test the magnitude or likelihood of these differences. Confidence intervals (95%) for these odds ratios were calculated to ensure that they did not 'span' or cross over '1' as this would imply that the odds for each group were the same (even). Where continuous variables were tested through ANOVAs, three post-hoc tests from the 25 available in SPSS were used to see whether results were consistent across them (thus giving more confidence in the conclusions). The Bonferroni, Scheffe and Games-Howell (for when population variances were not equal) were chosen as they are considered some of the more robust and flexible of the tests available (Newsom, 2006). For example, the Tukey and Duncan tests are in comparison quite simple post-hoc tests high in 'power' (Newsom, 2006). Being high in power, this meant that they were more likely to reject the null hypothesis before the Bonferroni, Scheffe and Games-Howell tests did.

Homogeneity of variance (Levene's) was also tested to ensure the assumption of equal group variance was not violated. Where the population variances were found to be significantly different, Kruskal-Wallis H-tests or Mann-Whitney U-tests were used as the non-parametric alternative.

3.1. Overall Summary

Table 9 summarises the results of the numerous factors measured that may be attributed to the *Jimmys* behaviour. The following sections discuss these results in more detail. Results were considered significant at the 5% level ($p < .05$) of uncertainty. Appendix E contains a summary of all significance values regardless of whether they were significant or not.

Table 9: Potential Influences on Behaviour

Variables	Statistical Significance (p-value)
3.2. Individual Psychological Factors	
altruistic obligation	NS
egoistic protest	NS
moral satisfaction	NS
concern environmental issues	NS
3.3. Demographics	
gender	NS
age	NS
life-stage (living situation)	NS
ethnicity	NS
household income	NS
3.4. Social Psychological Factors	
green identity	0.03*
fatality	NS
futility	0.02*
'average-other' pay for DG	NS
'average-other' pay for SWH	NS
effort compared to 'average-other'	NS
'average-other' household income	NS
% homes with DG or SWH	NS
3.5. Behavioural Economic Factors	
DG WTP per month	NS
SWH WTP per month	NS
DG length WTP	0.01*
SWH length WTP	0.01*
3.6. Characteristics of the Innovation	
DG or SWH increase house value	NS
co-benefits	NS
3.7. Contextual Factors	
<i>Perceived Personal Capabilities</i>	
habits	NS
pressure felt	NS
previous experience	NS
previous houses had DG or SWH	NS
extra-ordinary heating requirements	NS
spent >\$500 to actively improve energy performance	NS
<i>Characteristics of the Household and Dwelling</i>	
power consumption	NS
# people resident	NS
region	NS
dwelling density	NS
dwelling type	NS
length planning to stay in house	NS
tenure	NS
house value	NS
% area glazing	NS
house have:	NS
DG and/or SWH	NS
ceiling, wall or under-floor insulation	NS
heated swimming or spa pool	NS
wet-back	NS
instant electric or gas water heating	NS
electric hot water heat pump	NS
other efficient home heating	NS

* = Results were considered significant at the 5% level ($p < .05$) of uncertainty; NS = non-significant

3.2. Individual Psychological Factors

The *Jimmys* were not significantly different to the *Nigels* on any of the individual psychological variables measured.

The factor analysis (see section 2.3) extracted two opposite value-orientations, *altruistic* and *egoistic*, neither of which was found to explain the *Jimmys disconnected* behaviour. While no significant difference was found between groups, both the *Jimmys* and *Nigels* were higher in altruistic obligation (*Jimmys*: $M=3.76$, $SD=0.44$; *Nigels*: $M=3.82$, $SD=0.72$) than they were in making an egoistic protest (*Jimmys*: $M=3.14$, $SD=0.65$; *Nigels*: $M=3.14$, $SD=0.80$). There is a chance that these higher levels of altruism are due to socially-desirable responding, especially as both groups demonstrated this trend. This result therefore needs to be reviewed in context with the results from the studies 1 and 3.

The *Jimmys disconnected* behaviour was also not explained by their general level of *concern for environmental issues*. That is, both the *Jimmys* and *Nigels* showed relatively neutral levels of concern for environmental issues (*Jimmys* $M=5.51$, $SD=1.79$; *Nigels*: $M=6.18$, $SD=2.17$) (11-point scale).

In support of Kahneman and Knetsch (1992), the findings from this study showed a significant correlation (although weak) between respondents' WTP values for the public CV scenarios with the degree of satisfaction they would receive from contributing towards these funds. That is, the amount they were WTP increased with the amount of satisfaction respondents believed they would get:

Switching to renewable energy: $r(383)=0.30$, $p<.001$

Conservation of natural habitats: $r(379)=0.50$, $p<.001$

Looking at just the *Jimmys*, a significant relationship was also found:

Switching to renewable energy: $r(159)=0.47$, $p <.001$

Conservation of natural habitats: $r(159)=0.50$, $p<.001$

No significant difference was found between the *Jimmys* and the *Nigels* levels of *moral satisfaction* however. That is, moral satisfaction did not explain the *Jimmys disconnected* behaviour, as they were just as likely to get satisfaction from contributing to either public good as the *Nigels* were.

3.3. Demographics

The *Jimmys* were not significantly different to the *Nigels* on any of the demographic variables measured. Their *disconnected* behaviour was therefore not a product of their *age*, *gender*, *ethnicity*, *household income* or *life-stage* for example.

3.4. Social Psychological Factors

While perceptions of *fatality* were not found to explain the *Jimmys disconnected* behaviour, a perception of *futility* was. A significant difference was found between the *Jimmys* and *Nigels* for the social cognition of *futility*. While the ANOVA was not significant, the Games-Howell post-hoc test was significant suggesting a population variance difference. A Mann Whitney (U) test was therefore conducted as the non-parametric alternative. This test showed a significant difference: $U(1, N=196)=2,129.50, p<.05$. The *Jimmys* ($M=2.31, SD=0.88$) were significantly more futile in their beliefs about reducing household energy-use than the *Nigels* were ($M=1.94, SD=0.78$). This was reported on a scale of 1-to-5, where '5' represents strongly agree and '1' represents strongly disagree.

Attitudes towards a *green identity* were also identified as another reason for the *Jimmys disconnected* behaviour as a significant difference was found between the *Jimmys* and *Nigels*: $F(2, 363)=3.44 p<.05$ (homogeneity of variances not violated). Post-hoc tests showed the *Jimmys* ($M=3.12, SD=0.68$) to have a lower green identity than the *Nigels* ($M=3.49, SD=0.90$) (on the same 5-pt scale).

While no significant difference between groups was observed for comparisons to the 'average-other', the trends produced were note-worthy. Other-self comparisons showed that the majority of *Jimmys* (59%) thought most other people were 'just like them' in that they were only WTP the same as what they did. A large percentage (32.5%) also thought that this 'average-other' was worse than they were as they would be WTP less than they had. Almost identical results were found across the two scenarios (DG and SWH) as shown in the following table.

Table 10: The *Jimmys* 'Average-Other' Comparisons for WTP amounts

Self-	DG	SWH
Less	32%	33%
Same	59%	59%
More	9%	8%

A similar trend was found for the level of effort the *Jimmys* believe they make to reduce their household energy use in comparison to the typical New Zealand household. In both groups (*Jimmys* and *Nigels*), the majority believe they ‘make about the same’ (51% and 47% respectively) or ‘more’ (46% and 47% respectively) effort. Only 3% (*Jimmys*) and 6% (*Nigels*) acknowledge that they might make ‘less’ effort.

This trend was also found when comparing the *Jimmys* and *Nigels* household income with their estimates of the ‘average-other’s’ household income. That is, the majority in both groups (*Jimmys* and *Nigels*) thought that this ‘average-other’ New Zealand household earned about the same (44%, 50%) or less (41%, 44%) than they did. Only a few (15%, 6%) thought that this ‘average-other’ earned more than them. These results suggest that the *Jimmys* do not think their ability to adopt the innovations is disadvantaged because of their household income.

The *Jimmys disconnected* behaviour could not be explained by their normative perceptions of how common DG or SWH are as there was no significant difference between groups. However, both the *Jimmys* and *Nigels* estimates of the percentage of homes that have DG or SWH were higher than the actual number of installations (as shown in table 11). This could imply a *false uniqueness bias* (see chapter 3, section 2.3).

Table 11: Estimated Percentage of Houses that have DG or SWH

	<i>Jimmys</i>	<i>Nigels</i>	<i>Actual statistics</i>
DG	12%	14%	4%
SWH	8%	10%	1-2%

3.5. Behavioural Economic Factors

As shown in figure 6, the *Jimmys* represented the highest proportion of respondents in all but one CV survey version. This suggested that the *Jimmys* were not just protesting at the cost or level of benefits they would receive from the innovations. This is because if they were, then one would expect the 10%-\$10,000 version to have the largest number of *Jimmys* of all the versions as this represented the ‘worst’ case scenarios from a rational cost-benefit perspective. That is, assuming homeowners can recognise a ‘deal’ when they see one, one would expect the number of *Jimmys* to show a trend opposite to our ‘rational actor’, the

Nigels. That is, more people (and subsequently less *Jimmys*) WTP to adopt when the cost is low and the benefit is high, and less people (more *Jimmys*) not WTP when the cost is high and the benefit is low.

Figure 6: Distribution of Segmentation Groups by Version

Odds ratios showed that the odds of a *Jimmy* having the high-cost low-benefit version (10%- \$10,000) were no different from any of the other groups (that is, the confidence interval crossed '1'). These findings therefore suggest that their behaviour is either purposeful (for example, a strategic bid), and/or that a more dominant factor is influencing their behaviour.

Table 12 and figure 7 demonstrate two different ways the *Jimmys* WTP values can be interpreted: 1 - as the actual amount they were WTP in absolute terms, or 2 - as the difference between what they were WTP and the cost of the innovation (expressed as a percentage).

Table 12: The *Jimmys* WTP Responses by the Level of Cost (Version) Received

Cost Version	Scenario	WTP amount (\$)	WTP length (months)	Total WTP amount	%-difference from cost
\$2,500	DG	\$23.89	38.89	\$851.70	66%
	SWH	\$23.55	41.22	\$886.95	65%
\$7,000	DG	\$33.56	56.79	\$1,607.36	77%
	SWH	\$38.21	60.21	\$1,882.76	73%
\$10,000	DG	\$30.57	60.07	\$1,720.15	83%
	SWH	\$32.62	58.87	\$1,741.27	83%
Average		\$30.40 per month	52.68 months (4.40 years)	\$1,448.00 total	74% discount

Figure 7: Total WTP Responses Compared to the Percentage 'Discount'

Interpreting the *Jimmys* WTP responses from the first perspective, there appears to be no real trend or 'ideal price' that the *Jimmys* responses suggest. This finding reiterates the inappropriateness of taking WTP-values as an indication of the true monetary value of the innovations.

From the second perspective, a linear trend is observed where the difference between what they were WTP increases as the cost increases. That is, as the cost increases they appear to demand a larger 'discount'. This could be because they perceive a greater financial risk for example. However, what the motivations are behind this trend will need to be explored further in the following study. It can only be inferred from this study that the more

informative and valid interpretation of the *Jimmys* WTP responses is the difference or ‘discount’ they require and not the actual WTP amount. As Kahneman, Ritov and Schkade (1999) discuss, the *Jimmys* WTP-values appeared to be a means for them to express their attitudes rather than an indication of an economic preference.

The importance of having different versions is also reflected in these findings. For example, if just the \$7,000 version cost-level had been tested, then a WTP value around \$1,700 could have been assumed as the ‘true’ market value that the *Jimmys* considered acceptable. Further, the trend between the different costs could not have been observed if fewer than three cost-levels had been used.

Significant population variances (Levene’s) were found when comparing the *Jimmys* and *Nigels* responses to the two WTP variables: 1 – the amount they were WTP per month, and 2 – the length of time they were WTP. When assuming non-equal population variances, the average length of time the *Jimmys* were WTP was found to be significantly shorter (DG: $M=53.99$ months; SWH: $M=55.49$ months) than the average length of time the *Nigels* (DG: $M=106.46$ month; SWH: $M=102.91$ months) were WTP. This occurred for both DG ($t(37)=-2.82$, $p<.05$) and SWH ($t(37)=-2.60$, $p<.05$). The lack of a significant difference for the monthly WTP amount could suggest that the dimension of time is more important to the *Jimmys disconnected* behaviour.

One reason for the *Jimmys* apparent unwillingness-to-pay for too long could have been because they were planning to move soon. However, the ‘unreasonableness’ of their behaviour is demonstrated as the length of time they were WTP ($M=4.40$ years, see table 12 above) was substantially less than how much longer they estimated they would be living in their current house ($M=11.21$ years) (see section 3.7 for a further discussion). For example, despite 51% of the *Jimmys* saying that they expected to live in their house for 10 years or more⁴², only 18% of these *Jimmys* (or 9% of all *Jimmys*) were WTP for the energy-efficiency innovations for this length of time. The average length of time the *Jimmys* said they would be WTP (4.4 years) is similar to Holland’s (2006) findings where most (49%) said they would only be willing to wait 5-to-9 years until the initial investment had been repaid through the benefits. Holland (2006) also found that although 57% of his respondents expected to live in their home for more than 20 years, only 11% were willing to wait this long for the energy-

⁴² 10 years was used as the benchmark for this thesis because 10 years appeared to be the maximum length of time the *Jimmys* (with the exception of two) were WTP.

efficiency equipment to payback. These findings suggest that the length the *Jimmys* were WTP was not because they were planning to move soon.

3.6. Characteristics of the Innovation

Given the criteria for a respondent to be classified as a *Jimmy* (as per the segmentation process described in section 2.4.2), it is already known that the *Jimmys disconnected* behaviour is not due to one of the innovation's characteristics.

No significant difference was found between groups on how they valued the various co-benefits. However, within the *Jimmys* it was found that the public benefits (for example CO₂ emissions) ($M=\$5.60$, $SD=\$10.82$) were valued significantly less on average than the private benefits (for example power savings or improved comfort) ($M=\$15.50$, $SD=\$2.00$) for the DG scenario only ($t(156)=-9.90$, $p<.01$). This was the only technology effect observed and the same pattern was observed for the *Nigels* suggesting that this was not a defining feature of the *Jimmys disconnected* behaviour. The table below demonstrates the average value (as a proportion out of \$100) placed on each benefit. Benefits that were interpreted as 'public' are marked with an asterisk (*).

Table 13: Value Placed on Different Co-Benefits (as a proportion of \$100)

	DG		SWH	
	M	SD	M	SD
Savings on power bill	\$22.34	\$15.27	\$28.28	\$18.47
Reduced energy use	\$8.30	\$8.89	\$14.16	\$8.60
Reduced CO2 emissions*	\$5.60	\$10.81	\$10.88	\$11.08
Clean, renewable supply of energy*	NA	NA	\$25.72	\$15.78
Increased comfort/warmth	\$27.34	\$15.68	NA	NA
Reduced noise	\$13.23	\$10.42	NA	NA
Reduced condensation	\$17.10	\$11.42	NA	NA
Increased security	\$5.01	\$6.60	NA	NA
Reduced reliance on power supply companies	NA	NA	\$18.88	\$14.80
Other	\$1.05	\$5.85	\$1.50	\$5.77

While no significant difference between the *Jimmys* and *Nigels* was found in terms of the amount they thought DG or SWH would increase their property value, the amount they did state was observed to be higher than the initial cost of the innovation. This amount varied between the different groups as shown in table 14.

Table 14: Average Perceived Increase in Resale Value⁴³

	DG		SWH	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<i>Jimmys</i>	\$2,799.65	\$5,608.84	\$3,940.34	\$31,609.66
<i>Nigels</i>	\$435.65	\$5,766.52	-\$819.65	\$5,197.61
<i>Garys</i>	-\$2,200.00	\$4,256.75	-\$1,533.33	\$3,879.86
<i>Derricks</i>	\$5,750.00	\$5,057.99	\$2,000.00	\$4,472.13
<i>Inconsistents</i>	\$2,024.64	\$11,462.74	-\$193.57	\$5,770.44
<i>Overall Sample</i>	\$2,264.88	\$8,101.35	\$1,925.29	\$23,267.86

It appeared as though the *Jimmys* were displaying an *endowment effect* (see chapter 3, section 3.2) as the amount they wanted to give up having the energy-efficiency innovation (as reflected through their perceived resale price) was higher (DG: \$4,280.87; SWH: \$5,549.41) than the amount they were WTP to acquire it (DG: \$1,481.21; SWH: \$1,609.06).

3.7. Contextual Factors

As reported in this quantitative survey, perceived barriers from factors relating to *personal capability* (habits, perceived pressure, and previous experience) were not found to explain why the *Jimmys* show *disconnected* behaviour. No significant difference was found between the *Jimmys* and *Nigels* mean scores as both group's attitudes towards the difficulty in changing habits was neutral (*Jimmys*: $M=3.20$, $SD=0.91$; *Nigels*: $M=3.18$, $SD=0.97$) as was the personal pressure they felt to reduce their household energy use (*Jimmys*: $M=3.11$, $SD=0.89$; *Nigels*: $M=3.23$, $SD=0.84$). The *Jimmys* were found to have no more or less *experience* than the *Nigels*. Nor were they found to be more likely to have different 'types' of experience with energy efficiency (for example personal research compared to work experience).

It did not appear that the characteristics of their *dwelling or household context* provided a reason for them to show *disconnected* behaviour as no significant differences were found. For example, the *Jimmys* average power bill (\$169.43) was almost identical to the total sample average (\$168.43) and the *Nigels* (\$177.85). The *Jimmys* therefore did not gain more or less benefit through power savings than the other groups and it did not appear that their *disconnected* behaviour was motivated by this.

⁴³ Figures represent the difference between perceived resale price and total WTP amounts. That is, a positive (+ve) value indicates a net return on the initial investment, a negative (-ve) value indicates a perceived loss on the initial investment, and '0' represents break even.

Similarly, how many more years the *Jimmys* were planning to stay in their house ($M=11.21$ years, $SD=9.60$ years) was comparable to the *Nigels* ($M=12.15$ years, $SD=10.24$ years) and as noted above (section 3.5), not an explanation for their *disconnected* behaviour. Note that this sample was found to be substantially higher than the national average (6.80 years) for years at usual residence (Statistics New Zealand, 2006b). This only makes their behaviour look more ‘unreasonable’ because it could imply that the *Jimmys* rationally have more reason to adopt the innovation as they have a longer time to recoup the pay-back benefits. However, it could also be that these respondents are showing an *inter-temporal bias* (chapter 3, section 3.4) in that they are under-estimating how their circumstances could change. The benefit of the mixed methods approach is highlighted as these factors that were not measured directly through the survey instrument had the opportunity to be reflected in the verbalisations of the following study 3.

No significant differences were found for the other potential dwelling and household characteristics that could result in *disconnected* behaviour (for example tenure, type of dwelling, area of glazing, amount of pre-existing insulation, other energy-efficient innovations, or high energy-consuming appliances or requirements). The results from this study therefore suggest that the *Jimmys* were not advantaged or disadvantaged in terms of their living contexts compared to the *Nigels*.

The large majority of the sample reported that they lived in a single stand-alone detached dwelling (97.5%) in a medium-density area (94%). Approximately half were ‘owned with mortgage’ (44%) and the other half ‘owned without mortgage’ (53%). There were no rented properties. These findings confirmed that the target population was reached.

3.8. Results Summary

The motivations for the *Jimmys disconnected* behaviour did not appear to be attributed to contextual factors such as income, power consumption or the length they were planning to stay before resale. No individual psychological factors were found to explain the *Jimmys disconnected* behaviour either. For example, the *Jimmys* were no more egoistic (self-interested) than the *Nigels* were.

While their attitudes towards environmental issues did not explain their behaviour, ratings of overall environmental concern in combination with these attitudinal statements,

suggested that it was not the case that the *Jimmys* do not 'value' energy efficiency. This finding further highlights the *disconnected* nature of their behaviour.

Futility and attitudes towards a green identity were found to be significant suggesting that the *Jimmys* behaviour is influenced to some degree by social factors. Although there was a significant difference between the *Jimmys* and *Nigels* responses to these two variables, the *Jimmys* held a neutral position in that they neither agreed nor disagreed with the view that there is no point making changes (futility), or that having a green identity was a negative trait.

While the other-self comparisons showed no significant difference between groups, the trends provided suggested that the *Jimmys* thought that their behaviours were the same or even better than the 'average-other'. This trend was found across a number of questions suggesting that social comparisons are an important influence on their decisions.

Technology effects were controlled for in the segmentation process and no regional effect was found suggesting that the *Jimmys disconnected* behaviour could be generalised to other New Zealand locations and energy-efficiency innovations.

No effect by the version they received was found suggesting that the *Jimmys* unwillingness-to-pay the full amount for the innovation was more appropriately viewed as the 'discount' they require rather than as an indication of the innovation's 'ideal' price. That is, regardless of the cost or benefit level presented, it appeared as though the *Jimmys* were only WTP a small percentage (approximately 26%) of the actual cost.

4. Chapter Conclusion

The purpose of this study was to identify (see section 1.1): 1 - whether homeowners are showing an *apparent disconnect*; 2 – what percentage of homeowners show *disconnected* behaviour; and 3 - why they behave this way.

This first objective was achieved with the use of CV scenarios and WTP responses as an econometric measure to group respondents who showed similar departures from 'rationality'. This dependent measure was constructed through a segmentation process that separated respondents who were inconsistent or 'mistaken' in their logic from those who showed considered responses.

The results showed a massive bias in the sample of homeowners not following economic rationality. For the purposes of this research, this large group of homeowners who displayed *disconnected* (41% of the responding sample) were labelled '*Jimmys*'. Through a survey design that asked respondents to reflect on their own logic, it was shown that these homeowners were aware of their apparently unreasonable behaviour to value the energy-efficiency innovations at a price lower than that set by the contingent market. This finding suggests that the *Jimmys disconnected* behaviour is not simply a cognitive or unconscious error, but that they believe they have some reason to behave this way. The lack of sensitivity to the innovations' costs and benefits further suggested that their behaviour was motivated by something more complex than simple cost structures. That is, regardless of how cheap or expensive the innovation was, the *Jimmys* appeared to be 'systematically unreasonable' in that they required a substantial 'discount' to acquire the innovation that they knew would save them money.

In order to reveal what was different about the logic underlying the *Jimmys disconnected* behaviour, the *Jimmys* responses were compared to a key reference group: the *Nigels*. Compared to the *Nigels*, the *Jimmys* were not distinguishable on any psychological, demographic, personal, dwelling or household factor. Apart from being unwilling-to-pay for more than 4.4 years (on average), the only other significant influences on the *Jimmys* behaviour were found to be social in nature. The lack of an obvious explanation for the *Jimmys* behaviour supports hypothesis H3 and the use of a mixed methods approach, as it suggests that the results from a single study cannot explain the nature of this apparently complex phenomenon.

To summarise, this chapter presented the results from study 2: a survey designed to identify *disconnected* behaviour and homeowners reasons for engaging in this behaviour. However, this survey only gave the products; the results of the numerous considerations respondents went through to produce these final responses. It is likely that further explanation for homeowners' *disconnected* behaviour lies in these thought processes. To quote Schkade and Payne (1994), "the process is just as important as the product." The following chapter presents a study designed to reveal these thought processes.

Chapter 8. Study 3: Think-Aloud Interviews

“Oh you want me to talk! Cool!”

(Research Participant: *Jimmy #6*)

The previous chapter presented the results from study 2 of the mixed methods approach. While some factors relating to the social context were found to distinguish the *Jimmys* from the *Nigels*, no single factor came through as the dominant explanation for the *Jimmys disconnected* behaviour.

A major limitation of the CV scenarios and survey approach used in study 2 was its hypothetical nature and inability to reveal the underlying thought processes that lead to the *Jimmys* final responses. For example, if the WTP responses from study 2 were interpreted on their own, it could have been concluded that the *Jimmys* were just economically unreasonable: “*But I’d think that you know, a lot of people want to get something for nothing and so umm... they’d be trying to make it more beneficial so they would probably pay less... (Jimmy #30)!*”

As introduced in Chapter 6, the verbal report (VR) method provided a way to overcome this limitation and uncover the underlying motivations that may otherwise remain hidden. This chapter describes the second experimental study (referred to as ‘study 3’) that used this VR method to provide a qualitative interpretation to the results from study 2.

The thematic analysis conducted identifies two types of themes. The first, ‘*Disconnected Behaviour*’, describes the dissonance in the *Jimmys* responses; whilst the second, ‘*Rationales for Behaviour*’, encompasses the reasons they expressed for this behaviour. A content analysis of the CV scenarios also illustrates that different ‘types’ of considerations are used depending on the nature of the good being valued (private or public) and the characteristics of the task and context.

Further, a similar pattern of results is found when comparing the results from this study to the results from study 2. This suggests that participants’ responses were not affected by the additional verbalisation task, and, that the *Jimmys disconnected* behaviour is a consistent reality and robust phenomenon (as per hypothesis H2).

1. Study 3: Think-Aloud Interviews

1.1. Interview Objectives

The purpose of this study was to gain an understanding of the thought processes behind participants' responses. While responses to the survey used in study 2 provided quantitative results, little insight was gained about the decision rules and processes that were applied to make these decisions. This study was therefore used to explore further the many factors as outlined in chapter 3 that could be causing an *apparent disconnect*, especially those not measured directly in study 2. Thus, hypothesis H3 - that no single explanation or discipline can explain homeowners *apparent disconnect* – was also tested in this study.

While the motivations behind *disconnected* responses were of primary interest, this study also provided a means to test the reliability of the CV method and survey approach. Many unsubstantiated hypotheses have been put forward as to how respondents determine their WTP responses in CV scenarios (Schkade and Payne, 1994). However, it was not until 1994 when Schkade and Payne applied this technique from cognitive psychology⁴⁴ to CV surveys, that a more informed insight was gained. According to Baker et al (2008), there are only four known studies that have applied the VR method to CVM: Chilton, Covey, Jones-Lee, Loomes and Metcalf (2004), Schkade and Payne (1994), Smith (2007), and Svedsater (2003). The topics of interest for these studies included saving birds from an environmental hazard (oil on ponds), the benefits of healthcare, and global warming. Given this small number of studies and the lack of application to housing energy-efficiency, this study therefore adds to Schkade and Payne's (1994) initial results.

Comparing the results from this study to those of study 2 also enabled an understanding of: 1 - whether the verbalisation task influenced responses, and 2 – whether *disconnected* behaviour is a robust phenomenon in that it can be observed in two different samples (H2).

The objectives of study 3 therefore were to:

1. Provide an in-depth understanding of the motivations behind *disconnected* behaviour;
2. Understand the processes respondents went through when answering the CV scenarios;
3. Understand how the additional verbalisation task may have influenced responses;
4. Understand how robust any observations of *disconnected* behaviour were.

⁴⁴ From Ericsson and Simon's (1999) work on 'verbal protocols' in particular.

1.2. Interview Design

The success of VRs is largely determined on whether participants simply talk aloud and say whatever comes to mind as opposed to trying to explain their thoughts. Subsequently, Ericsson and Simon (1999) stress the benefit of gathering verbal reports (VRs) during the task (as opposed to after) as it is easier for respondents to verbalise the contents of their short-term or working memories as they occur. These are referred to as ‘concurrent VRs’ (Ericsson and Simon, 1999). Further, because the alternative, ‘retrospective VRs’, are often incomplete and subject to post-rationalisations (Carroll and Johnson, 1990), concurrent VRs were considered most suited for this research.

1.2.1. Verbalisation Instructions

The VR instructions used in this study were developed from previous studies (Ericsson and Simon, 1999; Smith, 2007; Svedsater, 2003). These instructions also have implications for the success of the VR method as the additional task of verbalising could interfere and change the structure of respondents’ thought processes from what would occur under normal experimental conditions, such as in study 2 (Carroll and Johnson, 1990; Ericsson and Simon, 1999). For example, Wilson (1994) found that asking people to think about the reasons for their decisions tended to focus their attention on words that were easily accessible in memory and less so on concepts harder to verbalise. To help overcome this potential for bias, respondents were told to imagine that they were ‘talking to themselves’ or participating on the game show *‘Who Wants to Be a Millionaire’*.

As recommended (Carroll and Johnson, 1990; Ericsson and Simon, 1999), these instructions informed participants that they should keep talking throughout the survey and that they may be prompted to continue if they fall silent for “any length of time”. Compared to a conventional interview, these prompts are the only interaction a VR interviewer has with the respondent. While Ericsson and Simon (1999) have found these prompts to have little affect on the verbalisations, it was important that these prompts were “neutral and nondirective statements (Schkade and Payne, 1994)” to avoid making the VR task seem more important than the survey questions.

Warm-up exercises are also important as they allow respondents to become familiar with the task of verbalising (Carroll and Johnson, 1990; Ericsson and Simon, 1999). The exercises chosen for this study were adapted from examples that Ericsson and Simon (1999) and

Smith (2007) have found to work well. A copy of the VR instructions and warm-up exercises can be found in Appendix F.

1.2.2. Survey Instrument

The same survey instrument used in study 2 was used for this study apart from the addition of two important questions relating to the VR task. These were:

1. **How did you come up with this amount and length of time?** *Please just think-aloud for this question*
2. **How difficult were questions X and Y to answer? Why?** *Please just think-aloud for this question*

These two questions occurred after each WTP question. A symbol of a stylised figure holding a megaphone (see Appendix F) was also placed at these points as a visual prompt to remind respondents to think-aloud.

The first of these two questions was intended to engage respondents with the verbalisation task in case they had not already been talking. This question was observed to elicit more in-depth responses than was obtained without this prompt.

The second question was included due to Schkade and Payne's (1994) findings that respondents who found the questions difficult to answer and who were not very confident with their answers, tended to give a higher number. They believed that this reflected a "somewhat shallow" thought process. It was considered superfluous to ask both questions (difficulty and confidence) in this research given that Schkade and Payne (1994) found a significant negative relationship between difficulty and confidence: respondents who found the question harder to answer were less confident.

Due to the qualitative nature of this study and the small sample used (see section 1.3.2 below), only one version of the survey was tested. This ensured that the sample was large enough to draw conclusions from and to compare to at least one version from study 2. Schkade and Payne's (1994) findings also provide support for using only one version. They found that despite testing different levels of birds saved (2,000, 20,000, or 200,000) no significant difference was observed in the 'types' of responses given at these different levels. To test this assumption however, two different levels were used during the pilot of the survey (as discussed in chapter 7, section 1.4.1). Similar to Schkade and Payne (1994), it was found that respondents answered both scenarios with the same 'mind-set' despite the scenarios having different levels of cost, energy savings, and innovations associated with

them. The final version used in this study was 'Version 5' in which DG and SWH were valued at the 20%-benefit and \$7,000-cost level (see table 3 in chapter 7, section 1.2.1). This version was chosen on no other basis than that it represented the 'middle' cost.

1.3. Sample Design

1.3.1. Sample Population

This study used the same target population as study 2: suburban owner-occupiers. Participants were sampled from the Wellington region. While this posed a potential limitation in that this sample population was from a different region to study 2 (Auckland and Canterbury), the lack of any regional effects from study 2 suggested that this was not an issue. Further, if geographic or climatic factors were an influence on respondents' decisions, it was believed that these would be reflected or commented upon in the verbalisations.

1.3.2. Sample Size

A sample of 30 people was used for this study due to the time intensive nature of the process and the different objectives of this study compared to study 2. While little statistical significance can be attached to the overall quantitative data generated from this small sample, it was considered sufficient to illustrate common trends within participants' verbalisations. Further, 30 responses is generally considered the minimum sample size for making population estimates (Salkind, 2007).

The sample size used was also consistent with what other VR type studies have used. For example, Chilton et al (2004) conducted VR interviews with 26 people. Their purpose was similar to this study in that it was not to gather a representative sample but to conduct a 'follow-up' study to their previous WTP-study. The 'Sustainable Consumption Roundtable's' research also chose to conduct in-depth interviews with 30 households in order to explore different groups' roles in driving change towards sustainable consumption (NCC et al, 2006).

1.3.3. Sample Selection

Friends, family, and work colleagues were asked for suggestions of homeowners they knew who might be willing to participate in the research. This method was used so that participants were unknown to the researcher. While a volunteer approach is considered a weak method of sampling because of self-selection biases (that is, differences between

volunteers and non-volunteers) (Cozby, 2001), because the same segmentation process as study 2 was used and the objective of this study was to provide the corresponding qualitative evidence to the quantitative evidence gained in study 2, this was not considered an issue.

1.4. Data Collection

Participants responded to the survey individually in the presence of the interviewer. The interviews were conducted in a range of locations that suited the respondent (for example, at their home, their office, or in a meeting room at work). The interviews were recorded on an 'iPod' with a microphone attachment for later transcribing and coding. Participants' worked at their pace. The average time participants took to talk through the survey was 33.34 mins (Max: 59.52 minutes; Min: 20.42 minutes).

As Ericsson and Simon (1999) also found, respondents soon became accustomed to the presence of the interviewer and recording equipment as they became engaged in the task. While some respondents did note the presence of the interviewer, these situational factors were believed to have little influence on respondents' verbalisations because these respondents said the presence of the interviewer actually helped them 'think-aloud'. This was because they could pretend that they were talking to someone (even though they knew the interviewer could not respond).

2. Analysis

2.1. Data Entry and Transcription

The interviews were downloaded into 'iTunes' and transcribed into a word template. One person transcribed and coded the verbalisations. It was therefore undetermined how reliable the transcription and coding processes were.

As a conversation, discourse or narrative analysis was not undertaken (see the following section), a high level of detail in transcriptions was not needed (Braun and Clarke, 2006). However, a verbatim account of all verbal and non-verbal utterances (for example 'laughter') and punctuation was made in the transcripts so that a true account of respondents' intended meanings was retained.

2.2. Analysis Methods

The range of available analysis methods for this study varied from qualitative approaches such as thematic analysis, discourse analysis, conversation analysis, narrative analysis, protocol analysis and grounded theory methods, to more quantitative approaches such as content analysis (Baker et al, 2008; Braun and Clarke, 2006).

Given the different objectives of this study, three analysis approaches were necessary:

1. **Thematic Analysis**
2. **Content Analysis**
3. **Comparison to Study 2**

2.2.1. Thematic Analysis

A thematic analysis was performed to inform objective 1 of this study. While the following content analysis looked more specifically at the conscious thought processes respondents gave, this thematic analysis sought to uncover the underlying reasons for *disconnected* behaviour through a more holistic perspective of respondents' thought-streams. That is, the aim of this thematic analysis was to identify repeated patterns that could be defining the *Jimmys disconnected* behaviour.

The thematic analysis method was chosen over the other possible analytic methods due to its approach to search for themes across individuals as opposed to within one particular data

item as narrative analysis, interpretative phenomenological analysis or case-study approaches tend to (Braun and Clarke, 2006). Although the analysis was not theoretically bound, it did have a specific research question in mind, thus deeming a grounded theory approach inappropriate (Henwood and Pidgeon, 1992). Finally, as the focus was on the themes or patterns of interest to the research question, and not on the use of language or problem solving processes used, an approach based on discourse, conversation, or protocol analysis was unsuitable (Braun and Clarke, 2006; Ericsson and Simon, 1999). A thematic analysis approach has also been used by other researchers utilising this mix of CVM with a qualitative application (see Baker et al (2008) and Vadrnjak and O'Connor (1994)).

An exploratory approach was used and the thematic analysis was considered data-driven in that no pre-existing coding frame was used (Braun and Clarke, 2006), unlike the following content analysis.

The thematic analysis was conducted on the *Jimmys* responses only. The same process used in study 2 was used to determine which respondents were '*Jimmys*' (see chapter 7, section 2.4). While there were only eleven *Jimmys* in this data-set, each data-item (transcript) was analysed in its entirety. This is in contrast to the content analysis which only analysed the four WTP questions (see the following section).

Similar to Vadrnjak and O'Connor (1994), this thematic analysis was viewed as a process to distil the *Jimmys* remarks around key themes that became clear through the process. This was performed as recommended by Braun and Clarke (2006). That is, each verbalisation was initially coded to encompass the key idea(s) it was believed the respondent was expressing. This was performed manually and each extract could have had numerous codes. These initial codes were then collated into potential themes and reviewed visually through a 'thematic map'. This review highlighted how the codes 'worked' in relation to each other to form sub-themes and themes. It also identified where labels needed to be changed to better encompass the common ideas being expressed. The transcripts were then re-coded to reflect this review and the same process of grouping codes into themes and reviewing them was repeated until all coded extracts under each theme read together coherently. This reductive process meant that the complexity inherent in the initial transcripts was narrowed down to key concepts and themes. These final themes were believed to represent the common driving views amongst the *Jimmys*. The prevalence of these themes was measured in terms of how many *Jimmys* articulated the theme and by how many times it was mentioned across the entire data-set (Braun and Clarke, 2006).

Two types of themes were identified. The first, *'Disconnected Behaviour'*, described the dissonance in the *Jimmys* responses; whilst the second, their *'Rationales for Behaviour'*, encompassed the reasons they expressed for this behaviour. The following diagram displays the final thematic map showing these two types, the three main themes, the eleven sub-themes, and their final labels that were thought to capture the essence of each theme.

Figure 3: Final Thematic Map

2.2.2. Content Analysis

A content analysis was undertaken for the purpose of objective 2. In particular, an insight was needed into whether respondents showed economic reasoning as this had implications for the validity of their WTP responses.

This would also have theoretical implications as previous researchers have found evidence against the underlying presumptions of CVM (Carson and Mitchell, 1993; Schkade and Payne, 1994). That is, factors, that according to economic theory ought to form the basis for WTP values (for example, the scope of the problem, the personal worth of the good, or how much they could afford to pay), have been shown to be infrequently considered (Vadnjaj and

O'Connor, 1994; Svedsater, 2003). For example, Vadsdal and O'Connor (1994) found that respondents more often expressed social norms when deciding how Rangitoto Island should be developed, rather than using economic reasoning. Schkade and Payne (1994) demonstrate however that although direct references to economic trade-offs are not always present (that is, where the payment will 'come from'), some form of economic reasoning tends to be evident in participants' VRs. They therefore concluded that whether respondents refer to economic reasoning or not in their VRs is not a limitation of the method, but rather, a reflection of participants' thought processes.

So that the results were comparable to previous studies that have sought to document the processes respondents go through in CV surveys, pre-defined categories established from these previous studies were used. The previous studies included: Baker et al (2008), Chilton et al (2004), Kahneman and Knetsch (1992), Schkade and Payne (1994), Smith (2007), and Svedsater (2003). These categories were adapted where needed and additional categories were added to cover the nature of respondents' verbalisations in the context of this research. For example, a 'reference to household situation' category was included to account for contextual variables of their house, household occupants and living situations. These categories and the previous researchers who have used them were:

1. **Reference to the innovation or good provided** (Schkade and Payne, 1994; Svedsater, 2003). Do respondents refer to the innovation or its characteristics? For example the cost, savings, benefits or disadvantages?
2. **Reference to economic reasoning** (Baker et al, 2008; Chilton et al, 2004; Kahneman and Knetsch, 1992; Schkade and Payne, 1994; Smith, 2007; Svedsater, 2003). This category documented any reference the respondent made to their personal economic situation or an expenditure category (or mental budget) that was used as a guide to form responses or from which the WTP amount would come from. This is referred to as 'mental accounting'. Any references to repayment characteristics (for example interest rates or pay-back time) were also documented.
3. **Reference to household situation.** Do respondents refer to their personal or household situation? For example, the suitability/compatibility of their house to the innovation, the length they plan to stay in their house, any recent improvements, and the opinions of other household members.
4. **Reference to any details of the CV scenario** (Baker et al, 2008; Chilton et al, 2004; Schkade and Payne, 1994; Svedsater, 2003). This category included documented any

reference to the agency providing the good (for example issues of fairness or outrage) or to the characteristics of the payment vehicle (for example the number of others contributing or the length of time they were WTP for). Notions of doubt towards the validity of the information provided in the CV scenarios were also measured.

5. **Reference to other solutions and considerations** (Baker et al, 2008; Chilton et al, 2004; Svedsater, 2003). This category included references to alternative solutions (for example other technologies or payment methods), as well as references to other environmental or social concerns. References to how they felt about making this payment (for example moral satisfaction) were also measured.
6. **Miscellaneous** (Schkade and Payne, 1994; Svedsater, 2003). This category included responses that were made up or guessed, where no reason was given, 'don't know' responses, and when participants stated that they needed more information.
7. **Response Characteristics.** The purpose of this category was to understand how respondents understood and interacted with the task and context. For example, did they treat the process as a maths exercise, did they show a misconception, did they refer to the previous scenario, or did they already appear to have well-defined preferences for the innovation before reading the simulated CV scenario. This category would also help validate that the segmentation approach used was accurate in distinguishing different 'groups' of homeowners.

As highlighted earlier, the second category, whether respondents show 'economic reasoning', was of particular interest to this research. One aspect of this was whether respondents demonstrated 'mental accounting'. This describes the phenomenon when people have a set notional budget from which they use to assign a WTP amount. For example, Schkade and Payne (1994) found that 17% of respondents seemed to have a pre-defined budget for charities (a 'good cause account') which they used as the point of reference for their WTP amount, and Svedsater (2003) also found a small number of his respondents to use their previous spending on charities as a guide for their WTP values.

Whether respondents' show such economic reasoning was important as a lack of consideration could suggest insensitivity in WTP responses and that they were not engaging realistically with the contingent market (Baker et al, 2008; Smith, 2007). For example, one problem associated with WTP responses is that respondents may choose to ignore normal

expenditure and savings patterns in order to avoid having to make a trade-off between the good they are required to value with other things they value. As Baker et al, (2008) describe: “in stating a WTP that leaves normal expenditure and savings patterns untouched, respondents are avoiding making difficult trade offs between the good being valued and all the other things they value.” Kahneman and Knetsch (1992) therefore argue that in order for a respondent to understand what is being asked of them, they must realise that the WTP contribution must mean a reduction in spending elsewhere. That is, they must give an indication of how they would actually pay for the good by being realistic about their other costs and what this repayment would mean to their economic situation.

The fourth category, ‘reference to details of the CV scenario’, was also important for establishing how reliable responses were. This is because other researchers have found that scepticism towards the scenario’s details can influence WTP valuations. For example, Baker et al (2008) found such scepticism to occur towards the agency who would deliver the good, especially if the payment vehicle was a form of taxation payment or through a private company. Baker et al (2008) term this scepticism a ‘lack of trust’. ‘Moral outrage’ has been shown to occur when either the respondent has an issue with ‘who should pay’ or when they are “asked to place a value on a good they feel is inappropriate to consider in monetary terms (Baker et al, 2008)”. For example, homeowners may have an issue with the individual consumer paying towards the cost of building renewable electricity infrastructure if it appears that a private company will ultimately profit.

All respondents (the data corpus) were analysed in this content analysis regardless of their segmentation group (for example, *Jimmy* or *Nigel*). Unfortunately there were no *Nigels* or *Garys* in this sample to comment on the nature of their considerations to the WTP questions.

Only the two WTP questions (monthly amount and length of time) and their two follow-up VR questions (see section 1.2.2) were analysed for this content analysis in an approach similar to Schkade and Payne (1994). A distinction was made between the four different CV scenarios: the two private energy-efficiency innovations (DG and SWH) and the two public good scenarios (renewable infrastructure and habitat restoration).

Like Schkade and Payne (1994), a dummy variable (0-1) was used to indicate whether each coding category was present in a respondent’s verbalisations or not. A respondent could only be coded once for each consideration regardless of how many times they referenced it.

2.2.3. Comparison to Study 2

To satisfy objective 3, studies 2 and 3 were compared to see if they were similar on key WTP responses.

One concern of using the VR method is that the additional verbalisation task could cause respondents to behave differently and therefore elicit different responses to what would occur in a 'normal' CV study (Schkade and Payne, 1994). This is referred to as the *effect-of-verbalisation* bias (Ericsson and Simon, 1999) or the *reactive-effects* issue (Crutcher, 1994). For example, the verbalisation process may make respondents actively negotiate their decisions more so than they would in reality or make them more inclined to rationalise their decisions (as discussed in chapter 6, section 1). Lehrer (2009) also comments on this problem, albeit from a slightly different perspective. He suggests that in some cases too much conscious self-analysis can actually lead to less self-awareness, as over-thinking can lead respondents to weigh the relevant and irrelevant variables incorrectly (Lehrer, 2009).

However, Ericsson and Simon (1999), in their comprehensive review of verbalisation studies, found little evidence to suggest that VRs affect the speed, accuracy, memory or types of decisions made. Schkade and Payne (1994) also provide evidence against this bias with the finding that the results from their VR study were similar to the original study without the VR application. Despite comparing numerous statistics (for example WTP values, means, medians, modal responses, % of zero-responses, and log-normal distributions of nonzero responses), they found the same pattern of results. They therefore concluded that it was unlikely that the task of 'thinking aloud' substantially altered the processes normally used. While Schkade and Payne's (1994) results suggest that differences are unlikely, the results from study 2 were compared with the results from this study to ensure that the verbalisation process did not affect respondents' WTP responses.

This comparison process with study 2 also provided a means to assess objective 4 of this study. That is, by comparing the distributions of the responding samples, an indication of how robust observations of *disconnected* behaviour were (as per hypothesis H2) could be gained.

3. Results

This section describes the results from the three different analyses. The first section presents the results from the thematic analysis of the *Jimmys* verbalisations. Each theme and its sub-themes are described followed by an account of how prevalent each theme was.

The second section describes the considerations commonly used in the CV scenarios as informed by the content analysis. A comparison between the segmentation groups also illustrates the differences in their response characteristics.

The third section addresses the question of whether the verbalisation task influenced participants' responses by comparing key WTP statistics from studies 2 and 3. The samples from studies 2 and 3 are also compared in this section to identify how robust the observed phenomenon of the *Jimmys* and their *disconnected* behaviour is.

Two other concerns with the use of VRs are that respondents may fail to verbalise some of the information that passes through their short-term memory and that the verbalisations may be independent of the actual thought processes. These are known as the *incompleteness* and *irrelevance* arguments (Ericsson and Simon, 1999) (the latter is also referred to as the problem of *epiphenomenality* or *validity* issue (Crutcher, 1994; Ericsson and Simon, 1999)). This raises the question of whether the information contained in respondents' VRs is an accurate reflection of their thought processes. For example, one reason why they may not be is due to information becoming 'automatised' or because some thoughts are hard to represent verbally (Ericsson and Simon, 1999; Wilson, 1994). Consequently, only information that is conscious, attended to in short-term memory and easy to verbalise is measured (Crutcher, 1994). This issue of whether non-conscious processing occurs and is untapped in verbalisations has been largely ignored by previous researchers, who prefer instead to argue that such processing is rare (Wilson, 1994). Ericsson and Simon (1999) suggest that if a verbalisation can be shown to meet three criteria (relevance, consistency and memory) then it "could only be produced by a processing mechanism similar to the one performing the task". However, others argue that ultimately there is no true way to know how complete the VRs are (Wilson, 1994; Schkade and Payne; 1994). Subsequently, the results reported in the following sections should only be viewed as a partial representation of respondents thought processes.

3.1. Thematic Analysis: Underlying Motivations

3.1.1. Prevalence of Themes

The following table summarises the number of *Jimmys* (out of 11) who articulated each theme at least once during their verbalisations. Each theme was referenced by at least two-thirds of the *Jimmys* suggesting that the thematic analysis uncovered common themes.

Table 15: Prevalence of Themes

	Themes and Sub-Themes	# of <i>Jimmys</i>	% of <i>Jimmys</i>
Type-1 Themes: 'Disconnected Behaviour'	'Angels and Demons'		
	<i>I'm usual; I'm unusual</i>	11	100%
	<i>I'm a citizen; I'm a consumer</i>	11	100%
	<i>I'll trust you; I don't trust you</i>	10	91%
Type-2 Themes: 'Rationales for Behaviour'	'I'm sticking with what I know'		
	<i>It's not worth it</i>	10	91%
	<i>I can't think that far ahead</i>	11	100%
	<i>I need to weigh everything up</i>	9	82%
	<i>I don't know enough</i>	9	82%
	'I will if you will'		
	<i>It's not just up to me</i>	10	91%
	<i>That's not fair!</i>	7	64%
	<i>What will others think?</i>	9	82%
	<i>...But don't control me!</i>	7	64%

The sub-themes under *'Angels and Demons'* (type-1) demonstrated that all *Jimmys* showed some form of inconsistency in their thought processes. In terms of the rationales for their behaviours (type-2), the most commonly reported beliefs were: issues of commitment and long-term thinking (*'I can't think that far ahead'*); that the innovations were not suitable to their context (*'It's not worth it'*); and references to others actions (*'It's not just up to me'*).

Table 16 shows the frequency each theme was mentioned across the entire data-set. This table also demonstrates the average (mean), minimum, and maximum number of times each theme was articulated by an individual *Jimmy*. A break-down by each respondent can be found in Appendix G.

Table 16: Frequency Each Theme was Mentioned

Themes and Sub-Themes	Mean (Min, Max)	Frequency
'Angels and Demons'		
<i>I'm Usual; I'm Unusual</i>	6.64 (4, 12)	73
<i>I'm a Citizen; I'm a Consumer</i>	9.00 (1, 16)	99
<i>I'll trust you; I don't trust you</i>	3.45 (0, 7)	38
Subtotal	19.09 (5, 33)	210
'I'm sticking with what I know'		
<i>It's not worth it</i>	2.73 (0, 5)	30
<i>I can't think that far ahead</i>	2.27 (1, 4)	25
<i>I need to weigh everything up</i>	2.00 (0, 4)	22
<i>I don't know enough</i>	2.91 (0, 4)	32
Subtotal	9.91 (14, 58)	109
'I will if you will'		
<i>It's not just up to me</i>	1.91 (0, 4)	21
<i>That's not fair!</i>	1.09 (0, 3)	11
<i>What will others think?</i>	2.09 (0, 7)	23
<i>...but don't control me!</i>	1.00 (0, 3)	11
Subtotal	6.18 (1, 12)	66
TOTAL	35.00 (14, 56)	385

3.1.2. 'Angels and Demons'

The 'Angels and Demons' theme neatly summarised the *Jimmys* behaviour: an *apparent disconnect* or disparity in their views. It showed the numerous instances where the *Jimmys* displayed inconsistencies in their thoughts or motivations.

These inconsistencies were categorised into three sub-themes:

- **'I'm usual; I'm unusual'** reflected a view of themselves as being similar yet different to the 'average-other' homeowner;
- **'I'm a citizen; I'm a consumer'** demonstrated a value orientation that was *both* altruistic/biospheric and egoistic in nature;
- **'I'll trust you; I don't trust you'** illustrated a confidence *and* lack of confidence towards advice from experts and the motives of government and private companies.

The dominance of these themes in the *Jimmys* thoughts could be interpreted to suggest that contradiction leads to inaction; an idea similar to the cognitive dissonance explanation Samuelson and Zeckhauser (1988) propose for status quo biases. This idea is explored further in chapter 9 (section 3.2).

3.1.2.1. *I'm usual; I'm unusual*

This sub-theme was formed to illustrate how the *Jimmys* would use others as either an excuse or justification for their behaviour. In particular, 'I'm usual' was used as a justification with the underlying idea that 'everyone else is just like me so my behaviour is okay':

"I would say the average or typical New Zealand household would probably pay about the same if not slightly less because we're not long term thinkers New Zealand are we (Jimmy #23)?!"

'I'm unusual' was often used as a way to relieve guilt or dissonance through the idea that 'I may not be paying or doing much, but I am still better than everyone else because they would do even less than me'. That is, the 'average-other' homeowner is worse than I am:

"I suspect an average typical New Zealand house would not really be willing to pay anything towards it. So I would say less (Jimmy #15)."

"Umm... I guess I would say I make more of an effort than a typical NZ household but that's consistent you know its not just when we are told to reduce energy... umm... so probably more (Jimmy #8)."

'I'm unusual' was also used as an excuse for their behaviour through the idea that their house or household situation was not suitable or compatible to the innovation. Therefore, it was not worth their while to pay more for the innovation because they would not benefit as much as others would:

"Umm maybe 10 just cos my house isn't that good (Jimmy #22)."

"But I think overall and if I was in a bigger house, a government scheme that provided double glazing with no interest would probably interest me a lot more than if I was in this house (Jimmy #12)."

Some *Jimmys* also demonstrated this disparity in being 'usual' but 'unusual' within a single thought-stream:

"Argh average... the average New Zealand house... umm 'jees' that's hard to know, I think I would say about the same... total cost... but they might just configure it differently. They might be willing to go for longer but possibly at a lower... less than \$100 a month, \$100 is probably a bit tight for most people. Yeah I think total cost about the same (Jimmy #21)."

While these comments could be justified reasons for their *disconnected* behaviour, it was more likely that they were excuses because if the *Jimmys* situation really was not suitable, then why be WTP something? That is, why not behave like a *Derrick* and pay nothing?

3.1.2.2. *I'm a citizen; I'm a consumer*

As others studying environmental problems have found (Sagoff, 2008; Ritov and Kahneman, 1997), the 'I'm a citizen; I'm a consumer' sub-theme revealed the tension homeowners felt between what they want to do with what they think they should do. That is, while they wanted to act for their own private interests, they also thought that they ought to act for the benefit of the wider public. This is known as a *citizen-consumer* discrepancy (a concept introduced in chapter 3, section 2.1). As Sagoff (2008) describes, it appears that "the individual [homeowner] as a self-interested consumer opposes himself as a moral agent and a concerned citizen."

This theme corresponds to the findings of study 2 (chapter 7, section 3.2) in that the *Jimmys* showed both an *egoistic* and *altruistic value orientation*. The *Jimmys* 'consumer' (or egoistic) side was characterised through their considerations of the innovations' costs, benefits and payback periods:

"Well I think if it's a major contributor, the solar water heating, looking to save 20% on your hot water bill, again for the cost of putting it in, how long is it going to take you to recover the cost, and we calculated that to 14 years at those costs. It takes a long time to recover the outlay if you're only looking at a short-term... hmm with that, the saving would probably go up as the electricity went up to. Well I'd like to think that 20% was too low. Cos I'd like to think that if you were going to put a solar water heating system in, for the cost, it would do the major part of the work, so that you're only losing electricity to prop it up perhaps during the winter time or a cold week (Jimmy #10)."

"Do I personally feel pressure to reduce my power bills? Only to try... to try and get the power bills down, not necessarily for environmental issues (Jimmy #23)."

While the *Jimmys* were predominantly 'consumers', most (82%) also showed hints of 'citizenry' (or altruistic) traits in that they considered broader environmental and social concerns:

"Yeah I don't like flooding our land. I don't like people being displaced. I don't like orchards being flooded and I think natural disasters get rid of enough of our property without us doing it ourselves (Jimmy #22)."

Again, an individual *Jimmy* could show a discrepancy between their differing citizenry and consumer values within a single thought-stream:

"Yeah I don't know that I would necessarily get satisfaction out of it... I don't know I suppose it is sort of an obligation really... hmmm yeah its not that I don't think it is a good thing... but I think it is... rather than feeling all sort of warm and fuzzy about it, I think it is, you know what we should probably do so... having said that its not like I wouldn't get any satisfaction at all from knowing that that was what was"

being done... middle again... there you go, nice and safe, sit on the fence! (Jimmy #8)."

"I should do whatever I can to prevent my house from being energy hungry. I should do, I agree with that. But it costs a lot of money (Jimmy #15)."

"It's quite tricky because there are a lot of variables. You know you have to think about other things that we want to spend our money on. Umm...What are the benefits for example compared to the system that we have at the moment "It's quite nice to think that you're using the sun to heat your... you know... it's kind of that... irrational kind of emotional thing as well... umm yeah... I think the really hard thing is, (it's) quite a lot of money to commit yourself to for the amount of return I think. Although it's good to feel like you're doing something for the environment I guess (Jimmy #23)."

3.1.2.3. I'll trust you; I don't trust you

This sub-theme arose from the observation that the *Jimmys* appeared to accept and show trust in the information they were given in the survey (presumed to be 'the expert'), yet at other times would dispute it. The 'trust in expert' effect appeared to occur when they showed doubt at their own knowledge:

"Well that sounds about right. Hmm about right, I have absolutely no idea what double glazing costs (Jimmy #15)."

"Arrghh... it is my original umm idea, what I thought. I thought it was too high but I will believe you (Jimmy #6)."

"I have no idea actually... maybe about right! I will believe you when you say 20% (Jimmy #16)."

Some *Jimmys* did question the facts they were told and they appeared to be more informed from personal experience or else doubted the suitability of the innovation to their situation:

"Oh, too low for the \$7000 because we only had one door quoted, a set of double doors, and that was nearly \$5000. So I think \$7000 for a whole house is a bit ah... (Jimmy #10)."

"Umm I found that quite hard to answer cos my house is a converted shop and I have different type windows and probably a few less windows than other houses, so it was a 'guesstimate' on how much it would cost, cos I think it would cost less than \$7000, maybe more depending on what kind of windows I guess (Jimmy #22)."

"I think that's a bit low from what I've heard. I think umm... yeah cos you need to have a place to put all the batteries, a little room, you need to upgrade all your batteries all the time. So maybe is for installation of the panels, but then when you get all your wiring and that stuff sorted it might be a bit low (Jimmy #21)."

Elements of mistrust towards power companies (in particular) and government were observed:

"I guess saving money is kind of the big issue but also the feeling good about you know... reducing carbon emissions and not relying on power companies which are probably going to keep putting their prices up... so umm... reliant on power companies (Jimmy #8)."

"Umm okay so how much would I be prepared to pay towards the cost of building a new hydro-electric dam? I'd say I would pay \$5 per month towards that but umm I'd want to think that if you were paying something like that every month you could really trust the power companies to be fair about what they charge other than that (Jimmy #12)."

"I'll be dead by then! On top of my power bill! Okay... well my instant reply to this would be that they are making shit loads of money already from us and umm the fact that the commerce commission is now sitting on the gas companies to reduce their price, they are overpriced... so we are already contributing to it (Jimmy #16)."

While this mistrust or outrage towards power companies could have been an unintended influence from media-hype over directors' salaries at the time of sampling (see chapter 7, section 1.4), it none-the-less highlights how important a sense of trust is to the *Jimmys*.

Again, a *Jimmy* could show a perception of trust and lack of trust within a single response, highlighting their confusion over whether to believe claims from 'so-called experts' and whom to trust:

"\$7000 sounds like a lot to me but I've got no idea how much it costs so umm... yeah and I guess a typical NZ house is bigger than this house so I'll tick too high just because that's what I think but I'll believe it (Jimmy #12)."

"It sounds quite high to me actually but didn't you give me the information back here... (Jimmy #23)."

"Umm... this is funny... because if it is privately owned, it is a different way of thinking. If it is a privately owned company that has to go changing from its coal fired – do we have a coal fired power station? If it is a private company changing then I really think that they should be paying because they will be saving too. If it is government owned then... I don't know... (Jimmy #16)."

3.1.2.3. Awareness

The thematic analysis also indicated that the majority (73%) of *Jimmys* were aware of either the apparent discrepancies in their opinions and/or that their responses were egoistically motivated:

"Umm the amount I said I was prepared to pay was much less than what it would cost... umm... so probably a bit unrealistic (Jimmy #12)."

"I have a lot of enthusiasm on a theoretical level; not so good at putting it into action (Jimmy #21)."

"More important concerns... hmm that's a hard one cos u know we should all care about the environment but whether we do or not... well yes I do have more important concerns, sorry. Definitely not environmentally friendly – this is going to be hugely contradictory (Jimmy #23)!"

"Hmm, don't know if I'd do it. Selfishly I think the 'fathing' round would be too much and I would like to know how efficient it is in winter, so hmm... but that's a pretty selfish attitude... I'll say 20... \$50 per month (Jimmy #21)."

"So I think there's a whole educational thing, but then we will also say 'I'm educated, I want to be green and environmentally friendly umm... and it's going to cost me... boo' (Jimmy #26)."

"Hmm it's easy to say reduced carbon emissions, you know put it down on paper but then you have to actually do it, and you have a personal cost to that (Jimmy #21)."

Some *Jimmys* also stated that they were aware that the short periods they were WTP for were unrealistic and that this would not pay the full price back. However, despite this awareness, they still maintained their answer and did not change it in order to suit the survey logic:

"Payback for? I'd be prepared to pay that for however long it took to pay off I think. Which would be... oh no... which would be 233 months, which is 20 years, which is fairly depressing. I'll put 233 months... no actually I won't I'd be prepared to pay that for 36 months which is 3 years, umm so again I am being quite unrealistic (Jimmy #12)."

"Yes... cos if I'm only paying \$35 per month that makes it quite a long time doesn't it. I would have to be prepared to pay for [calculating it out].... Wow! That would be like 20 years! That's a long time. Umm... is this that I would be prepared to pay for, or having said I would pay \$35 per month that's how long I would have to pay for? I'd want to pay for it 5 years – so 5 times... 60 months. So I'm not going to pay it off am I (Jimmy #23)."

In support of the segmentation process and manipulations to the CV scenario (see chapter 7, sections 1.2.1 and 2.4.2), this awareness illustrated that the *Jimmys* were conscious of their thought processes and subsequent decision to under-pay for the innovations. This finding further emphasises the robustness of this phenomenon and that it is not a 'mistake' or unconscious bias.

3.1.3. 'I'm sticking with what I know'

The common thread underlying the 'type-2' themes was the expression of a rationale for their behaviour. The first main theme, 'I'm sticking with what I know', encompassed the numerous observations where the *Jimmys* showed a perception of a risk and an aversion to change. These repeated patterns were predominantly found in the private CV scenarios (DG and SWH) where the *Jimmys* evaluated what the benefits or risks would be to their current situation if they adopted the innovation. The sub-themes showed the various ways this was manifested:

- **'It's not worth it'** demonstrated a desire to reclaim investments (*sunk costs*) either through resale or payback periods. This was influenced by the belief that their house or household situation was not suitable or compatible;
- **'I can't think that far ahead'** showed that the *Jimmys* were hesitant to adopt the innovation because of the commitment it would mean in terms of debt or because future unknowns remained;
- **'I need to weigh everything up'** illustrated the *Jimmys* need to consider all the variables in order to make an 'educated' decision and avoid regret. Competing priorities were also illustrated to be an issue;
- **'I don't know enough'** highlighted a perceived lack-of-knowledge while also suggesting a lack of desire (for example because of 'laziness' or 'inconvenience') to gain this knowledge.

The sub-themes discussed in this section could be interpreted to illustrate that this group of homeowners are conservative and cautious in nature - similar to the early majority group in the 'adoption diffusion' model (for a further discussion see chapter 9, section 3.4). However, similar to the 'I'm unusual' sub-theme, it could also be assumed that the reasoning's they show are actually excuses for their apparently unreasonable behaviour. This is because if it is true that their dwelling or personal context are not suitable, then why did they offer to pay something? Whether these reasons are 'real' barriers to adoption or whether they are just perceived, is explored further in chapter 9 (section 3.3).

3.1.3.1. *It's not worth it*

This sub-theme illustrated scepticism towards the benefits of DG or SWH. In particular, that the innovation was not worth adopting because the initial investment would not be reclaimed due to their dwelling or household situation not being suitable:

"Hmm... how much would I save on my power bill? Cos actually my main source of heating is not electricity, so even though it would be a benefit from having double glazing I wouldn't actually save a huge amount on electricity I guess (Jimmy #8)."

"Well I'm really not sure how long you have to have the sun there for, but we don't have the sun for very long (Jimmy #13)."

"Umm but also that is thinking of this house which I don't think the benefits would be as great as if I was in a bigger house which would cost more for power anyway (Jimmy #12)."

3.1.3.2. *I can't think that far ahead*

This sub-theme described the *Jimmys* aversion to making a commitment when there was a future variable that remained unknown. These future variables included changing circumstances or the length of time they will be in their current house. These findings could also suggest that the *Jimmys* are comparably quite short-term thinkers, focussed on the present and incapable of taking a long-term outlook:

"Umm... I said 3 years just because umm... it seems like a really finite period of time (Jimmy #12)."

"I've the duration based on age and retirement and superannuation. Okay? So what I'm saying here is that I don't want to say for the next 15 years I'll keep paying this off. I'm going to be moving on to something else or forced into other circumstances when I get to that (Jimmy #26)."

"And how did I come up with this length of time... [...] because I hate having things hanging over me for ever and ever and if I thought I was paying it off I mean just psychologically that's a... you know if you think you had to pay 10 or 20 years for it... (Jimmy #23)."

"I just wouldn't want to have an outgoing commitment for any longer than that, it's kind of a debt really and I wouldn't want an outgoing for longer than 36 months at the moment (Jimmy #21)."

"We want to do it but umm it's the same thing we are not sure how long we are going to stay there. If we were going to stay there for 10 years then we definitely would (Jimmy #6)."

The comments expressed under this sub-theme suggest that the *Jimmys* do not believe they will reclaim their initial investment for DG or SWH when they sell their house. Therefore, they did not want to take the risk that they would ‘overpay’ for the innovation:

“Don’t think so. Again, I think it might just make the sale faster but people will not pay more because it is there, they may be happier to put an offer... but maybe those two are connected, I don’t know (Jimmy #16)!”

“... and who knows if I’m going to stay in the house for that long that’s another thing, so whether I actually get the benefit of the 7 thousand dollars (Jimmy #23).”

“Oohh... hmm... I suspect... put 5 grand but only because there maybe other buyers out there that have the same concerns like me about how easy they are to manage and ongoing costs and hassles and the winter thingy so... I don’t think it would devalue it because you can always hook into the normal power supply if you’re not using solar... it’s not like you are going to go cold or without a shower etc, but I’m not sure if the increased valuation would be the same as the double glazing (Jimmy #21).”

“So if you currently own a house as I do with no double glazing, and then anticipating to sell it, I don’t think it would increase the value of your house terribly. But if you were building a new home then I think it would be a good idea to put in the best and latest materials that you could use. So ... I think it might marginally, it might give it an edge over anybody else who hasn’t got double glazing on today’s market. So I will mark it up a little more, not a great deal more, but it might help sell better (Jimmy #10).”

3.1.3.3. I need to weigh everything up

The *Jimmys* conservative nature and aversion to what could be considered ‘risky’ behaviour was demonstrated in this sub-theme. While their apparent need to consider all the variables could be viewed as a way to defer making a commitment or decision, it could also be interpreted that the *Jimmys* are not hedonically driven, but rather, that they like to think through large investment decisions in a reasoned manner:

“I think the difficult thing is to consider all the factors and like again how much you want to stay in that place, how much you are prepared to pay for the whole thing... and umm hoping that the government umm can sponsor part of the expenses. So it is really considering all the factors that makes it a bit harder (Jimmy #6).”

“I suppose they are reasonably hard to answer in one way because you are tossing up that with other things, seems like, you know you could ‘tott’ up quite a bill (Jimmy #15).”

“... Because you’ve got to... you’re juggling other things that you might want to pay for in the mean time (Jimmy #23).”

"I think these were a bit harder because I've heard mixed reviews on the benefits. Not the benefits of solar heating but how, whether the hassle outweighs the benefits. So that was a bit harder to answer I suppose (Jimmy #21)."

This sub-theme also illustrated the effect of *competing priorities* (see chapter 3, section 3.3) on their decisions:

"The problem is when you think about insurance – that is what I am thinking about right now - medical insurance for my wife, my baby and me... is about \$1 per person. And when you pay for that kind of thing, you have to prioritise. And when you start cutting down... shall I pay for this type of insurance, or, should I pay for this which is a more general thing (Jimmy #6)?"

3.1.3.4. I don't know enough

'I don't know enough' demonstrated that the *Jimmys* aversion to taking a risk could also be due to a perceived lack-of-knowledge:

"I don't really know. I don't know whether it's that effective but maybe it is. We're not coming from a lot of experience of this in NZ (Jimmy #26)."

"I know absolutely nothing about solar water heating actually so I've got no idea. I mean isn't solar water heating supposed to completely reduce your... I mean I don't know... I don't even know how it works (Jimmy #23)."

"I'm not going to pay anything for it... I can't see... what I'd have to do is talk to a solar water heating engineer and say this is how I get my power, hot water now and what would solar water heating add to it (Jimmy #26)."

As the Oxera (2006) study also found, it appears that some *Jimmys* perceive a 'cost' in having to gain this knowledge as they showed a disinterest in housing or sustainability related issues and an inconvenience in having to learn about the innovations:

"And so that's how I came up with it. So unless someone could persuade me, I mean tell me, then I might be prepared to cough up a bit more (Jimmy #15)."

"Were difficult because I have no idea, I have never investigated solar water heating (Jimmy #16)."

"I don't know! We've only been there a year and I haven't been up in the ceiling to have a look (Jimmy #23)."

The limits to their knowledge the *Jimmys* show could be interpreted from the perspective of *bounded rationality* (see chapter 3, section 3.1). However when taken in consideration with the results from study 2 (see chapter 7, section 3.7), it could also be that this lack-of-knowledge is a perceptual barrier rather than an actual impediment. This needs to be explored further as chapter 10 (section 2.5) discusses.

3.1.4. 'I will if you will'

The second 'type-2' theme, 'I will if you will', embodied the social influences apparent on the *Jimmys* decisions. The patterns repeated under this theme were predominantly found in the public CV scenarios. As summarised by the four sub-themes, it contained issues of *fairness*, *trust*, *futility*, *behavioural control*, *normative comparisons* and *social identities*:

- **'It's not just up to me'** encompassed the references made to other households, businesses and government also taking action;
- **'That's not fair'** demonstrated that a perception of fairness matters as shown through arguments that the 'polluter- or profiteer-' should pay;
- **'What will others think?'** highlighted a concern for how others might behave and for how others might perceive their actions;
- **'... but don't control me!'** showed a perceived need for behavioural control particularly through reduced reliance on businesses - whose motives were viewed sceptically.

The name of this theme is also the title of the 'Sustainable Consumption Roundtable' report (NCC et al, 2006) which also found this notion of a supportive framework for collective action to be a common theme from their engagement with consumers and businesses:

"But to act, they need the confidence that they will not be acting alone, against the grain and to no purpose. One thing we have observed though, is that both the business world and citizens are increasingly willing to embrace key aspects of a smarter, more sustainable lifestyle, but on one reassurance: that others, whether your neighbour at home or your competitor in business, act likewise – the simple idea of 'I will if you will'. (NCC et al, 2006)."

3.1.4.1. It's not just up to me

Issues of fairness and futility were shown to influence the *Jimmys* decisions through this sub-theme. That is, it appeared as though the *Jimmys* did not want to act alone because it was only fair or beneficial if other households, businesses and government also acted:

"And you know I'm a bit of a believer in trying to do something so I think it would help if everybody paid that (Jimmy #23)."

"Umm I'll put umm 6 ½ umm I'd get some satisfaction from contributing personally but I also think that umm you know the government should be making real efforts, you know if that's what it takes then they should find a way to do that, umm... you know cos from taxes or whatever as well (Jimmy #12)."

"No I disagree; everyone has a responsibility (Jimmy #15)."

"Yes now that's a common feeling I get... what difference does my action make... yeah... and I'm unsure about that. I mean I still do it, but I do wonder what difference it will make if everyone else is chucking 'their' rubbish out. We've actually changed to putting our stuff in the compost bin now (Jimmy #10)."

3.1.4.2. That's not fair!

This sub-theme was predominantly projected towards power companies as a form of 'moral outrage' at their apparent profits and lack of responsibility to 'undo' the damage they were perceived to have done:

"Ok so they are rectifying the destruction... yeah well I think it's important but I think it's the responsibility of the company that does it rather than necessarily asking the public to pay for these things (Jimmy #8)."

"I actually think that they should be able to pay it themselves since they can give themselves big increases in salaries (Jimmy #10)."

"And I would umm... yeah I would get satisfaction from doing that but I think if the power companies activities are affecting the natural habitat then I would like to think that if the power companies made huge profits that some of those would also go, at least match the amount contributed by households. Although I guess where the ones using the power so I don't know what I think about that actually (Jimmy #12)."

"Because I think they should pay for it themselves, they shouldn't expect us to (Jimmy #13)."

"Okay... well my instant reply to this would be that they are making shit loads of money already from us and umm the fact that the commerce commission is now sitting on the gas companies to reduce their price, they are overpriced... so we are already contributing to it (Jimmy #16)."

Some also showed this outrage towards government however:

"I don't want to contribute at all! I pay enough taxes as it is (Jimmy #26)."

3.1.4.3. What will others think?

This sub-theme showed how the *Jimmys* considered others' views when making their valuations. As Svedsater (2003) also found, this was often unprompted. This consideration was two-way in that they not only considered how other people might judge or view their actions (thus showing the influence of social norms and identity concerns on their decisions):

"I have lots of enthusiasm for living an environmentally friendly lifestyle. Yes but I'm not a fanatic so maybe I will just put 4 (Jimmy #16)."

"I think that I probably make... I do make an effort to save energy but it's probably about the same as a typical NZ household. I don't do anything too extreme (Jimmy #12)."

But also, that they considered how other people, particularly lower-income groups, may feel about the situation:

"I don't think many people would be able to pay \$7000. I mean, I possibly could because I am working, but most of the families I think that this is aimed at, would not be earning enough to cover \$7000 within months. So this is a really hard question. (Jimmy #10)."

"I'd think that a 7k umm expenditure is huge for people on or going on fixed incomes (Jimmy #26)."

While these verbalisations could be interpreted as a demonstration of compassion in that the *Jimmys* can consider how other people may feel, it could also be interpreted from the perspective of the 'I'm usual; I'm unusual' sub-theme in that these considerations of others were used to justify their behaviour:

"Umm... argh... I don't know I would say... I would say that... I would've thought that it would be slightly less than that. I think if they want people to take it up it needs to be less than that (Jimmy #23)."

This consideration of 'what others will think' was also common when they were asked whether the innovation would increase their sale price:

"No not really. A couple of 'k'; I don't think many people would care (Jimmy #15)."

"Umm... possibly not I'll say. Maybe a little bit. So I would say... umm well that's interesting because the perception is... we would probably get more from the perception than what it actually would do for the house do you see what I mean? If you could advertise that a house is double glazed and people don't think through the whole stained glass benefit thing, we could probably ask a lot more than what it actually is worth... (Jimmy #23)."

3.1.4.4. ...but don't control me!

'... but don't control me' expressed the *Jimmys* desire to have more control over their energy requirements, particularly through reduced reliance on power-supply companies:

"Okay well everybody wants to be less reliant on power supply companies don't they (Jimmy #23)."

While this desire for control was sometimes due to environmental intentions:

"Umm... reduced reliance on rainfall in the catchment lakes. And I like the idea umm... of not using generated power if we can. So generate ourselves from the farm (Jimmy #22)."

It also appeared to be a by-product of their lack-of-trust towards business:

“Reducing carbon emissions and not relying on power companies which are probably going to keep putting their prices up... so umm... reliant on power companies (Jimmy #8).”

“And reduced reliance on power supply companies would be desirable as well umm because it’s sort of a situation that you don’t have a lot of control over (Jimmy #12).”

3.2. Content Analysis: CV Scenario Considerations

This section presents the results of the content analysis designed to achieve objective 2 of this study. The first section presents the considerations used in each of the CV scenarios regardless of segmentation group. The second section provides a comparison between the different segmentation groups.

3.2.1. Overall Considerations

The following table summarises the top three considerations used in each CV scenario. The number of participants out of the total sample (30) who mentioned it is shown in brackets underneath. Appendix H contains a summary of all categories and a break-down by segmentation group for the four CV scenarios.

The most predominant processes that respondents’ used to interpret and respond to the two private CV scenarios (DG and SWH) were all forms of economic reasoning. As discussed in section 2.2.2, this had important implications for the quality of the WTP responses. In particular, the three most common were references to: 1 - the pay-back period, 2 - ‘reinvesting’ their power bill savings into their WTP amount, and 3 - their household budget or what they could comfortably afford:

“Because how long would it take to recoup if you’re saving \$70 a month times 12 is about a grand a year times 7 years. So over 7 years you would recoup that cost wouldn’t you (Wayne, #30).”

“I wouldn’t be prepared to pay more than I expect to gain per month (Jimmy #10).”

“Well if I’m saving \$40 then 20 would be great. Umm... because umm it would be half of what I am trying to... half of what I save over the month. So if I save \$40 then \$20 a month for double glazing would be... I still save AND I get double glazing (Jimmy #6).”

Table 17: Most Common Considerations Mentioned in Each CV Scenario

DG (Private)	SWH (Private)	Infrastructure (Public)	Habitat (Public)
Budget/Can afford (10, 33%)	Power bill savings (12, 40%)	# of Households contributing (8, 27%)	# of Households contributing (6, 20%)
Repayment characteristics (10, 33%)	Pay-back period (12, 40%)	Broader environmental concerns (8, 27%)	Their fault, their problem (5, 17%)
Pay-back period (10, 33%)	Budget/Can afford (8, 27%)	Power company profits (7, 23%)	Power company profits (5, 17%)
			Different payment method (5, 17%)

These results are comparable to findings from other studies. For example, Baker et al, (2008), Chilton et al (2004), and Schkade and Payne (1994), all found references to budgets, the amount the respondent thought they could afford, comparison to other benchmark expenditures and mental accounting to be prominent considerations. In comparison to Kahneman and Knetsch (1992) who found discretionary spending (for example on entertainment and holidays) as the expenditure category respondents would mentally 'draw' their WTP money from, these respondents referenced their potential power bill savings. This was most likely due to the nature of the CV scenario and proceeding question which asked them to calculate their power bill savings. However, this finding also demonstrated that respondents were aware of the benefit they were getting and the contingency they were therefore taking - as was the intention of the survey design (see chapter 7, section 1.2.1).

Similar to Chilton et al (2004) and Smith's (2007) findings, no reference was made to giving up payments for essential goods (for example groceries or mortgages). However, these were sometimes used as reference points for their WTP amount or to work out what they could afford to pay after these 'priorities' had been covered:

"And is this a priority? Because at the moment what's a priority is putting food on the table and being able to live in your house. And that's a mortgage, so this is not a priority (Wayne #2)."

"But I don't want to pay more than 50 bucks per month because my power bill is already pretty high (Wayne #25)."

Some respondents (approximately one-third) also showed 'realism' in their thoughts by referring to how the payment would be made and what this payment could be affected by in 'real-life'. These most often included reference to hire purchase repayments, pay-back periods and interest rates:

"There are a lot of other things you would want to take into consideration when you are actually looking and how much would want to pay off and the length of time. Like interest rates, the economy (Wayne, #3)."

"Um, the number of months why I thought about it was like if I was paying off a fridge or freezer or a lounge suit or a flat screen or something like that. I would put it on a year to 18 months interest-free payment. So that's what I would be thinking about with the length. Um 'HP payments' is what I was thinking out loud on (Wayne #2)."

"The maximum hire purchase I ever looked at is 3 years and so I just made it a fraction longer for that (Inconsistent #24)."

"I'm thinking of it like paying off a couch or something (Wayne #1)!"

In comparison to these two private CV scenarios, the most common considerations mentioned for the two public CV scenarios were towards the details of the scenario and broader environmental concerns. In particular, these included: 1 - considerations towards the number of other households who would also be contributing; 2 - signs of protest or outrage towards power companies and their profits; and 3 - concerns around the wider environmental impact of building a hydro-electric dam:

"Yip, I think I'd be prepared to pay \$10 a month indefinitely... umm... because \$10 is not a great deal but if everyone put in \$10 that would be an enormous amount of money (Inconsistent #7)."

"Oh well if everyone in the region paid \$20 a month then it would make something like a wind farm or whatever probably financially viable. And it's a fairly small price to pay for the long-term benefits, and it's affordable so yeah (Jimmy #21)."

"I actually think that they should be able to pay it themselves since they can give themselves big increases in salaries (Jimmy #10)!"

"I would get some satisfaction but I would feel mixed about the changes to the environment (Inconsistent #20)."

"I'm going to put none because I don't like them flooding our hills and valleys. I don't like the thought of losing parts of NZ landscape that will never be retrieved again (Jimmy #22)."

"It's an interesting example, the hydro electric dam because I'm not necessarily a big fan of hydro energy... umm you know cos they can have sort of negative impacts on the environment as well... umm... but yeah it's got to be better than coal fired power station... hmm... (Jimmy #8)."

These results are also comparable to other findings. For example Baker et al, (2008) and Schkade and Payne (1994) found issues of trust, moral outrage and concerns for larger environmental issues to be key considerations, as well as an obligation to pay a fair share of the cost.

Unlike the private scenarios, little reference to economic reasoning was found in the public scenarios. For example, there were only 7-8 instances in total of economic reasoning shown in the two public CV scenarios compared to 47-56 times in the two private (DG and SWH) scenarios. Conversely, the private scenarios showed no consideration to issues of trust or moral outrage. This pattern aligns with Baker et al's (2008) finding that lack of trust and moral outrage only occur when the good being valued is public in nature.

The findings from this content analysis also suggest that the CV scenarios used for the two energy-efficiency innovations elicited realistic responses as captured through respondents' economic reasoning. That is, as CV theory assumes, respondents in this study showed signs of making an economic trade-off. It was believed that this was due to the private nature of the innovations' benefits and the way the questions were structured so that respondents were prompted to consider such reasoning processes. These results therefore suggest that the type of thought processes respondents go through when making WTP valuations are largely influenced by the characteristics and questions used in the scenario (the task and context) and the nature of the good (private or public) they are asked to value.

3.2.2. Differences between Groups

The following tables display the top considerations used by more than one-third of respondents in each segmentation group. Only the DG and SWH scenarios are compared. All groups showed some form of realism or economic reasoning in their thought processes. That is, it was not the case that the *Jimmys* showed economic reasoning and the *Waynes* did not.

The main difference between the groups considerations was that the *Jimmys* gave more attention to their household budget (what they felt they could afford) and the length they planned to stay in their house.

Table 18: Most Common Considerations in the DG Scenario by Segmentation Group

<i>Jimmys</i> (11)	<i>Derricks</i> (1)	<i>Waynes</i> (7)	<i>Inconsistents</i> (11)
Budget/Can afford (7, 64%)	Debt/commitments (1, 100%)	Power bill savings (3, 43%)	Repayment characteristics (4, 36%)
Power bill savings (4, 36%)	Don't want government interference (1, 100%)	Repayment characteristics (3, 43%)	Pay-back period (4, 36%)
Pay-back period (4, 36%)			House characteristics (4, 36%)
Length plan to stay (4, 36%)			

Table 19: Most Common Considerations in the SWH Scenario by Segmentation Group

<i>Jimmys</i> (11)	<i>Derricks</i> (1)	<i>Waynes</i> (7)	<i>Inconsistents</i> (11)
Budget/Can afford (5, 45%)	Debt/commitments (1, 100%)	Budget/Can afford (2, 29%)	Power bill savings (7, 64%)
Pay-back period (5, 45%)	Don't want government interference (1, 100%)	Power bill savings (2, 29%)	Pay-back period (6, 55%)
Length plan to stay (4, 36%)		Made-up/Guessed (2, 29%)	

The response characteristics (see section 2.2.2, 'category 7') of the different groups were also compared to give an indication of how relevant their responses were to the task. Compared to the *Jimmys* (36%), a large proportion of *Inconsistents* (55%) and *Waynes* (57%) worked through the questions as a maths exercise (*Derricks*, 0%):

"I can do the maths I promise you... 1, 3... (Wayne #14)."

"5 years. 5 x 12 is 60 (Inconsistent #17)."

"Umm off the top of my head so \$5000 a year... which would be per month... oh no my maths is going to get hard... um instead let's go for \$6000 so \$500 per month... so if I said \$500 per month for 12 months... per month for a year... I'd prefer to spread that over a longer period of time (Inconsistent #29)."

"Umm slightly more difficult because I didn't choose a number easily divisible by 12. So that's why 8 & 9 made it more complicated. And I obviously made an assumption that was incorrect (Inconsistent #29)."

"Hmm... ok I can see where you're going. So I just want to do some maths (Inconsistent #27)."

"Logically you just got to think I got to pay 70 until you recoup the costs... Oh well that would be 7 x12 isn't it, 94... 7 x 12 is 84, yeah 84. So if I did the calculation again it is probably not quite right. [...] Depends on how good your maths is I suppose isn't it (Wayne #30)!"

While only the *Waynes* demonstrated miscalculations (57%), both the *Waynes* (57%) and *Inconsistents* (36%) showed a misunderstanding of the question. In comparison, no *Jimmys* or *Derricks* showed misunderstandings or miscalculations in their VRs.

The *Waynes* (29%) were also noted to 'make-up' or 'guess' their answer:

"Umm... intuitively and a bit of mental arithmetic (Wayne #9)."

"Pure guess. Absolute guess. And that indicates how difficult because I don't know enough about solar heating. The benefits of it... (Wayne #5)"

"Umm 70 months shall we say that... 72 months. Intuition (Wayne #9)."

Of the *Inconsistents* who understood the question (64%), well-defined preferences were illustrated for one good (DG or SWH) but not for the other:

"I found it a lot easier to answer because it was more straightforward than the question about double glazing because I felt that it was more applicable to my situation (Inconsistent #27)."

"Umm... I think I would probably look at solar water heating before I would look at double glazing... I suppose I would look before double glazing at improving the curtains in my home rather than DG and in terms of the water heating, I think in my household would be the major cost and that's why I give it a bit more priority even though it's probably still very cheap month... you know I wouldn't recover the costs properly from someone like me on the basic calculating here (Inconsistent #24)."

The one *Derrick* (100%) in this sample was very certain in their preferences or responses:

"No I wouldn't be interested in doing that. I would not do that (Derrick #11)".

These findings suggested that while not all groups' responses were relevant to the task, the *Jimmys* responses did appear to be in that they did not make 'mistakes' in their calculations or misunderstand the survey questions. The thematic analysis also highlighted that the *Jimmys* were aware of their responses (see section 3.1.2.3) and that they engaged with the CV scenario through consideration of 'real-world' factors (outside of the survey context) such as the economy and their household budget (see section 3.1.3).

The differences illustrated between groups suggests that the segmentation process used in study 2 (see chapter 7, section 2.4.2) provided a valid distinction between homeowners who showed differences in their adoption decisions towards energy-efficiency innovations.

3.3. Comparison to Study 2

3.3.1. Effect of Verbalisation Bias

As table 20 illustrates, no significant differences between studies 2 and 3 were found in terms of their mean and median WTP responses⁴⁵. Note that the only difference between these two samples (apart from demographic and sampling differences) was that study 3 participants had the added task of verbalising their thoughts.

Table 20: Comparison between WTP Responses from Studies 2 and 3 (Total Sample)

<i>Total Sample</i>		Study 2 Sample (All)	Study 2 Sample (Version 5 only)	Study 3 Sample (Version 5)	Significance* (p-value)
WTP Total	<i>DG</i>	\$2,712.99	\$3,090.76	\$6,332.83	NS (p=.07)
(Mean)	<i>SWH</i>	\$3,497.35	\$3,481.40	\$5,561.33	NS (p=.33)
WTP Total	<i>DG</i>	\$1,440.00	\$1,800.00	\$1,800.00	NS (p=.99)
(Median)	<i>SWH</i>	\$1,440.00	\$1,440.00	\$2,700.00	NS (p=.99)
WTP (\$)	<i>DG</i>	\$73.15	\$118.22	\$68.63	NS (p=.66)
per Month	<i>SWH</i>	\$102.11	\$120.67	\$73.00	NS (p=.69)
WTP length	<i>DG</i>	66.68	66.87	90.20	NS (p=.37)
(months)	<i>SWH</i>	65.63	69.22	118.00	NS (p=.23)

* Results were considered significant at the 5% level ($p < .05$) of uncertainty; NS = non-significant.

No significant differences were found when comparing just the *Jimmys* from each sample either, as table 21 shows.

Table 21: Comparison between WTP Responses from Studies 2 and 3 (*Jimmys* only)

<i>Jimmys</i>		Study 2 Sample (Version 5 only)	Study 3 Sample (Version 5)	Significance* (p-value)
WTP Total (Mean)	<i>DG</i>	\$1,820.29	\$1,899.28	NS (p=.59)
	<i>SWH</i>	\$1,990.58	\$2,187.27	NS (p=.71)
WTP Total (Median)	<i>DG</i>	\$1,200.00	\$1,200.00	NS (p=.99)
	<i>SWH</i>	\$1,200.00	\$1,800.00	NS (p=.99)
WTP (\$)	<i>DG</i>	\$41.03	\$38.36	NS (p=.62)
per Month	<i>SWH</i>	\$41.84	\$41.82	NS (p=.98)
WTP length (months)	<i>DG</i>	46.00	53.27	NS (p=.76)
	<i>SWH</i>	49.94	58.36	NS (p=.49)

* Results were considered significant at the 5% level ($p < .05$) of uncertainty; NS = non-significant.

Similar to Schkade and Payne (1994), it was concluded that respondents' WTP valuations were not affected by the additional verbalisation task.

⁴⁵ Despite no significant difference being found between WTP values from studies 2 and 3, responses from the VR participants in study 3 were not included in the larger sample and analyses in study 2 as they would have unevenly distorted the cell sizes. That is, this would have resulted in a higher number of respondents in the 20%-savings and \$7,000-cost version.

3.3.2. Consistency Across Samples

The final objective of this study (and hypothesis H2) was to understand whether the *Jimmys disconnected* behaviour is a robust and consistent phenomenon or whether it is an anomaly of a certain energy-efficiency innovation or methodological artefact. As outlined in chapter 4 (section 3), this research proposed that the replication across different samples was one way to represent how ‘true’ observations of *disconnected* behaviour were.

As shown in table 22, the *Jimmys* were found to represent a similar proportion of both studies responding populations. No significant difference was observed between these population splits ($p=.27$). It was therefore inferred that the *Jimmys* and their *disconnected* behaviour were a consistent reality and robust phenomenon.

Table 22: Proportion Segmentation Groups Represented Both Sample Populations

	Study 2 Sample (Version 5 only)		Study 3 Sample (Version 5)	
	Frequency	Valid Percent	Frequency	Valid Percent
<i>Jimmys (Less)</i>	30	43%	11	37%
<i>Nigels (Same)</i>	7	10%	-	0%
<i>Garys (More)</i>	-	0%	-	0%
<i>Derricks (Zero)</i>	-	0%	1	3%
<i>Waynes (Wrong)</i>	10	14%	7	23%
<i>Inconsistents</i>	23	33%	11	37%

3.4. Results Summary

A rich description of the motivations behind the *Jimmys* adoption decisions was gained through the thematic analysis. In particular, the type-1 ‘Angels and Demons’ theme illustrated the dissonant nature of the *Jimmys* thoughts towards energy-efficiency decisions. As illustrated through the sub-theme ‘I’m usual; I’m unusual’, the *Jimmys* used other homeowners as a comparison base to justify their decisions. The ‘I’m a citizen; I’m a consumer’ discrepancy highlighted that while the *Jimmys* predominantly hold an egoistic value-orientation focussed on personal economic gain, they also have a ‘softer’ altruistic side. This suggested that while they are ruled by a consumer-driven society with contemporary consumer aspirations, they do also care about broader social and environmental issues. However, this finding could also be interpreted as an excuse. That is, they are egoistically defensive and do not want to be seen to be selfish. The final sub-theme, ‘I’ll trust you; I don’t trust you’, illustrated their desire yet confusion over whether to trust ‘experts’ and their mistrust at those who were perceived to make a profit from them.

The type-2 theme, 'I'm sticking with what I know', encompassed the numerous observations where the *Jimmys* perceived a risk from change. In particular, 'It's not worth it' showed a pessimistic view towards reclaiming the financial investment in the energy-efficiency innovation. 'I can't think that far ahead' demonstrated an aversion to commitment, debt and a conservative attitude when future outcomes were unknown. 'I need to weigh everything up' illustrated their need to consider all the variables to make an educated decision and avoid decision regret, and 'I don't know enough' highlighted a lack of confidence in their knowledge for housing or sustainability related issues. Together, these sub-themes suggested a view of energy-efficiency decisions as complex and therefore endowed with more risk.

The second type-2 theme, 'I will if you will', represented the social context and the influences this had on their decision processes. 'It's not just up to me' included reference to others also taking action and 'That's not fair' demonstrated that perceptions of fairness mattered. 'What will others think?' showed a concern for how other households might behave or perceive their actions, and '...but don't control me' showed a desire for individual control through reduced reliance on businesses whose motives were viewed sceptically. The verbalisations summarised by this final theme could also be viewed as a means for the *Jimmys* to alleviate feelings of guilt or dissonance they could be experiencing from not acting on their 'citizenry' beliefs. As Kollmuss and Agyeman (2002) describe, delegation is normally a rejection of personal responsibility in the form of blame towards others, particularly businesses and government.

Through a content analysis, a more detailed and nuanced account of how participants responded to the WTP questions was obtained. Different types of considerations were found between the private (DG and SWH) scenarios compared to the public (infrastructure and habitat) scenarios. While forms of economic reasoning were commonly used for the two energy-efficiency innovations, in the public scenarios respondents tended to refer to issues of trust, fairness, and moral outrage. These findings therefore supported previous beliefs that CVM is more suited to valuing private goods as opposed to complex public goods given that many of the problems associated with WTP (for example moral outrage and lack of trust) tend to be related to public goods (Baker et al, 2008).

When comparing study 2 to study 3, essentially the same pattern of results (WTP responses and % of *Jimmys*) was found suggesting that: 1 – the additional verbalisation task did not influence participants' responses, and 2 – *disconnected* behaviour is a robust phenomenon.

4. Chapter Conclusion

The weaknesses of the quantitative survey conducted in study 2 were highlighted in chapters 6 and 7. It was not only shown how the nature and motivations behind responses remains unknown with just a quantitative analysis, but also that methodological influences can be better understood with a qualitative examination. This second study provided a method to assess the psychological processes that influence and lead to respondents' decisions. The purpose of this study was therefore to provide the qualitative data needed to inform the research of what participants' responses were actually capturing and what affect the task and context may have unintentionally had on these.

The VR method used in this study contributed to the greater CV literature through gathering an understanding of how people interpret and respond to WTP questions. In particular, it was found that private innovations are more suited to the CV method than public goods, and, that economic reasoning can be facilitated in respondents' considerations through manipulations to the CV scenario and following questions.

Despite some apparent limitations of the VR method, for example that it could not measure if non-conscious processing occurred (Wilson, 1994), it presented a compatible and useful methodology for this research to study the contents of consciousness as they pertain to energy-efficiency decisions, economic thought, and CVM. This greater understanding 'beyond just numbers' meant that assumptions made in study 2 needed to be reviewed in light of these VRs. For example, while the CV survey suggested that the *Jimmys disconnected* behaviour was not due to differences in contextual or demographic variables, the VRs suggested otherwise as respondents' often cited the characteristics of their house or household situation as reasons for why they were not WTP the full cost described to them. The following discussion chapter presents this wider consideration through a reflection of the results from all three studies. The aim being to provide a clearer and more rigorous understanding of the reasons for the *Jimmys disconnected* behaviour.

Chapter 9. Discussion

“Change is not in our interest. Our only rational policy is not to risk provoking it.”
(Wright, 2004)

A mixed methods research approach was employed in order to widen the inquiry and to provide a more rigorous response to the aim of this research – ‘*to understand why New Zealand homeowners are not apparently adopting energy-efficiency innovations*’. This chapter integrates the results from each of the individual studies. The aim is to develop a coherent picture of what appears to be an *apparent disconnect*.

This *apparent disconnect* is demonstrated in this chapter to be a robust and reliable problem in that the greatest proportion of respondents ‘consistently’ and ‘knowingly’ displayed this unreasonable behaviour. A review of the findings that each study brought to the table demonstrates that the reason this target group was displaying this *disconnected* behaviour was because of an asymmetrical perception of risk where higher importance was placed on the potential risks than the benefits they could gain. In particular, there appeared to be three types of perceived risks: a risk of over-capitalising and that no financial reward would be gained (*financial risk*), that the innovation would not perform and be too complex to understand (*functional risk*), and that there would be a risk to one’s social identity for going against the norm (*social risk*).

This chapter concludes with a discussion on the contribution this research can offer future studies utilising the contingent valuation methodology (CVM) and ‘adoption diffusion’ model.

1. Disconnected Behaviour

The first objective of this research was to gather an understanding of whether an *apparent disconnect* towards the adoption of energy-efficiency innovations exists, and if so, to quantify how large the problem is through determining what percentage of homeowners demonstrate *disconnected* behaviour. This section demonstrates how each of the individual studies contributed to this objective.

The preliminary study (‘study 1’) was conducted in a real-world setting to ensure that an *apparent disconnect* was real and not a methodological artefact over-emphasised by results from previous experimental studies (as discussed in chapter 6, section 1). The results confirmed the need for this research by demonstrating that energy-efficiency features are not a priority in the housing market at a national level. When compared to previous survey results that show homeowners to value the benefits of ‘sustainability’ (as described in

chapter 2, section 2.2), these findings demonstrated an *apparent disconnect* in the market. These results also highlighted that the follow-up experimental studies needed to use a non-market technique to measure *disconnected* behaviour as they indicated that energy-efficiency features are not valued in the traditional market sense. This preliminary study also illustrated which energy-efficiency innovations would allow an understanding of *disconnected* behaviour in that they were common to homeowners yet not being adopted. These were found to be Double Glazing (DG) and Solar Water Heating (SWH) panels.

The first experimental study ('study 2') contributed the mass quantitative data for this research through a survey designed to determine the extent and nature of any *apparent disconnect*. This was achieved through a repeated measures design of two contingent valuation (CV) scenarios that asked respondents to reflect on their own logic. Respondents were classified into groups depending on whether they were willing-to-pay (WTP) zero, the same, more, or less than the cost presented to them in the simulated CV markets for DG and SWH. The focus of this research were those who displayed consistent preferences across the two energy-efficiency innovations and who understood the process in that they knew what the 'logical' answer should be⁴⁶. Of these homeowners who showed considered responses, it was found that the majority (79%) displayed *disconnected* behaviour in that they indicated that they wanted the innovation but that they were not prepared to pay for it. For the purpose of this thesis, this group was coined the '*Jimmys*'.

The second experimental study ('study 3') used the verbal report (VR) tool as a qualitative application to the survey used in study 2. By asking respondents to 'think-aloud', the thought processes they went through while answering this survey were captured. This provided a wider perspective of the considerations behind the *Jimmys disconnected* behaviour. In support of the findings from study 2, the thematic analysis also revealed the dissonant nature of the *Jimmys* thoughts. To reflect this conflict, the type-1 theme ('*Disconnected Behaviour*') (see chapter 8, section 2.2.1) was labelled 'Angels and Demons'. Three sub-themes were identified under this over-arching theme that illustrated the types of inconsistencies the *Jimmys* showed in their thoughts. These were, 'I'm usual; I'm unusual', 'I'm a citizen; I'm a consumer', and 'I'll trust you; I don't trust you'.

The benefit of the tripartite nature of this research is therefore illustrated as all three studies confirmed that a *disconnect* exists. The findings from studies 2 and 3 further illustrated that

⁴⁶ As per the criteria identified in chapter 4 (section 2)

a large proportion of respondents knowingly showed this *disconnected* behaviour. Thus hypothesis H1, that a large proportion of New Zealand homeowners are showing an *apparent disconnect* towards the adoption of energy-efficiency innovations by not acting consistently with their beliefs or with an opportunity for individual benefit, was proved.

2. A Robust Phenomenon

In relation to objective 2 (and hypothesis H2), the *Jimmys disconnected* behaviour was found to be a robust and reliable phenomenon that was not innovation specific nor due to a methodological error. This was demonstrated in a number of ways:

1. As noted in the previous section, three separate studies showed the existence of a *disconnect*.
2. Regardless of the cost or benefit level presented, the *Jimmys* represented the largest proportion of respondents in each survey version. This suggested that their *disconnected* behaviour was not simply due to the price of the innovations.
3. Near identical proportions of the responding populations were *Jimmys* in both studies 2 (41%) and 3 (37%).
4. As per the criteria for being identified as a *Jimmy*, these homeowners showed the same *disconnected* behaviour across two energy-efficiency innovations. That is, their *disconnected behaviour* was not due to the characteristics of a specific innovation.
5. Finally, by allowing respondents the opportunity to reflect on their responses, the *Jimmys* were not only shown to understand the task, but also that their decision to under-pay for the innovation was not a 'mistake' but a deliberate and conscious decision. This awareness of their *disconnected* behaviour was further demonstrated in the verbalisations from study 3 (see chapter 8, section 3.1.2).

The robust statistical support of the results from studies 2 and 3 has therefore shown that the *Jimmys disconnected* behaviour is consistent and that they were aware of their decisions. This finding challenges the assumption that imperfect information is one cause for *disconnected* or irrational behaviour (Simon, 1985; Tversky and Kahneman, 2004) as the *Jimmys* made these 'non-optimal' decisions despite showing an understanding for what the optimal decision was. However, in support of these researchers' work, a large proportion

(48%) of other homeowners did display such ‘bounded rationality’ through an apparent misunderstanding or mistake in their logic (16%, *Waynes*) or through displaying inconsistent preferences (32%, *Inconsistents*) (see chapter 10 (section 2.1) for a further discussion). These results suggested that the *Jimmys* believed they had some reason to behave this way. To uncover what these reasons were was the purpose of the final objective of this research.

3. Influences on Disconnected Behaviour

The previous two sections proved the size and nature of the adoption problem first introduced in chapter 1. The final objective of this research was to identify the reasons why this problem exists. That is, in response to the aim of this research, this objective sought to understand ‘why’ the *Jimmys* displayed *disconnected* behaviour.

Study 2 not only determined when homeowners were showing *disconnected* behaviour, but it also tested numerous psychological, social psychological, behavioural, and contextual factors that were viewed as plausible influences. By comparing the *Jimmys* to another key reference group, the *Nigels*, it was found that the *Jimmys* were not significantly different on any of the psychological, demographic, contextual or technological factors measured. While no significant difference was observed between groups on the ‘average-other’ variables, the statistics suggested that the *Jimmys* thought most other homeowners also displayed this unreasonable behaviour, or, that they were even more unreasonable than they were. This suggested that social comparisons were an important influence on the *Jimmys* decisions.

Despite monetary savings and the perception of ‘getting a deal’ apparently being important motivating factors for New Zealanders to adopt sustainable heating or energy behaviours (Fryer et al, 2008; Trotman, 2007), this research demonstrated that the *Jimmys* unwillingness-to-pay was not due to the cost of the innovation or the energy savings they would receive. Regardless of how cheap or expensive the innovation was, or how small or great the energy savings were, these respondents knowingly displayed this unreasonable behaviour. As one participant states, “*well you know basically I don’t want to have to pay anything for anything (Jimmy #23).*” This therefore suggested that it was not the actual cost or characteristics of the energy-efficiency innovation that was preventing adoption. Instead, it seemed that they wanted to be paid to acquire the innovation that they were aware would save them money. The apparent unreasonableness of this behaviour is especially demonstrated when considering that respondents were given a ‘gain’ to start with. That is,

despite there being no upfront cost, interest-free repayments, and immediate benefits (therefore removing the sense of an immediate sacrifice with unknown future outcomes), the *Jimmys* still believed they had some reason to justify not paying the full price.

The thematic analysis conducted in study 3 identified a second type of theme (type-2) which encompassed the *Jimmys* '*Rationales for their Behaviour*' (see chapter 8, section 2.2.1). Two main themes were identified under this type: 'I'm sticking with what I know' and 'I will if you will'. These revealed some of the motivations behind the *Jimmys disconnected* behaviour. For example, the sub-themes under 'I'm sticking with what I know' demonstrated that the *Jimmys* were resistant to change from their current situation for numerous reasons and that their focus was on the short-term. The themes under 'I will if you will' highlighted the need for energy-efficiency innovations to become a 'social norm' if the diffusion rate is to be increased as it appeared that the *Jimmys* did not want to 'change alone'.

Study 1 added a third insight to this objective through the finding that energy-efficiency features were dropped from real estate advertisements when there was an implied pressure to reduce words. This result suggested that energy-efficiency features are not perceived by real estate agents as a priority for the majority of home-buyers.

The lack of an obvious explanation for the *Jimmys* behaviour proved hypothesis H3. The fact that the nature of this apparently complex phenomenon could not be explained by the results from any one study or discipline supported the decision to use a mixed methods approach. However, while no single factor could account for the *Jimmys disconnected* behaviour, a trend can be observed across the different explanations. That is, they all suggest a perception of risk.

3.1. Perceived Risks

There appeared to be three broad types of risk the *Jimmys* perceived:

- **Financial risk**
- **Functional risk**
- **Social risk**

The perceived risks the *Jimmys* displayed were similar to what other researchers have found people to perceive when making either consumer purchases or a behaviour change towards reducing greenhouse gas emissions (Chaudhuri, 2001; Swim et al, 2009)⁴⁷.

3.1.1. Financial Risk

On the surface, it could have appeared in study 2 (chapter 7) as though the *Jimmys* unwillingness-to-pay full price was a protest at the cost. However, in combination with the themes found in study 3, it was revealed that their unwillingness-to-pay was better interpreted as an expression of the financial risk they perceived.

Given the economic focus of the CV method used, one would expect the *Jimmys* to consider and describe *financial risks*. While such thoughts show that the *Jimmys* understood the survey task and were realistic (as discussed in chapter 8, section 3.2), they more importantly highlight the reasons why they perceived a financial risk in this decision. These reasons were particularly evident in the sub-themes ‘It’s not worth it’ and ‘I can’t think that far ahead’. These showed that the *Jimmys* were hesitant about paying the full price because:

- They thought their house or household was ‘different’ and would therefore not receive the energy savings:

“It’s quite possible the benefits would be a lot greater than I’m imagining they would be for this house which is just because umm we really don’t have to heat this house that much we only use one small heater. But I think overall and if I was in a bigger house a government scheme that provided double glazing with no interest would probably interest me a lot more than if I was in this house (Jimmy #12)”.

- They were averse to debt or committing to an out-going payment for too long when there were unknown future variables:

“3 years cos I just feel it’s a nice round time that I could umm... afford to pay that extra money and it’s got to come to an end sometime. So 3 years doesn’t seem to be too long (Jimmy #10).”

“Because I hate having things hanging over me for ever and ever and if I thought I was paying it off I mean just psychologically that’s a... you know if you think you had to pay 10 or 20 years for it, and who knows if I’m going to stay in the house for that long that’s another thing so whether I actually get the benefit of the 7 thousand dollars (Jimmy #23).”

⁴⁷ Chaudhuri (2001) measured five types of risk: functional, financial, social, physical risk (“this product could cause me physical pain”), and a psychological risk (“this product could cause me mental pain”). Swim et al (2009) describe an extra ‘sixth’ type of risk also: time (lost) risk.

"Ok it's because I'm heading into retirement and I don't want to increase my financial commitments (Jimmy #26)."

- They thought they would be over-capitalising and that their initial investment would not be recouped if they moved:

"I was thinking about our old house which had double glazing and how we moved to a house with single glazing. I wanted to put double glazing but we didn't know how long we were going to stay there so what's the point in putting in double glazing (Jimmy #16)."

"And the length of time is really what we kind of expect to live in this house. Between 3 and 4 years. So it's not completely relevant to how much I spent over that period of time its rather how much time I want to be in the house for (Jimmy #6)."

"Umm so assuming that its \$7000, 50 per month would be what... 600 a year; that would be more than 10 years to pay it off. Would I stay in my house for 10 years more? Don't know (Jimmy #16)."

3.1.2. Functional Risk

The *Jimmys* perceived a *functional risk* in adopting the innovations. This was reflected through the doubt they voiced at the compatibility or suitability of their dwelling or household situation to the innovation:

"Well I'm really not sure how long you have to have the sun there for, but we don't have the sun for very long (Jimmy #13)."

"Because we've got a really old fashioned house and umm... its got a lot of stained glass windows in it and a lot of that really mottled glass as well... so.... [...] But would that be a waste of money given that the heat will go out the little [stained glass] ones? It'd be just wasting our money pretty much. Argue whether we would get the benefit given the cost (Jimmy #23)."

As shown through the sub-themes 'It's not worth it', 'I need to weigh everything up', 'I don't know enough', and 'I'll trust you; I don't trust you', this doubt also appeared to arise from:

- Reservations about the innovation's performance:

"Oh boy... umm... I'm not actually a great fan of solar water heating mainly because they have got a bit of bad rap (Jimmy #10)."

"Umm yeah the amount is for the reasons I've outlined, I don't want the 'fathing' around and also I'm not entirely convinced about the winter thing I'd need to read more up about that. If I don't have a hang of a lot of space to be having a nice little cupboard with it all in there etcetera (Jimmy #21)."

- The decision as being too complex:

"I suppose they are reasonably hard to answer in one way because you are tossing up that with other things, seems like, you know you could 'tott' up quite a bill (Jimmy #15)."

"Umm... well it's the same thing. It depends what factors I consider. If it's only the total amount um then it's reasonably easy to divide it. I think the difficult thing is to consider all the factors and like again how much you want to stay in that place, how much you are prepared to pay for the whole thing... and umm hoping that the government umm can sponsor part of the expenses. So it is really considering all the factors that makes it a bit harder (Jimmy #6)."

- Themselves as lacking in knowledge:

"Well I don't know how the whole thing works... a bit naive. If it doesn't... sun shine... then less likely to be able to heat your water. So I will say less sun equals no hot water. So I think therefore it is going to be a little bit risky in a place like Wellington (Jimmy #15)."

Bayne (2006) and Mitchell (1999) also highlight how low confidence about one's ability or the innovation is linked to the amount of risk a consumer will perceive: "as consumers become more knowledgeable about a product category, the perception of risk will also decrease (Bayne, 2006)."

3.1.3. Social Risk

In addition to the obvious risks that the technology might not suit their house or that the financial return would not occur, homeowners seemed averse to being seen to be different from the average person. That is, they wanted to maintain an identity that was viewed by others as the norm. As Swim et al (2009) illustrate, the "potential damage to one's ego or reputation" poses a *social risk*.

Results from study 2 demonstrated that the *Jimmys* thought that most other homeowners were either 'just like them' (59%) in that they would also not be prepared to pay for the innovation, or, that they were 'worse' than them (33%) in that they would be WTP even less than they had. This suggests that despite knowing that their behaviour was unreasonable, they still viewed themselves as being either the same or even slightly ahead of the pack:

"But I'd think that you know, a lot of people want to get something for nothing and so umm... they'd be trying to make it more beneficial so they would probably pay less... but I'm not that way inclined... myself (Jimmy #30)!"

"I would say the average or typical New Zealand household would probably pay about the same if not slightly less because we're not long term thinkers New Zealand, are we (Jimmy #23)?!"

The 'I will if you will' theme (study 3) and the neutral position the *Jimmys* showed towards having a *green identity* (study 2), suggested that they did not want an identity that set them apart from the majority:

"But I'm not a fanatic (Jimmy #16)."

"I do make an effort to save energy but it's probably about the same as a typical NZ household. I don't do anything too extreme (Jimmy #12)."

Their concern over what others may do or think was also reflected in the sub-theme 'what will others think?' This demonstrated that they perceived a risk in how others might judge their behaviours:

"Which isn't very much, sounds a bit 'miserly' (Jimmy #8)!"

To go against the norm can be considered a risk to one's social reputation as one may be judged as foolish or ill-advised for adopting the innovation when there are apparently 'commonly known' risks. For example, people who go tramping in the New Zealand mountain ranges without proper equipment and clothing to suit all conditions are labelled as 'foolish' as it is a commonly known risk that the weather can change unpredictably. However, while this norm for trampers may be true, the current non-adoption norm for energy-efficiency innovations may not be the 'real truth'. That is, despite non-adoption appearing to be the norm, as the results from this research and previous studies have shown, homeowners privately say the opposite – that is, that they value the benefits of energy efficiency. This could therefore be viewed as a situation of *pluralistic ignorance* (chapter 3, section 2.3) in that non-adoption has become the imagined social norm due to homeowners wrongly interpreting each other as not wanting the innovation because they must also perceive the same risks:

"I would've thought that it would be slightly less than that. I think if they want people to take it up it needs to be less than that. Is that how I should be thinking about that? Or just whether I think the price for a solar water system is right or not? Umm... solar water... umm... it's probably about right actually (Jimmy #23)."

This imagined social norm further appears to be compounded by biases of the *availability heuristic* (for example the *confirmation* and *frequency biases*) (see chapter 3, section 2.3) as homeowners look to confirm that their decisions are socially correct:

"Umm solar water heating panels I would say 3% because I haven't seen many. Not that I look (Jimmy #12)."

In addition to the potential to damage one's social reputation, the *Jimmys* perceived other social risks as reflected in the results from study 2 and the 'It's not fair' and 'It's not just up to me' sub-themes from study 3. As the NCC et al (2006) report also found, it appeared that the *Jimmys* were only willing to act when others did - when it became a collective norm. That is, they were unwilling to act alone due to a sense of *futility* - the view that by themselves, their actions would make little difference:

"Yes now that's a common feeling I get... what difference does my action make (Jimmy #10)?"

The need for a sense of fairness - that others were also 'doing their bit' - was another social risk the *Jimmys* perceived if they acted when others were not: *"Everyone has a responsibility (Jimmy #15)"*. This sense of fairness and trust in other homeowners to contribute also extended to business and government. In particular, businesses were viewed as needing to take more responsibility for their actions through a 'polluter-pays' argument instead of passing the cost on to consumers:

"Okay so they are rectifying the destruction... yeah well I think it's important but I think it's the responsibility of the company that does it rather than necessarily asking the public to pay for these things (Jimmy #8)."

3.2. An Asymmetrical Perception of Risk

The themes found from the *Jimmys* verbalisations in study 3 highlighted that they were more disposed to discussing the risks associated with adopting the innovations as opposed to the benefits they stood to gain. McGee et al (2006) also found positive perceptions to play a secondary role compared to negative perceptions in housing-sustainability decisions. They found that while consumers held positive perceptions about the cost-savings from housing-sustainability, the negative perception of the upfront cost was ultimately the more dominant driver in consumers' decision-making.

This asymmetrical perception of the risks relative to the benefits could be viewed as an anomaly of *prospect theory* or *loss aversion* (chapter 3, section 3.2) in that the *Jimmys* appear to be over-reacting to the potential losses (the perceived risks) in comparison to the potential gains (the benefits).

The *Jimmys* behaviour also appears to support Tversky and Kahneman's work on the *framing effect* (see chapter 3, section 3.2). That is, the framing effect would suggest that one reason why the *Jimmys* appear risk-averse is because the decision they had to make was framed as a gain. They therefore had more to lose than if this decision had been framed as a loss (Tversky and Kahneman, 2004). However, prospect theory and the framing effect cannot provide a full account for the *Jimmys disconnected* behaviour because the other groups of homeowners did not appear to be affected by this same cognitive bias. That is, the *Jimmys* being the only group of respondents to demonstrate an aversion to the financial risk is an anomaly in a context where all respondents received the same scenario presented as a gain.

The 'I'm sticking with what I know' theme found in study 3 fundamentally represented an aversion to change and a preference for their current situation. This could suggest that the *Jimmys* were using their current situation as the reference point to evaluate whether the innovations presented a positive or negative change; an idea that Knetsch (1997) also discusses for expectations of fairness. It therefore appeared that the *Jimmys disconnected* behaviour was not only characterised as an aversion to risk but also as an aversion to change – that is, a *status quo bias*.

Regret avoidance (see chapter 3, section 3.3) could be one cause for the *Jimmys* risk perceptions and apparent tendency to favour their current situation at the expense of change. This is especially given that regret avoidance can also explain the social risks the *Jimmys* perceived (conformity to norms and maintaining identity) and has links to loss aversion (Samuelson and Zeckhauser, 1988). That is, the higher the risk, the higher the chances for decision regret. Consequently, the status quo appears the 'safest' choice for the *Jimmys*.

The cause of this status quo bias could further be attributed to a *projection bias* (see chapter 3, section 3.4) in that the *Jimmys* are over-estimating the change and impact the innovation could have on their future quality of life and under-estimating their own ability to adapt to this change. Loewenstein and Frederick's (1997) findings also suggested that a projection bias was the cause for the resistance they observed when studying peoples' reactions to environmental change.

Given the large amount of disparity observed in the *Jimmys* thoughts (as reflected through the 'Angels and Demons' sub-themes), it could also be inferred that 'contradiction leads to inaction'. That is, that the need for decision consistency could be one cause for the *Jimmys*

tendency to over-weigh the risks. As discussed in chapter 3 (section 3.3), Samuelson and Zeckhauser (1988) also proposed *cognitive dissonance* as an explanation for status quo biases. This is because in order to reduce the internal conflict, often the most familiar path (in this case non-adoption) is chosen over the one that involves the change.

Closely related to this need to maintain decision consistency is the need for *control*, which the *Jimmys* showed through the ‘...but don’t control me’ sub-theme. Samuelson and Zeckhauser (1988) also believe the need to feel control is a cause for status quo biases. That is, an illusion of control is gained when current decisions are maintained.

Understanding the *Jimmys* WTP responses from a status quo perspective means that the ‘discount’ they require (that is, the difference between the cost and what they were WTP for the innovation (see figure 7 in section 3.5, chapter 7)) can be viewed as either an ‘economic buffer’ to prevent this change or as a form of compensation for the risks they perceive. However, this trend can also be interpreted from the perspective of loss aversion, as reflected in the definition of a perceived risk: “a subjectively-determined expectation of loss; the greater the probability of this loss, the greater the risk thought to exist for an individual (Mitchell, 1999)”. Regardless of how this ‘discount’ is best conceptualised, as the cost increased the amount of risk the *Jimmys* needed compensation for increased.

This section has illustrated that the *Jimmys disconnected* behaviour and asymmetrical risk perceptions could be interpreted from two broad perspectives: as an anomaly of prospect theory or as a status quo bias. However, as alluded to in chapter 3 (section 3.2), there is debate within the literature over the necessity of either the ‘loss aversion’ or ‘status quo bias’ term. For example, while Kahneman et al (1991) suggest that loss aversion can explain the status quo bias because utility is measured by the “change relative to a neutral reference point”, Gal (2006) opposes this argument saying that the “propensity towards the status quo [...] is sufficient to explain these phenomena. [...] Thus, a loss aversion principle is rendered superfluous to an account of the phenomena it was introduced to explain.” While this debate remains over which term, if either, is correct, both provided explanations in this research that aided the interpretation of the *Jimmys disconnected* behaviour. To encompass both perspectives, it was concluded that the *Jimmys disconnected* behaviour is best viewed as an asymmetrical perception of risk that is the result of numerous cognitive and social biases.

3.3. Real or Perceived Risk

It is entirely possible that the risks the *Jimmys* described are ‘real’ barriers to change. For example, it may well be that their house is not suitable to having SWH installed. In terms of such *functional risks*, the results from study 2 did not show the *Jimmys* to be significantly different to other homeowners in certain dwelling or household characteristics, their previous experience, any financial variables (for example household income or house value), or in their demographics. Comparing the results from study 2 to study 3, this therefore suggests that the functional risks the *Jimmys* state are not ‘real’ barriers but rather a reflection of their concern at whether they will receive the benefits of the innovation as the manufacturer or expert suggests:

“Umm I have been told and I don’t know whether this is correct, don’t know whether it is the double glazing or the metal joinery... maybe it’s a combination of the both, but if you have a new house with double glazing and/or metal joinery that you can get umm a greater build up of condensation because there’s none of that internal ‘draughtiness’ going on... so, that’s a question I’m not sure about. And so a lot of people have to end up installing things like DVS which means there energy costs are increased anyway (Jimmy #21).”

While the *Jimmys* saw a *financial risk* in the hypothetical purchase decisions in studies 2 and 3, findings from study 1 (which was based on data from the ‘real-world’), also suggested a financial risk in that the market does not value energy-efficiency features. That is, the *Jimmys* views of the current market for energy-efficient housing and the risk of over-capitalising were reflected in the results from study 1. The overall picture arising from all three studies seemed to be that *“it might make your home easier to sell”* but the full investment would not be recouped:

“Umm would it increase the value? Hmm yeah I think it probably would, not by 10 grand though (Jimmy #8).”

“The benefits are good and that you’re saving umm in heating costs and you get the benefits of reduced noise etc, but in a reducing market as it is currently umm I wouldn’t go to the expense to put it in if I was planning on selling my house (Jimmy #10).”

“No not really. A couple of ‘k’. I don’t think many people would care (Jimmy #15).”

While it appeared that the *Jimmys* did not believe the energy-efficiency innovations would increase their property’s value, other results from study 2 showed the *Jimmys* still to believe that the innovation would increase their property value by more than what they were WTP (see chapter 7, section 3.6). Despite this apparent *endowment effect* (see chapter 3, section

3.2), overall, all three studies suggest that the financial risk the *Jimmys* discussed in terms of over-capitalising, is a real risk that the market needs to correct.

Another reason the *Jimmys* gave for why there was a risk of over-capitalising was because they were planning to move in the short-term: “*Umm well the amount is just a budgetary issue umm... and then factoring in the length of time I intend to stay in the house. So I wouldn’t invest that much money if I was thinking of leaving there in the short term (Jimmy #21).*” However, in contrast to what the verbalisations from study 3 suggested, the findings reported in study 2 (chapter 7, section 3.5) suggested that their WTP values were not dependent on whether they were planning to move in the short-term. This apparent contradiction therefore suggests that this reason for the financial risk was an excuse or rationalisation for their aversion to make what they perceived to be a long-term commitment.

The *Jimmys* were also correct in terms of the perceived *social risk* of ‘standing out from the crowd’ as study 2 demonstrated that the majority of respondents (82%, *Jimmys* and *Derricks*) would not adopt the innovation. Statistics also show that in reality few homeowners have actually adopted DG or SWH into their homes (approximately 4% and 2% respectively). However, as discussed in chapter 9 (section 3.1.3), while this perception is currently correct, this could be viewed as a situation of *pluralistic ignorance* confounded by the *availability heuristic*. That is, this appears to be a paradoxical situation that can only be overcome by changing what is currently viewed as the norm.

One ‘rational’ explanation however for why the *Jimmys* do not want to go against the norm and be the first to adopt the innovation could be in case the innovation becomes obsolete. That is, it could be that the *Jimmys* do not want to take the risk of having the ‘wrong technology on the block’ that would later not be valued by the market. This risk of investing in an innovation before mainstream diffusion has been demonstrated in the past with the VHS-Betamax video-tape format war (Besen and Farrell, 1994; Liebowitz and Margolis, 1999). While no observations of such reasoning were noted directly in respondents’ verbalisations, this belief can be reflected in their perceived financial risk of the innovation not being valued by the market.

While the *Jimmys* risk perceptions are likely to be a characteristic of their conservative and careful nature (see the following section), given the contradictions they demonstrate in their thought processes (see chapter 8, section 3.1.2), it is also likely that these heightened risk

perceptions are used as *rationalisations* to relieve this dissonance (as discussed in chapter 6, section 1). Kollmuss and Agyeman (2002) hypothesised that those who use rationalisations as a defence mechanism to distance themselves emotionally from their beliefs, are less likely to engage in pro-environmental behaviour. When considering that dissonance is an explanation for the status quo bias (as discussed in the previous section 3.2) it appears that this hypothesis holds true for the *Jimmys*.

Looking across all three studies, the results have shown that some of the risks the *Jimmys* stated (over-capitalising and departure from the norm) are valid reasons for their apparently conservative outlook to change. However, many of the functional and social risks were still shown to be cognitive misrepresentations or excuses used to rationalise their adoption decisions. This section has therefore demonstrated the benefit of the mixed methods approach as it provided a more rigorous interpretation of whether the risks are largely imagined concerns or actual barriers.

3.4. The Early Majority

The ‘adoption diffusion’ model (as introduced in chapter 2, section 2.1) provides useful knowledge that can be used to help understand the *Jimmys* adoption characteristics and their relationship to other homeowners.

The results from studies 2 and 3 showed the *Jimmys* to be directly comparable to the ‘early majority’ adoption group⁴⁸. For example, as the following table demonstrates, the proportion of *Jimmys* in the responding populations of both studies 2 and 3 is very similar to the early majority group’s approximate representation in a population as defined by Rogers (2003).

Table 23: Comparison between the Early Majority and *Jimmys* Population Percentages

	Percentage of Population
Early Majority	34%
<i>Jimmys</i> (Study 2)	41%
<i>Jimmys</i> (Study 3)	37%

⁴⁸ As discussed in chapter 4 (section 2.1), apart from categorising respondents on their socio-demographic characteristics and attitudes (which Morrison (2005) showed to be a poor predictor of actual behaviour), there appears to be no true way to map groups onto the adoption curve. The findings presented in this section can therefore only be viewed as a subjective interpretation as the method used to draw comparisons between the *Jimmys* and the adoption groups was inferential and not based on statistical reasoning.

The characteristics the *Jimmys* displayed also closely resembled the psychographic profiles that Rogers (2003), Moore (1991) and Morrison (2006) describe in the early majority adoption group. For example, in comparison to the early adopters, the early majority are believed to be less favourable toward change and less able to cope with uncertainty and risk (Rogers, 2003). Rogers (2003) also claimed that attitudes to risk (risk preferences) are key variables for distinguishing which adoption group an individual falls into, and Morrison (2006) found an unwillingness to take risks because of a potential financial loss to be a key predictive variable when he applied these adoption categorisations to farmers' willingness to adopt an irrigation system. Attitudes to social norms and social comparisons are also key variables that both Rogers (2003) and Moore (1991) use to distinguish the different adopter groups. In particular, compared to early adopters who are considered willing opinion leaders, the early majority "highly value the opinions their neighbours and friends hold about them (Morrison, 2006)." These were all characteristics that the *Jimmys* demonstrated. The following characteristics used to describe the early majority were also reflected in the risks the *Jimmys* described through the sub-themes in study 3:

- They need to be sure they are buying a well-tested product;
- They value others (colleagues, family and friends) experiences;
- They expect support procedures to already be in place when they adopt the innovation and that others will share the workload and responsibility;
- They expect the innovation to work properly and that it will integrate into their existing lifestyle without them having to change dramatically;
- They focus on their 'every-day' needs and consequently think in terms of the present-day. Therefore, they place little importance or interest on 'futuristic' technologies or recent advances;
- While they focus on the 'every-day', they view their actions as being for the long-term. Therefore, they are more risk-averse than early adopters who tend to keep changing their situations.

The early majority group were shown in chapter 2 to be one of the more important groups in the adoption curve as they represent the crucial segment that ultimately determines whether the innovation will become a market failure or success. The fact that the *Jimmys* closely represent the early majority therefore highlights the importance of focussing time and resources primarily on convincing this large group of homeowners.

Given Rogers (2003) and Moore (1991) work and the similarities noted, it was therefore inferred that many of the tactics or interventions that adoption theory provides for increasing mainstream diffusion, can also be applied to overcome the *disconnect* the *Jimmys* display (as will be discussed in chapter 10, section 3).

4. Contribution to Theory

CVM is not without its apparent anomalies as chapter 7 and the numerous publications that critique this approach highlight (Guagnano et al, 1994; Harrison, 1992; He et al, 2002; Nadeau, 2006; Nickerson, 1993; Nickerson, 1995; Sagoff, 2008; Vatn, 2004). While this research sought to minimise these potential biases through the mixed methods approach and survey design, because WTP values were not used to inform the 'true' monetary value of the innovations this also meant that many potential weaknesses associated with CVM were eliminated. That is, this research instead used WTP values (in combination with other variables) as a tool to segment the responding population and identify the target group of homeowners who showed *disconnected* behaviour.

In support of Awatere and Walton (2005), this research further established the benefit of asking respondents to first calculate the benefit they would be receiving and then to reflect back on their own logic (see chapter 7, section 1.2.1). These experimental manipulations were shown to be useful additions that enabled the distinction between respondents who understood the task from those who made apparent 'mistakes' in their logic or calculations (*Waynes*).

A measure of consistency across two CV scenarios was also shown to be another important addition that ensured that respondents who were affected by a methodological bias or who had inconsistent preferences (*Inconsistents*) to be identified from those whom it was inferred gave considered responses. Of those who do look at inconsistencies in survey responses, most are repeated measures or longitudinal designs where respondents are re-interviewed or re-surveyed at another time. For example, Smith (2007) used a test-retest approach to assess the temporal reliability of WTP-values. The process used here was more efficient from a data collection perspective than measuring responses across different occasions.

These two subtle yet important manipulations to CVM therefore ensured a robust mechanism to group respondents and separate out those homeowners who were aware of their responses and not affected by a methodological bias for example. This ensured a segmentation approach that could more precisely identify the 'right' homeowners towards which our actions need to be prioritised.

Through the mixed methods research approach, many critiques of CVM could be observed and/or reduced as the VR tool enabled a qualitative insight to this quantitative survey. It is well established within cognitive psychology and decision-making fields that decision behaviour is highly sensitive to factors of the task and context (Schkade and Payne, 1994). For example, Holland (2006) illustrated how responses to a question regarding the construction of a nearby wind farm could be biased if it was preceded by emotional questions on the effects of global warming. However, by conducting study 3, the impact such influences had on participants' responses could be measured. This analysis also contributed to the debate over how respondents actually reach their WTP values (Chilton et al, 2004; Schkade and Payne, 1994; Svedsater, 2003; Vadsnjal and O'Connor, 1994) as the *Jimmys* showed economic reasoning and did not simply 'pick a number out of the air'. For example, they were found to consider their household budget, to weigh up the costs and benefits, and to perform discounting calculations. Further, by comparing responses to the two private CV scenarios to the two public CV scenarios (see chapter 8, section 3.2), the findings from this study suggested that private innovations for which a normal market is conceivable are more suited to CVM than public goods, and, that economic reasoning can be facilitated in respondents' considerations through manipulations to the CV scenario and following WTP questions (the task and context). In support of the small body of research that has applied the VR method to CVM (Baker et al, 2008) these findings illustrate the benefit of the VR method as a way to interpret and measure the validity of responses that are elicited through surveys applying CVM.

The importance of the mixed method approach was again highlighted when it could be shown that the *Jimmys* were a robust phenomenon and not due to chance. That is, the choice of complementary research methods, all based on real or simulated markets, provided a way to observe whether a *disconnect* occurred in different samples and ensured that responses to the two experimental studies were comparable. The tripartite nature of this research therefore enabled an increased confidence in the results.

It is thus recommended that future studies employing CV scenarios utilise the experimental manipulations tested in this research and that a mixed methods approach is taken in order to ensure a more legitimate, valid and representative interpretation of the problem under study.

It was noted in chapter 2 (section 2.1) that it is still largely unknown what factors influence the decision or evaluation stage in the 'adoption diffusion' model. The knowledge gained from this research therefore supports others beliefs (Morrison, 2006; Rogers, 2003; Walker et al, 2003) that for the early majority group, this crucial decision stage is influenced by a variety of risk perceptions. However, the findings from this research also add to this belief by providing a better idea of why this early majority group are risk-averse. That is, because as shown in section 3.2, various cognitive and social biases influence their risk perceptions so that the risks of adopting appear more salient than the benefits do.

5. Chapter Conclusion

This chapter has highlighted how the mixed methods research approach, that used qualitative and quantitative approaches to provide descriptive, numerical and real-world perspectives, ensured a more valid representation of the *apparent disconnect* under study.

In particular, it was found that the *Jimmys disconnected* behaviour was a robust and consistent phenomenon that they were aware of and that occurs regardless of the energy-efficiency innovation being valued.

It was noted that this *disconnect* contained elements of both *prospect theory* and the *status quo bias* in that while the *Jimmys* understood the benefits of the innovation, they were resistant to adopting the innovation because they over-weighted the risks and impact of change relative to the benefits. This therefore meant that they perceived an overall negative change to their status quo and increased chance for decision regret if they were to adopt the energy-efficiency innovation.

The apparent 'deal' these homeowners wanted (the difference between what they were WTP and the full price of the innovation) was therefore viewed as either an 'economic buffer' to prevent change, or, as the amount they required to compensate for the perceived risks they would be taking. These risks were shown to fall into three broad categories:

financial, functional and *social*. These included for example that the initial investment would not be returned, that the claimed benefits were rarely gained, that it is too complex to understand, and, that everyone else must perceive these risks also as adoption does not appear to be the norm.

The benefits of the tripartite nature of this research were also revealed in this chapter as it could be shown that while some risks were actual barriers, some were largely imagined concerns or rationalisations. However, whether these risks are real or not is largely irrelevant as the very fact that the *Jimmys* perceived them to exist shows that they are still areas that need to be targeted in order to overcome this *disconnect* and increase adoption. The following chapter presents a set of principles that could be used to help overcome homeowners' cognitive misrepresentation of the risks and their subsequent inertia towards adopting energy-efficiency innovations in particular and housing-sustainability in general.

Chapter 10. Conclusion

“Once we understand when and where we may make erroneous decisions, we can try to be more vigilant, force ourselves to think differently about these decisions, or use technology to overcome our inherent shortcomings.”

(Ariely, 2008)

This chapter concludes this thesis through a review of how each chapter has contributed to an increased understanding of why New Zealand homeowners are not apparently adopting sustainability innovations.

Limitations of the research and subsequent opportunities for future research are then discussed. These include the need for an increased understanding of the other groups of homeowners identified, that further external validation is needed, and, that more research is needed on the risks homeowners perceive and their relationship to each other.

Based on the knowledge gained from this research of why homeowners are not adopting energy-efficiency innovations, a set of principles is provided as an example of the practical implications the findings could have for helping to develop effective interventions and public messages. That is, in response to the need for understanding outlined in chapter 1 this will ensure that effective public messages that connect with New Zealand homeowners are developed. In particular, consideration is given to how the perception of change can be minimised, how financial and functional risks can be reduced, how trust and confidence in their own and others actions can be increased, and finally, through creating the perception that the adoption of energy-efficiency innovations is the norm.

1. Thesis Summary

The aim of this research (see **chapter 1**) was:

“To understand why New Zealand homeowners are not apparently adopting sustainability innovations.”

The extent and nature of this problem was demonstrated in **chapter 2** where it was shown that homeowners are not adopting sustainability innovations despite an apparent preference for them. This problem was coined an *‘apparent disconnect’*.

The numerous factors that could be behind this *apparent disconnect* were reviewed in **Chapter 3** where the hypothesis was formed that no single explanation or discipline has the breadth necessary to account for this complex phenomenon.

Chapter 4 established the scope of this research by restricting the focus to energy-efficiency innovations and by providing criteria for when homeowners’ decisions could be classified as

disconnected. These research parameters and the segmentation approach were deemed necessary if any practical and targeted solution to this adoption problem was to be gained.

Further information was needed however to assist the choice of research methods and to determine which energy-efficiency innovations were most timely to study. This was gathered through a preliminary study ('study 1') of real-estate advertisements as described in **chapter 5**. In combination with the evidence presented in chapter 2, this study also reiterated the need for this research by illustrating that a market *disconnect* exists in that energy-efficiency features were not a priority sale factor but rather dropped from a property's description when there was an implied pressure to prioritise selling features.

Chapter 6 presented a mixed methods research approach that transcended disciplines and gathered both quantitative and qualitative data from stated and revealed preference techniques. This approach was used in order to widen the inquiry and ensure a more valid and representative interpretation of any *apparent disconnect*.

Chapter 7 described the development and results from the first experimental study, 'study 2'. This utilised the contingent valuation methodology (CVM) and willingness-to-pay (WTP) tool as a way to segment the responding population of New Zealand homeowners and identify the target group that this research sought to understand – those who showed *disconnected* behaviour towards the adoption of energy-efficiency innovations. These homeowners were defined as those who displayed apparently unreasonable behaviour in that despite knowing what the logical answer should be they still said that they were not willing to pay full price for the innovations. This group was labelled the '*Jimmys*' for the purposes of this thesis. In order to reveal what was different about the logic underlying their *disconnected* behaviour, the *Jimmys* were compared to the other groups identified through the segmentation process. The experimental manipulations used in this survey design, where respondents were asked to calculate the benefit they would be receiving and to reflect back on their own logic, were shown to be useful extensions to CVM (as discussed in chapter 9).

The second experimental study, 'study 3', was described in **chapter 8**. This study was designed to increase our understanding of 'why' homeowners are not adopting energy-efficiency innovations by providing a deeper qualitative understanding. The themes and sub-themes identified highlighted the inherent complexity in the *Jimmys* thought processes,

reinforcing what others have noted (NCC et al, 2006) that encouraging a behaviour change towards the adoption of energy-efficiency innovations is no trivial task.

Chapter 9 pieced the various forms of evidence from the three individual studies together to provide a more rigorous overall account of the situation, as was the purpose for taking the mixed methods approach. In response to the aim of this research, the reason why homeowners are not apparently adopting energy-efficiency innovations was observed to be due to an asymmetrical perception of risk caused by numerous social and cognitive biases. While the somewhat expected financial and functional risks were reported, social risks were also apparent in that these homeowners did not want to be the first to adopt the innovation in case they were judged as different by others.

Therefore, as this concluding chapter will discuss, in order to overcome homeowners lack of change towards housing-sustainability, perceptions of risk need to be reduced by removing the risk and by utilising to positive effect the cognitive misrepresentations and social influences that are affecting their adoption decisions.

2. Limitations and Opportunities for Future Research

While the mixed methods approach and experimental design proved successful, limitations became apparent as an increased understanding of the results was gained. These limitations all present opportunities for future research as the following sections discuss.

2.1. Look Beyond the ‘Jimmys’

This thesis only focussed on the *Jimmys*. While this group was viewed as the key group to understand (the early majority), it is acknowledged that the other groups identified in the segmentation process (the *Garys*, *Derricks*, *Nigels*, *Waynes* and *Inconsistents*) are also important to understand as they too represent important segments to achieve mainstream diffusion of energy-efficiency innovations into the majority (see chapter 2, section 2.1). For example, the early adopters (which could be conceptualised as the *Garys* and *Nigels*) also play a crucial role in whether the innovation is communicated across the chasm and into the early majority.

It was not feasible within the context of this thesis to understand the other groups' motivations. This was due to time and resource constraints and unsubstantial sample sizes. Gathering solid and consistent data on these other market segments therefore represents an important next step.

A large proportion of respondents were found to display inconsistent preferences (*Inconsistents*, 32%) or make 'mistakes' in their logic (*Waynes*, 16%). This was despite the simulated market used in studies 2 and 3 being extremely simplified compared to reality. That is, respondents were presented with a large amount of information and asked to make a decision in an extremely simple and self-reflective way. The motivations or influences behind these two groups therefore present two particular anomalies that need to be understood, especially as consistent or coherent preferences are an assumption of CVM and economic theory (Carson and Mitchell, 1993; Schkade and Payne, 1994).

Further clarification is therefore needed as to why the *Inconsistents* showed different responses to the two innovations. It was noted in chapter 7 (section 2.4.2) that two possible reasons for their inconsistencies were a bias from the survey methodology or because of a single innovation's characteristics. The *Waynes* behaviour suggested that they could be affected by conditions of *bounded rationality* (chapter 3, section 3.1). However, this assumption also needs to be substantiated, especially as it is unknown whether this is due to a lack of understanding about the complexities inherent in energy efficiency or housing-sustainability issues, or, whether it is the result of a cognitive bias or mathematical error for example.

2.2. Extend to Other Housing-Sustainability Innovations

To focus the results and output of this research, energy-efficiency innovations were studied as one type of housing-sustainability innovation. As discussed in chapter 4, because of the multiple applications and complexity inherent in the 'sustainability' concept, this focus was necessary if any accurate measurement and increased understanding of homeowners' adoption behaviours was to be made.

While this means that the findings from this research can only make conclusions about energy-efficiency innovations, it is believed that the principles (see section 3 following) can be applied to other housing-sustainability innovations. This is because it was argued in chapter 4 (section 1.1) that if the motivations for energy-efficiency innovations can be

understood, then the findings are likely to be more transferable to other sustainability innovations where the incentive to act for personal benefit is less.

Further, as shown through study 1 (chapter 5, section 4.3), because the two energy-efficiency innovations (DG and SWH) studied in the experimental research were high profile energy actions that are common within homeowners' awareness, the apparent lack of adoption for these two innovations is harder to understand. Therefore, these findings are likely to be more transferable to other innovations that are not as common and not currently affected by an *apparent disconnect* to the same extent.

Finally, because the *Jimmys* appear to resemble the early majority group in the 'adoption diffusion' model, it is believed that the behaviour the *Jimmys* show for the specific action of adopting energy-efficiency innovations can be applied at a more general level to sustainability innovations. That is, the 'adoption diffusion' model is believed to be a general model applicable to any innovation and not just limited to energy-efficiency innovations.

While this study has established the fundamental existence of an *apparent disconnect*, further more applied research is still advisable to test how similar the motivations behind the adoption of the energy-efficiency innovations studied in this research are with other housing-sustainability innovations (for example water, waste, and materials).

2.3. Increase 'Real-World' Insight

This research used a mixed methods approach to overcome the limitations and systematic biases specific to each method. In particular, study 1 used an approach based on revealed preferences in order to overcome the limitations that asking people to state their preferences can have. Despite this preliminary study utilising 'real-world' data, studies 2 and 3 were still based in an experimental setting where the hypothetical nature of the survey meant that the questions did not have real-world consequences for respondents. This could have influenced the validity of their responses. It would therefore be useful to expand in a more directed study the real-life context of this problem as initially investigated in study 1.

One critique of survey methods and CVM is that respondents will provide a number even if they find the questions difficult to answer (Carson and Mitchell, 1993; Jones-Lee and Loomes, 2004; Nadeau, 2006). The issue therefore is that the mechanisms which respondents use to produce this number may be produced through somewhat arbitrary and inventive mechanisms and not from any discernible thought process that would motivate

their decision in a 'real-life' situation (Jones-Lee and Loomes, 2004; Schkade and Payne, 1994). Some even believe that in real-life consumer choices, carefully thought out decision processes do not exist for many economic decisions (Nadeau, 2006), and that ultimately, people may be unable to articulate their underlying decision processes (Carroll and Johnson, 1990). In light of these critiques, the concern is that despite the use of the VR approach to uncover the decision processes behind responses, it may still have been that the *Jimmys* apparent indications of awareness were still only post-rationalisations for their survey responses (Nadeau, 2006).

The assumption in study 1 that real estate agents are 'in-tune' with the values of the market should also be investigated further as this may not be correct. By definition, the term 'market value' implies that all parties (agent, buyer and seller) are reasonably informed about the nature and characteristics of the asset and thus that supply and demand are invariably balanced (Daly, Gronow, Jenkins and Plimmer, 2003). However, Daly et al (2003) found that the extent to which consumers' preferences are taken into account in this market value was debateable. The recent introduction of 'Eco Savvy' training⁴⁹ for real estate agents also highlights that agents may not be knowledgeable on the benefits and value of housing-sustainability. One way to check how 'in-tune' real estate agents are to the demands of the market would be to interview the agent in the period immediately after an advertisement has been published. To ask the agent or seller what considerations were behind their advertising decisions and what their reasoning was for dropping energy-efficiency features, would provide further insight that was not gleaned through the surface analysis conducted in study 1.

Another way to provide further external validation of the findings from this research would be to study other housing-sustainability innovations that have already been successfully adopted by the early majority. For example, while heat pumps are not a 'true' innovation in that they are a replacement technology for other space-heating alternatives, a case study on their adoption history may offer insight into what marketing strategies were successful to overcome inertia and reduce the risks associated with their adoption. Further, as Cole (2003) illustrates, examples of status quo biases already exist in many commercial 'green buildings' where occupants make an effort to realign themselves back to their previous habits or expectations. For example, many do not like the lack of control in automated

⁴⁹ See <http://www.hikurangi.org.nz/?p=278> for more information (Retrieved October 9, 2009 from the World Wide Web)

blinds (Wienold, 2007) or intelligent lighting controls (Gehnen, 2008) and consequently will manually over-ride them - thus negating their intended effect. Studying such examples may also offer insight for overcoming homeowners' apparent resistance to change.

2.4. Further Measurement of Risk Perceptions

As Chaudhuri (2001), Bonini et al (2009), and Mitchell (1999) summarise, perceptions of risk need to be more directly measured. This is because there is a need to know the relative weighting and importance each 'type' or 'component' of risk plays for homeowners. That is, while financial and functional risks can almost be expected, it may be that perceptions of a social risk are more influential on their decisions. For example, Chaudhuri (2001) found that emotions associated with the product or consumption experience accounted for the variance in perceived risk whereas thoughts about the characteristics of the good were not significantly related to perceptions of risk. A New Zealand study also found social meanings to be prioritised over issues of improved performance (Trotman, 2007).

The different levels of importance homeowners place on these risks is necessary to establish as it would highlight where resources and effort are better directed when designing approaches to overcome these risk perceptions. This may be difficult to define however as Mitchell (1999) highlights, because "consumers may contrive to misrepresent the performance, financial and time aspects of a purchase in order to justify their ultimate purchase decision based on psychological risks."

2.5. Direct Measurement of 'Other' Variables

Some variables identified as important during the thematic analysis in study 3 (such as *trust*, *fairness*, *control*, and *personal capability*) were not measured in the original survey document (study 2). These therefore present variables that future research should measure directly. For example, a comparison between the results from studies 2 and 3 highlighted that there was a discrepancy between the amount of knowledge homeowners actually have and the amount they perceive themselves to have. As noted in chapter 8 (section 3.1.3), while this could be an indication of *bounded rationality*, it could also be due to a lack of confidence and not because the homeowner personally lacks knowledge or access to it. Additional questions which assess homeowners' perceptions of their knowledge may help inform this anomaly. Given that a need for control was also noted as important for the

Jimmys, these findings suggest that both aspects of Ajzen's 'perceived behavioural control' concept (Ajzen, 1991) need further exploration. That is, how much control the person has over the behaviour and the level of confidence a person feels about being able to perform the behaviour (Francis et al, 2004).

This section has shown how this research has presented opportunities for future research. Given the knowledge gained from this research about why homeowners are not apparently adopting energy-efficiency innovations in particular, the following section presents a set of principles that could be applied when planning action to overcome this housing-sustainability adoption problem.

3. Applications: A Set of Principles

Many of the cognitive and social biases that were reviewed in chapter 3 were found to help explain the *Jimmys disconnected* behaviour. These included *risk perceptions*, *regret avoidance*, a *status quo bias*, *prospect theory*, a *projection bias*, a need for *decision consistency and control*, *pluralistic ignorance*, the *availability heuristic (confirmation and frequency biases)*, and a propensity to be influenced by *social norms* and to make *social comparisons* (see chapter 9, section 3.1 and 3.2). Given these, and the fact that the *Jimmys* appear to resemble the early majority group within adoption theory (see chapter 9, section 3.4), this section presents a set of principles that could be applied to help overcome the *Jimmys disconnect* and increase the sustainability of New Zealand houses.

These principles have two underlying features in common:

1. **Reduce the possibility for decision regret.** As shown in chapter 9 (section 3.2), it appears that the *Jimmys* are using their risk perceptions as a way to justify that their apparently unreasonable behaviour was the most 'sensible' course of action. Therefore, aside from changing the *Jimmys* cognitive misrepresentation of these risks (which the following approach discusses), in order to encourage adoption these risks need to be reduced. That is, regardless of whether these risks are real or perceived (see chapter 9, section 3.3), as long as they exist the *Jimmys* will perceive an increased chance for decision regret.
2. **Utilise their cognitive shortcomings to positive effect.** This is often referred to as *asymmetric paternalism* (also known as 'choice architecture', 'soft-' or 'libertarian

paternalism') (Thaler and Sunstein, 2009). Asymmetric paternalism is a relatively recent political philosophy that works on the idea of utilising the cognitive and social biases people are affected by to overcome their irrational tendencies and make better, more deliberate decisions (Thaler and Sunstein, 2009; Lehrer, 2009).

3.1. Reframe the Perception of Change

As discussed in chapter 9 (section 3.2), the *Jimmys disconnected* behaviour possessed characteristics of the *framing effect* and *projection bias* in that they were over-weighting the salient risks and the negative impact of making a change. Attention needs to be focussed therefore on reducing both the relative importance placed on these risks and on the perception of a change. This can be done by creating incentives, policies or plans that take the focus off having to make a change 'today' (such as 'KiwiSaver'), or, by reducing the feeling of being 'locked-in' and unable to reverse the situation once the decision is made.

A 'lease-to-buy' scheme, similar to the one described in the CV scenarios of this research, presents one way to reduce the perception of a sudden and binding change. In order to make the change from the status quo seem less threatening and to let homeowners feel like they are not committed when future unknowns remain, homeowners would need to have the option of dropping out of the scheme at any time. The assurance being that things will go back to the way they were. However, given prospect theory and if the default option is to buy the innovation, then the literature would suggest that few homeowners would actually revert to their old situation. As Ariely (2008) summarises, "we fail to appreciate how our perspective will shift once we have it at home." Therefore, while homeowners have the comfort of knowing they can go back to the status quo, the *endowment effect* would suggest that once they have the sustainability innovation in their house, they would not want to give up this new 'ownership' as returning it would now be viewed as a loss. The power of the endowment effect is especially demonstrated when considering that the *Jimmys* appeared to be affected by it even within the survey instrument (see chapter 7, section 3.6). As Ariely (2008) demonstrates with the example of online auctions, it appears that the *Jimmys* felt ownership of the innovation before they actually owned it. Such a scheme therefore presents a way to utilise positively homeowners' natural tendency to be averse to loss.

The feeling of a change or loss can also be reduced by having monthly repayments. This is because Tversky and Kahneman's (2004) value function would suggest that multiple smaller

payments do not feel like as big a loss as a single large payment would. This perception can be reduced further by having the amount they contribute coinciding with their power bill savings. In a similar vein to the ‘Save More Tomorrow’ retirement savings scheme (Thaler and Sunstein, 2009; Lehrer, 2009), homeowners could agree when they first join to ‘pay more when they save more’. That is, the amount they pay towards buying the innovation each month would be an agreed on percentage of what they save in power that month. This would also alleviate their fear of debt or of committing to an outgoing payment when their future financial situation remains unknown. The benefits are therefore two-fold: 1 - homeowners are encouraged to reduce their energy use which 2 - means that they will also pay the innovation off faster.

The ‘SolarCity Solar Leasing Scheme’ is a similar approach already in place in the United States⁵⁰. This scheme works on the understanding that an overall saving is made even though homeowners are paying an amount each month to lease the solar panel. The ‘Solar Saver Scheme’⁵¹ implemented recently in New Zealand by Nelson City Council is also similar except the installation cost in this scheme is paid back as part of the homeowners’ rates. What these schemes both do however is allow homeowners to access SWH and its benefits immediately while reducing the perception of an immediate financial risk. The more than expected interest in the ‘Solar Saver Scheme’⁵² is proof of the appeal this has to homeowners. Scotts and Saville-Smith (2007) also found the availability of interest-free loans to be a key stimulus in homeowners’ decisions who installed SWH, and this idea appeared to be positively received by participants in this research: *“I think the fact that it’s a loan or a grant will help people take up this offer because they don’t have to face the upfront umm... cost (Jimmy #10).”*

There are limitations to such a scheme, particularly in that it would not be suitable for innovations such as DG that could not be easily removed if the homeowner decides to revert to their old status quo. Further, whether the scheme is administered by government or private business may have implications for its success (as section 3.4 discusses).

⁵⁰ See <http://www.solarcity.com/Default.aspx> (Retrieved October 21, 2009 from the World Wide Web)

⁵¹ See <http://www.nelsoncitycouncil.co.nz/solar-saver-scheme-launched/> (Retrieved January 16, 2010 from the World Wide Web)

⁵² See <http://www.nelsoncitycouncil.co.nz/solar-hot-water-1283/> (Retrieved January 16, 2010 from the World Wide Web)

Manipulations that change the decision frames of messages will also have an impact (as highlighted in chapter 3, section 3.2). For example, Yates and Aronson (1983) discuss evidence that shows how homeowners are more likely to adopt energy-efficiency innovations when the price includes a tax credit. They state that this is because they are then shown what they stand to lose from inaction. To overcome the *Jimmys* aversion to a negative change, messages need to focus on what they stand to lose from not adopting the innovation rather than focussing on what they will gain from adopting the innovation (Tversky and Kahneman, 2004; Yates and Aronson, 1983). For example, instead of saying, “*You will get a 20% saving in energy consumption from installing a SWH panel*”, this should be reframed as “*If you do not install a SWH panel you will lose the opportunity to save 20% off your power bill*”.

As briefly mentioned above, another way to overcome homeowners’ inertia is by making the sustainability choice the default. For example, if ‘Air New Zealand’ wanted more people to offset their carbon emissions when booking flights, then this option should be made the default option by already being ‘checked’. As Thaler and Sunstein (2009) illustrate, “defaults have some extra nudging power because consumers may feel, rightly or wrongly, that default options come with an implicit endorsement from the default setter.” In the context of energy-efficiency innovations, default options perhaps have more opportunity to influence choice in new houses as opposed to existing houses. For example, architects could assume SWH as the default. Then, if a homeowner does not want SWH, they must make an effort to request the architect to remove it; instead of the opposite as is current practice.

This understanding of why New Zealand homeowners are not apparently adopting sustainability innovations suggests the following principle:

- **Homeowners’ attention needs to be redirected through manipulations that reduce the emphasis placed on change and risk, and/or emphasise the potential for loss if they do not act.**

3.2. Encourage the Market to Value Sustainability

Study 1 indicated that energy-efficiency features are currently not valued by the market. The results from studies 2 and 3 indicated that the *Jimmys* were aware of this. In order to reduce the perception that energy-efficiency improvements are over-capitalising, an increased recognition by the market of the value of these investments is needed. This will

remove the current tendency for homeowners to focus on the *sunk cost* (see chapter 3, section 3.4) and instead refocus their attention to the *opportunity cost* the innovation could provide. One international example of the market being encouraged to value housing-sustainability can be seen through the 'Vancouver Valuation Accord'. This memorandum (signed in 2007) was an attempt to integrate environmental awareness into property valuation standards with the aim of influencing those involved with the financial side of real estate (for example appraisers, lenders, investors, and brokers) (Roberts, 2007). The introduction of 'Eco Savvy' training for real estate agents⁵³ in New Zealand is also a positive step towards achieving this, as are schemes that inform buyers of a home's energy-efficiency or sustainability performance (for example 'HERS' and the New Zealand Green Building Council's currently being developed 'Home Rating Scheme'). However, such rating-schemes are unlikely to become effective unless all houses display them. This is due to the social risk the *Jimmys* also perceive from the uncertainty around whether energy-efficiency features are socially approved by similar others (as will be discussed further in section 3.5). Furthermore, if homeowners are not interested in future energy savings as other studies have suggested (Oxera, 2006; Stoecklein et al, 2005a; 2005b), then a significant increase in house price may not be realised if just the energy savings are advertised. Such labelling might be valued for other reasons aside from this use-value however, for example as a mark of quality (Oxera, 2006) or as a symbol of social meaning as Baudrillard et al (1976) and Arnoux (1979) would suggest.

Another approach to reduce the perception of a financial risk is through a property tax. This was one idea the White House Council on Environmental Quality recently proposed (CEQ, 2009). The purpose of this initiative is to encourage homeowners to retrofit even when they might be moving before the investment is recouped. This scheme works on the principle that because the debt is tied to the property, the risk to the initial homeowner who makes the changes is removed as the current occupant who benefits from the retrofit pays for it through their annual property tax bill.

The finding that the *Jimmys* required a substantial discount (of approximately 74% on average) to compensate for the risks they perceived, has important implications for schemes such as the 'EnergyWiseTM home insulation package'. For example, this scheme currently offers a \$1,300 grant (approximately a 27% discount) to homeowners on the cost to install

⁵³ See <http://www.hikurangi.org.nz/?p=278> for more information (Retrieved October 9, 2009 from the World Wide Web)

ceiling and under-floor insulation. The findings from this study would suggest however that this discount is not sufficient to convince the large proportion of homeowners who identify with the *Jimmys*. Findings from the ShapeNZ poll (NZBCSD, 2009) also support this finding as they showed that a large proportion (44%) of respondents would not take-up this grant at the current cost to them.

This understanding of why New Zealand homeowners are not apparently adopting sustainability innovations suggests the following principle:

- **Investments in housing-sustainability need to be made more attractive so that the chance for financial decision regret is removed.**

3.3. Guarantee Performance and Compatibility

The *Jimmys* showed reservation towards the innovations' claims. This highlights the need to convince them that the innovation is compatible with their situation and functions as guaranteed. As early majority members, the *Jimmys* can be expected to adopt the innovation only once they have proof that it has been well-tested against established standards and that there are support services available to them (Moore, 1991). '*Consumer Magazine*' and the television show '*Target*' can be considered examples of the type of independent proof the *Jimmys* require to minimise these risk perceptions.

Moore (1991) suggests that another way to demonstrate performance is through providing an extensive list of industry references. However, given the scepticism the *Jimmys* showed towards business and experts' intentions, the findings from this research would suggest that references from 'similar others' would be more effective. This also corresponds to adoption theory which states that the best way to influence the buying decisions of the early majority, is to show them experiences of others who they consider to be similar to them (for example friends, family, colleagues or neighbours) (Moore, 1991). Therefore, not only do the *Jimmys* need reassurance of the innovations performance and compatibility to their situation, but this information also needs to be provided by references they respect.

Energy-use feedback tools (immediate or frequent) present another approach to help guarantee performance and instil reassurance that the product will meet its claimed performance benefits. Such technologies are also conducive to the homeowner gaining more knowledge on how to achieve savings (Swim et al, 2009). This can therefore increase

their confidence in their knowledge capability and subsequently their perceptions of behavioural control (as section 2.5 and 3.4 discuss).

Thaler and Sunstein (2009) also highlight how feedback tools positively utilise the *salience and vividness bias* as they make the benefits more salient. This has the benefit of directing homeowners' attention away from the risks. Messages intended to change behaviour can also apply this principle as Yates and Aronson (1983) demonstrate. That is, by making messages more vivid and personal, they are likely to have a greater impact on homeowners' imagination than messages that relay statistical facts or information.

Given that the *Jimmys* are averse to making future commitments, when marketing housing-sustainability innovations, the emphasis therefore needs to be on how the innovation is compatible with and will improve their 'every-day' needs. As Moore (1991) states, unlike the early adopters, the early majority do not place a lot of importance on 'futuristic' technologies. They therefore need to be reassured first that the innovation will integrate and work within their existing lifestyle. However, given that the innovation is then likely be compared to close alternatives (for example the way a space-heating heat pump may be compared to a cheaper fan or gas heater), the emphasis needs to be on how these innovations are comparable to other non-sustainable alternatives in terms of performance, cost, accessibility and convenience for example (Reuters, 2009). Only then will the sustainability features set the innovation apart from other products as the more attractive choice: "the best way to make a difference is to make the environmental choice also the more attractive choice - cheaper, easier, time-saving or more aesthetically pleasing (Reuters, 2009)."

This idea is similar to the 'stickiness factor' Gladwell (2000) refers to when he explains how people need to be shown how the idea or innovation can fit into their lives. One way to achieve this is to allow homeowners the chance to experience the innovation. As discussed in chapter 3 (section 5.1), the ability to trial an innovation is also an important factor for encouraging adoption as it reduces perceptions of risk because of uncertainty (Rogers, 2003). That is, by trialling the innovation this will help to guarantee performance and compatibility, instil confidence in their knowledge, and reduce the perceived complexity of the innovation. Digital technology may also present an opportunity in the future to engage homeowners interactively so they can experience how these innovations might look and feel in their homes.

This understanding of why New Zealand homeowners are not apparently adopting sustainability innovations suggests the following principle:

- **Homeowners' perceptions of risk can be reduced by having suitable references, by emphasising compatibility with their existing status quo, and by allowing them to trial the innovation. That is, by reducing the perception that they are taking a gamble on an unknown.**

3.4. Reduce the Complexity and Instil Confidence

The strength of a status quo bias is not only affected by the strength of an individual's preferences (the stronger the preference for the alternative, the weaker the bias), but equally so by the number of alternatives (the more options, the stronger the bias) (Kahneman et al, 1991; Samuelson and Zeckhauser, 1988). Given this finding and the *Jimmys* need to 'weigh everything up', it would appear that choice is beneficial up to a point. That is, the *Jimmys* need to consider everything only resulted in them switching back to the default option - which was to do nothing; to stick with their status quo.

Previous research has demonstrated that people adopt simplifying strategies as the choices become more numerous and varied (Thaler and Sunstein, 2009). Explicitly using such simplifying strategies as a way to shape homeowners' decisions is referred to as 'choice-editing' (Ariely, 2008; NCC et al, 2006; Thaler and Sunstein, 2009). Choice-editing is already common amongst government, manufacturers and retailers for example, and is often also viewed as desirable by consumers as it reduces the number of decisions they have to face (NCC et al, 2006). Default options (as mentioned in section 3.1) are one example of choice editing, as are programmes that eliminate the amount of decisions homeowners have to make. Swim et al (2009) suggest reducing the need to find competent contractors as one example. However, as Holland (2006) also suggests, findings like these could also imply that homeowners expect energy efficiency to come as standard so that they do not even have to think about it for themselves.

Closely related to the apparent complexity of the decision, the *Jimmys* displayed a certain fear of being incompetent – of not being knowledgeable about the innovations. While De Jager (2007) suggests that this feeling of incompetence is a natural part of the change process, these perceptions need to be reduced if the rate of adoption and chances for success are to be increased. However, it was not the case that the *Jimmys* were uninformed.

Therefore, as previous researchers have suggested (Walton et al, 2004; Schultz, 2002), approaches aimed at improving knowledge through information dissemination will not increase adoption. It is therefore necessary to instil a perceived sense of confidence through other means.

One way to encourage confidence is to provide the *Jimmys* with the illusion that they have 'control' over the change process. This is because control, or the perception of having control in one's decisions, was found to be important to the *Jimmys* and noted as a possible cause for their status quo bias (see chapter 9, section 3.2). As de Jager (2007) highlights, it is not that people resist change; it is that people resist being "changed without their consent and with no control over the process." Frame and Newton (2007) suggest that this confidence and perception of internally driven control can be increased by involving the individual to co-produce the knowledge, instead of taking an authoritative approach. More specifically, they suggest that sustainable consumption marketing could be made more effective if citizenship and consumption issues are brought together in advertising campaigns by referring to peoples' responsibilities as citizens and their rights as consumers while at the same time involving the individual in the message. This may be especially pertinent given the citizen-consumer discrepancy noted in the *Jimmys* verbalisations (see chapter 8, section 3.1.2).

To overcome the perceived lack of *behavioural control* (*futility*) the *Jimmys* showed compared to the *Nigels*, they need to believe that their actions will make a difference: "*Yes now that's a common feeling I get... what difference does my action make (Jimmy #10)?*" As illustrated in chapter 3 (sections 1.3 and 2.4) and reiterated by Nordhaus and Shellenberger (2007b), this means that narratives of eco-apocalypse and scaremongering techniques will not help to encourage these homeowners, who already perceive a negative change, to act. This is along the same lines as Trotman's (2007) conclusion that more needs to be done to build the existing profile of energy efficiency with positive associations. Therefore, when taken in consideration with section 3.1, while positive messages are needed to increase behavioural control, the loss the homeowner personally stands to lose from not acting also needs to be emphasised.

Aside from the social risk of acting when others do not (as the following section discusses), issues of *fairness* and *trust* that others were also 'doing their bit' were also found to influence the *Jimmys* willingness to change. This was especially noted towards the business sector where the *Jimmys* appeared dubious or sceptical of their motives: "*Umm... this is*

funny... because if it is privately owned, it is a different way of thinking (Jimmy #16)." The 'ShapeNZ poll' (NZBCSD, 2009) also found homeowners to be more trusting of groups that are not privately owned. This poll found that 60 out of 100 homeowners would like their council to offer a repayment or grants scheme for insulation retrofits and that 59% would either definitely take this up or would be likely to (48%). In comparison, if a privately owned electricity retailer was to offer such a loan, only 6% would definitely take up this offer and 45% might.

In a discussion on marketing techniques, Mitchell (1999) also recognises this important link between trust and perceived risk demonstrating how each can either increase or decrease the presence of the other. One way to increase trust and decrease risk perceptions is through transparency (NCC et al, 2006). That is, so that homeowners can see that intentions are motivated by environmental concerns rather than as raising revenue: *"I actually think that they should be able to pay it themselves since they can give themselves big increases in salaries (Jimmy #10)!"* The recent success of the 'Eco-Design Advisor' scheme (initiated by BRANZ and sponsored by local and national government⁵⁴) also illustrates that independent advisors are another way to decrease risk caused by trust issues. These findings again highlight the importance of having a suitable reference group to administer interventions aimed at increasing adoption.

Issues of fairness can also be overcome through normative messages (as the following section discusses in greater depth). For example, when assessing the effects of priming messages on perceptions of fairness, Sanfey (2009) found that what was advertised as the 'typical' or 'average' behaviour had a substantial influence on behaviour. Sanfey's (2009) findings imply that perceptions of fairness can be affected by altering the perceptions of what is typical. As Knetsch (1997) reiterates, whether people judge a change as positive or negative depends "largely on expectations of normalcy and what people regard as fair."

⁵⁴ See <http://www.ecodesignadvisor.org.nz/> (Retrieved January 16, 2010 from the World Wide Web)

This understanding of why New Zealand homeowners are not apparently adopting sustainability innovations suggests the following two principles:

- **The cognitive burden homeowners perceive needs to be reduced so that complexity does not lead to inaction.**
- **Homeowners need to be instilled with a sense of confidence that they are knowledgeable, that their actions will make a difference, and that they will not be acting alone.**

3.5. Make it the Norm

The results from this research highlighted that this group of homeowners are not concerned with defining an identity for themselves that sets them apart from the majority. The *Jimmys* want to be (or like to consider themselves) ‘the norm’ or ‘just like others’ and will only act when others do. That is, when it becomes a collective norm. Therefore, if there is to be any successes in overcoming this *disconnect*, a shared belief or norm about the benefits of housing-sustainability ultimately needs to be created.

Instead of energy-efficiency innovations (for example) being associated with an alternative ‘green identity’, they need to be seen as part of an ‘every-day identity’ that contains no social risk. As Futerra (2005) state: “the only way to change behaviour is to change what is socially acceptable.” This can be achieved by utilising positively many of the social biases mentioned in chapter 3 (section 2) to create messages that convince homeowners that the adoption of these innovations is actually the norm. Given that the current situation could be interpreted as an example of *pluralistic ignorance* in that the *Jimmys* thought that most other homeowners do not want to adopt the innovation, perhaps the best way to change the current norm is as Thaler and Sunstein (2009) state, to “inform people about what other people are doing.” In other words, the *Jimmys* need to be told that most other homeowners are also considering adopting the innovation. For example, when discussing how to encourage homeowners to adopt the recommendations from energy audits, Yates and Aronson (1983) recommend that homeowners are told how much their neighbours have been able to save through retrofitting.

Cialdini (2003) suggests that attention should not be drawn to negative descriptive norms that demonstrate ‘bad’ behaviours (for example, messages that emphasise that we are using too much energy). Instead, attention should be focussed on positive descriptive norms that

encourage pro-environmental behaviour (for example, messages that emphasise the good environmental behaviours others are engaged in). As Thaler and Sunstein (2009) reinforce, positively framed messages are more effective at changing behaviour than negative informational ones. Cialdini (2003) also shows how the persuasive power of these normative messages can be increased by combining descriptive norms (what people typically do) with injunctive norms (what people typically approve or disapprove of), as “people tend to do what is socially approved as well as what is popular (Cialdini, 2003)”. He especially demonstrates how messages that convey certain behaviours as being socially disapproved but widespread are very ineffective at encouraging change. For example, it would not be constructive to say, *“Many people are not installing insulation in their homes.”*

As well as informing the *Jimmys* of what others are doing, it is also important to inform them of how their actions compare to the norm. For example, Thaler and Sunstein (2009) describe a study where households were informed not only about how much energy they had consumed over a given period, but they were also told what the average energy consumption of households in their neighbourhood was so that they could judge their energy use in comparison to this ‘average-other’. While this social message made above-average users decrease their energy use, it also made below-average users increase their energy use. This thus demonstrated a cautionary note in that it is not good to let people know that their current actions are better than the norm, unless they are also told at the same time that their behaviour is socially approved.

For change to be successful, it needs to be socially visible. That is, homeowners need to see or hear about other homeowners adopting the innovation into their home. Creating such ‘hype’ is believed to be one factor for ‘KiwiSaver’s’ high participation success - more than double what was expected (NZPA, 2008b). This social visibility factor also works on our susceptibility to be influenced by psychological commitments. For example, by discussing it with others a norm is created that homeowners must feel they should conform to in order to maintain a picture of decision consistency. Graffeo et al (2009) therefore recommends social avenues such as public events as a way to establish this initial commitment.

Examples from others (either stated or observed) are also more effective than advertising or any other marketing appeal (Yates and Aronson, 1983). However, as discussed in the earlier sections and as many have said before (Gladwell, 2000; Moore, 1991; Rogers, 2003), “people tend to put most trust in those who appear to share their values and understand their needs (Marshall, 2009)”. Therefore, the characteristics of these communication channels are very

important. However, as Moore (1991) illustrates, this presents somewhat of a paradoxical situation as the “only suitable reference for an early majority customer, it turns out, is another member of the early majority, but no upstanding member of the early majority will buy without first having consulted several suitable references (Moore, 1991).” The problem therefore is in convincing a few early majority members to initially adopt the innovation. While enlisting the help of confederates or role models presents one way to overcome this, it is important that those communicating the norm or message are seen as similar-minded and trust-worthy (Gladwell, 2000; Marshall, 2009). Further, the more respected and embedded in cross-cutting networks these role models are, the faster the innovation will spread (Yates and Aronson, 1983).

The findings from the other-self comparisons further suggest that two different approaches are needed to target: 1 - those who think they are the norm (59%), and 2 - those who showed a *negative other or self-enhancement bias* in that they had a negative perception of the average-other homeowner (32.5%). For example, Walton and Bathurst (1998) suggest that campaigns which stress bad behaviour will only reinforce the perceptions of drivers who have a poor perception of the average driver. They instead suggest that campaigns need to show what the ‘average’ driver (or in this case the ‘average’ homeowner) does, the attitudes they possess, and a ‘positive disapproval’ from others when behaviour deviates from this norm. A later study (Walton and McKeown, 2001) further confirmed their hypothesis that those who have biased perceptions of the ‘average-other’ are more likely to ignore campaigns that try to discourage the negative behaviour. This was because these people think the campaigns are targeted at others who are ‘worse’ than they are, and not them.

This understanding of why New Zealand homeowners are not apparently adopting sustainability innovations suggests the following principle:

- **Homeowners, as people, will only change when ‘You and I’ do. In order to overcome this perceived social risk, attention needs to be focussed on creating effective normative messages and on identifying suitable ‘others’ to communicate these messages.**

This section has introduced a number of ideas and principles that could be applied as a means to overcome the *Jimmys disconnected* behaviour. Given the complexity and numerous causes behind this group of homeowners’ inertia, the most effective interventions

would therefore be ones that combine various intervention strategies, as others also recommend (McKenzie-Mohr and Smith, 1999; Swim et al, 2009). However, it is also important to remember that to the *Jimmys*, their current situation represents the sum total of all the investments they have made so far. These not only include financial investments in their house and lifestyle, but also social investments in terms of the ‘type’ of person they are. It is therefore understandable that they show a commitment to their current situation. Therefore, as de Jager (2007) recommends, perhaps the simplest strategy to take towards reducing the *Jimmys* reluctance to adopt housing-sustainability innovations is to show them that you respect their existing status quo and understand their concern for leaving it behind.

4. Final Words

This thesis has taken an important problem to New Zealand and explored it through a mixed methods research approach. It was the intention of this research to understand why New Zealand homeowners are not apparently adopting sustainability innovations. The benefit of understanding this problem being that a more informed approach could be taken to develop effective interventions and public messages that will connect with New Zealand homeowners and improve the sustainability of New Zealand homes.

The focus on energy-efficiency as one quantifiable aspect of housing-sustainability and the mixed methods approach provided a pragmatic solution to study this complex problem. By juxtaposing the results of the different studies together, a more valid and representative interpretation was achieved. The segmentation approach that employed slight variations to the way CVM is typically used, illustrated that the target group of homeowners who displayed *disconnected* behaviour were consistent and aware of their decision to under-pay for the innovation. That is, these homeowners’ responses were not a ‘mistake’.

It was found that the reason why these homeowners were not adopting the energy-efficiency innovations was not primarily due to the cost or the energy savings they would receive. Regardless of how cheap or expensive the innovation was, or how small or great the energy savings were, these homeowners knowingly displayed this behaviour. The reason for their behaviour was instead observed to be due to an asymmetrical perception of risk caused by numerous social and cognitive biases. These therefore made their current situation - their status quo - appear the ‘safest’ option. While the somewhat expected financial and functional risks were reported, social risks were also apparent in that these

homeowners did not want to be the first to adopt the innovation in case they were judged as different by others.

Therefore, in response to the aim of this research and the need for understanding, the knowledge gained from this research suggests that for a large proportion of homeowners, their decisions towards housing-sustainability are not exempt from the cognitive biases and social influences that plague many of the other decisions they face each day. However, as this chapter has illustrated, it is now up to us to reduce these risks and use their shortcomings to positive effect to develop interventions and messages that will help this group of homeowners overcome the inertia and subsequent *disconnect* they show towards the adoption of sustainability innovations.

Glossary

APA	American Psychological Association
CVM	Contingent Valuation Methodology
DG	Double Glazing
<i>Disconnect</i>	The discrepancy apparent towards the adoption of sustainability innovations
DV	Dependent Variable
EECA	Energy Efficiency and Conservation Authority
HEEP	Household Energy End-Use Project (conducted by BRANZ)
Homeowner	An owner-occupier responsible for making decisions to their home
Innovation	An idea, practice or object perceived as new by an individual (Rogers, 2003)
IV	Independent Variable
<i>M</i>	Mean
MED	Ministry of Economic Development
MfE	Ministry for the Environment
NZ	New Zealand
<i>SD</i>	Standard Deviation
SWH	Solar Water Heating panels
TA	‘Think-Aloud’ Interview
VR	‘Verbal Reports’
WTA	‘Willingness-to-Accept’
WTP	‘Willingness-to-Pay’

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Appendices

Appendix A: Study 2

Survey of Homeowners

The survey version presented here is version 5: \$7,000 cost and 20% energy savings.

What this survey is about

This survey concerns housing features that can reduce energy consumption. These features can reduce household power costs by reducing the amount of energy you need to either heat or cool your house, or to heat your water. Typically these housing features can be more expensive than standard construction techniques in the industry, but there are numerous benefits associated with them.

I am interested in determining how much you value improvements to your house. To assess this value I will be asking for your opinion of the improvements expressed in monetary terms. These questions are often hard to answer because most of us have no idea how much these different housing and construction features cost and the amount of benefit that can occur through improvements.

The questions are not intended to be difficult and there are no right or wrong answers. I just want your first impression.

When answering the questions, please keep in mind the following:

- Your typical monthly household power bill
- Your monthly household income
- Your usual household budget
- The other people in the household who may influence your household expenditure
- Be as realistic as possible about the value of goods. For example:
 - SKY TV costs at least \$49 per month,
 - a home phone line costs between \$37 to \$45 per month and,
 - a broadband internet connection at home costs at least \$25 per month.

IMPORTANT POINTS

- Please answer this survey with respect to the house where you normally live (i.e. not an investment property or holiday home)
- There are no right or wrong answers
- We value your opinion
- If a question doesn't make sense, let us know, but try to answer by choosing the most appropriate response
- You are entitled to a brief summary of the findings: you can obtain these by contacting us using the details above
- There is a comments section on the back of this resource page

Ethics approval for this research has been obtained from Victoria University's Human Ethics Committee. Responses collected will form part of my overall research project. The final thesis will be submitted for marking and deposited in the University Library. It is intended that one or more articles will be presented at conferences and submitted for publication in scholarly journals.

Please note that the scenarios presented in this survey are entirely hypothetical.

This is a resource page to help you if you are unsure of something in a question. Please refer back to this page if you need to.

HELP!!

An easy way to calculate percentages

10% of something is the amount divided by 10.

E.g. 10% of \$200 = $\$200/10 = \20

20% of something is the amount divided by 5.

E.g. 20% of \$200 = $\$200/5 = \40

What is a typical or average New Zealand household?

Some questions will ask you to consider a typical or average New Zealand household. Please consider this household as people who will be willing to pay no more or no less than any other person. It is a hard thing to do, but try your best!

Some characteristics of this 'average New Zealand household' include that they would spend about \$150 per week on food, \$135 per week on transport, and about \$100 per week on recreation and culture.

What is a typical or average New Zealand house?

A typical New Zealand house has a floor area around 120m²-130m² and it has approximately 20% of its total wall area (about 20-30m²) in windows or glazing. This house is likely to have 3 bedrooms with 3 people living in it. A typical house in New Zealand is a stand-alone timber frame with a weatherboard or brick veneer cladding and a corrugated iron or steel roof.

I don't usually pay the power bills?

Please pass this on to the person within your household who usually deals with the power bills. Otherwise, have a go at the questions you can answer sensibly.

I don't own this house?

It does not matter if you do not own the house you live in because you should still have costs related to your living. You may find some answers a little bit harder to answer, but please have a go at answering all the questions sensibly.

WHAT DO THESE WORDS MEAN?

Floor Area: is the floor area (expressed in square metres) of all interior spaces used for activities normally associated with domestic living.

Wall Area: is the area (expressed in square metres) of all internally-exposed external walls, including any door openings. This also includes the area of all vertical glazing (or windows) in the building.

Renewable energy: is energy derived from the sun, wind, biomass and other renewable sources, rather than from fossil fuels.

Carbon Dioxide (CO₂): is a greenhouse gas produced by the combustion of fossil fuels (e.g. petrol, oil, coal). It is thought to be a major contributor to climate change.

Please feel free to comment on the survey, the questions or any aspect of this research

.....
.....

3. A typical NZ household spends about \$200 per month (\$2,400 per year) on power. What is a normal monthly power bill for your household? (Please give an average over the year. We understand that there is likely to be a difference between summer and winter bills.)

\$..... per month

If your power bill shows a graph of your 12-monthly consumption pattern and you do not mind, can you please cut out this graph and return it with this survey in the envelope provided. Please remove any forms of identification such as your customer number, name or address.

Double glazing is a window that uses two panes of glass separated by a gap.

Solar water heating panels are panels usually placed on a roof (or some other sunny place) to absorb heat from the sun which is then used to heat water.

DOUBLE GLAZING

4. Do you currently live in a house with double glazing?

☐ I don't know

☐ No

☐ Yes

Please go to Question 3

Please go to Question 4

5. Imagine that you live in a house with double glazing, how much do you think you would save on your normal power bill per month?

\$.....less per month

Please go to Question 5 after reading the following box

6. Imagine that you now live in a house without double glazing, how much extra do you think your normal power bill would be per month?

\$.....more per month

For the following questions, please pretend that your house does not already have double glazing

Double glazing can reduce space heating costs. This can result in savings to the power bill of **20% for a typical New Zealand house. Some people say that the benefits of double glazing include:**

- Energy savings up to 2,290 kWh/year. This is equivalent to running 5½ spa pools for a year.
- Reductions in carbon dioxide (CO₂) emissions up to 850 kg CO₂/year. This is equivalent to a one-way flight from Auckland to Melbourne.
- Improved comfort and warmth
- Reduced noise levels
- Reduced condensation and dampness
- Increased security

The cost to retrofit double glazing for a typical NZ house is \$7,000 including the frame and all other costs (e.g. installation and finance costs). The expected lifetime of double glazing is around 25 years and they require no more maintenance than standard windows.

7. How much would you save if you saved 20% on your normal monthly power bill? (This can be calculated by dividing by 5. If you are not sure, see the help section on the pink resource page)

\$.....per month

8. Do you think a 20% saving from double glazing for a typical New Zealand household sounds about right, too high, or too small? (please tick the box that best applies)

☐ Too low ☐ About right ☐ Too high

9. Do you think a cost of \$7,000 for double glazing for a typical New Zealand house sounds about right, too high, or too low? (please tick the box that best applies)

☐ Too low ☐ About right ☐ Too high

Suppose that it costs \$7,000 to get your house retrofitted with double glazing by a government scheme. There is no initial upfront cost to your household, but to help recover the costs the scheme would require you to contribute an amount of money each month (interest-free) towards having the double glazing in your home.

10. Acknowledging that you get the benefits of double glazing straight away, what is the maximum amount that you would be prepared to pay to have double glazing in your house?

\$.....per month

11. What is the maximum length of time that you would be prepared to pay this amount for?

..... Month(s)

12. Is the amount you would be prepared to pay per month, about the same, more, or less than the monthly saving you could get on your power bill (i.e. Question 5)?

☐ Less ☐ About the same ☐ More

13. Remembering that the total cost to install double glazing is \$7,000, is the total amount you would be prepared to pay over the length of time you stated, about the same, more, or less than the cost to install double glazing?

☐ Less ☐ About the same ☐ More

14. Do you think an average or typical New Zealand household would be prepared to pay about the same, more or less than you to have double glazing in their house?

☐ Less ☐ About the same ☐ More

15. Are there any other advantages with having double glazing in your house, apart from those already listed in the box at the bottom of page 1? (Please list these)

.....
.....

16. Are there any disadvantages with having double glazing in your house? (Please list these)

.....
.....

17. Please divide \$100 between the benefits of double glazing depending on how much you and any other household members would value them? (Allocate more money to benefits you value more and less money to benefits you value less)

Benefit	Your Allocation	Example
Savings of 20% on my power bill		\$20
Reduced energy use		\$0
Reduced carbon dioxide (CO2) emissions		\$0
Improved comfort and warmth		\$60
Decreased noise		\$10
Decreased condensation and dampness		\$10
Increased security		\$0
Other (please state)		\$0
Total	\$100	\$100

18. If your house was to be sold in the next 2 months, what would be the expected sale price? (Note that this is entirely confidential and our interest is really in Question 17.)

\$.....

19. Do you think putting double glazing in your house will increase the sale price of your house? Place an X on the line to indicate the amount you think your house price would change by.

SOLAR WATER HEATING

20. Do you currently live in a house with solar water heating panels?

☐ I don't know

☐ No

☐ Yes

↓ Please go to Question 19 ↓

↓ Please go to Question 20 ↓

21. Imagine that you live in a house with solar water heating, how much do you think you would save on your normal power bill per month?

\$.....less per month

Please go to Question 21 after reading the following box

22. Imagine that you now live in a house without solar water heating, how much extra do you think your normal power bill would be per month?

\$.....more per month

For the following questions, please pretend that your house does not already have solar water heating

Solar water heating can reduce water heating costs. This can result in savings to the power bill of **20%** for a typical New Zealand house. Some people say that the benefits of solar water heating include:

- A clean, renewable supply of energy is used
- Reduced reliance on power companies for energy
- Energy savings up to 2,290 kWh/year. This is equivalent to running 5½ spa pools for a year.
- Reductions in carbon dioxide (CO2) emissions up to 850 kg CO2/year. This is equivalent to a one-way flight from Auckland to Melbourne.

The cost to install solar water heating (including a new hot water cylinder) retrofitted to an existing house is \$7,000. The expected lifetime of a solar water heating panel is around 20 years and a good system will require maintenance about once every 5 years.

23. How much would you save if you saved 20% on your usual monthly power bill? (This can be calculated by dividing by 5. If you are not sure, see the help section on the pink resource page)

\$.....per month

24. Do you think a 20% saving from solar water heating for a typical New Zealand household sounds about right, too high, or too small? (please tick the box that best applies)

☐
Too low

☐
About right

☐
Too high

25. Do you think a cost of \$7,000 for solar water heating for a typical New Zealand house sounds about right, too high, or too low? (please tick the box that best applies)

☐
Too low

☐
About right

☐
Too high

Suppose that it costs \$7,000 to get your house retrofitted with solar water heating by a government scheme. There is no initial upfront cost to your household, but to help recover the costs the scheme would require you to contribute an amount of money each month (interest-free) towards having the solar water heating in your home.

26. Acknowledging that you get the benefits of solar water heating straight away, what is the maximum amount that you would be prepared to pay to have solar water heating in your house?

\$.....per month

27. What is the maximum length of time that you would be prepared to pay this amount for?

..... Month(s)

28. Is the amount you would be prepared to pay per month, about the same, more, or less than the monthly saving you could get on your power bill (i.e. Question 21)?

☐
Less

☐
About the same

☐
More

29. Remembering that the total cost to install solar water heating is \$7,000, is the total amount you would be prepared to pay over the length of time you stated, about the same, more, or less than the cost to install solar water heating?

☐
Less

☐
About the same

☐
More

30. Do you think an average or typical New Zealand household would be prepared to pay about the same, more or less than you to have solar water heating in their house?

☐
Less

☐
About the same

☐
More

31. Are there any other advantages with having solar water heating in your house, apart from those already listed in the box at the bottom of page 3? (Please list these)

.....
.....

32. Are there any disadvantages with having solar water heating in your house? (Please list these)

.....
.....

33. Please divide \$100 between the benefits of solar water heating depending on how much you and any other household members would value them? *(Allocate more money to benefits you value more and less money to benefits you value less)*

Benefit	Your Allocation	Example
A clean, renewable supply of energy is used		\$40
Reduced reliance on power supply companies		\$0
Savings of 20% on my power bill		\$20
Reduced energy use		\$10
Reduced carbon dioxide (CO ₂) emissions		\$10
Other (please state)		\$10
Total	\$100	\$100

34. Do you think putting solar water heating in your house will increase the sale price of your house? *Place an X on the line to indicate the amount you think your house price would change by.*

35. Does your house have any of the following:

Insulation in the ceiling	☐ Yes	☐ No	☐ Don't Know
Insulation in the walls	☐ Yes	☐ No	☐ Don't Know
Insulation under the floor	☐ Yes	☐ No	☐ Don't Know
A heated swimming pool	☐ Yes	☐ No	☐ Don't Know
A heated spa pool	☐ Yes	☐ No	☐ Don't Know
A wetback	☐ Yes	☐ No	☐ Don't Know
Instant electric or gas water heating	☐ Yes	☐ No	☐ Don't Know
Electric hot water heat pump	☐ Yes	☐ No	☐ Don't Know
Any other form of efficient home heating <i>(Please state beside)</i>			

36. Please estimate how many windows your house has by indicating what percentage of your wall area is glazing. *(Remember that the average house has about 20% of its wall area in glazing) (Place an X on the line)*

37. In the last 12 months, have you spent more than \$500 to actively improve the energy performance of your house? *(If Yes, please briefly describe what these actions were below)*

..... ☐ Yes ☐ No

.....

38. Does your household have any extra-ordinary heating or energy requirements? *(Please list these)*

.....

.....

39. Have any of the previous houses you have lived in had double glazing? *(Do not include your current house)*

☐ Yes ☐ No

40. Have any of the previous houses you have lived in had solar water heating panels? *(Do not include your current house)*

☐ Yes ☐ No

Please circle the number that best describes how much you agree with the following statements	Strongly Disagree	Disagree	Not Sure/ Neutral	Agree	Strongly Agree
I like to be associated with being 'green'	1	2	3	4	5
The government should take stronger action to reduce greenhouse gas emissions from residential houses	1	2	3	4	5
I have more important concerns than environmental issues	1	2	3	4	5
All households have a responsibility to prevent environmental problems	1	2	3	4	5
I am likely to vote for a public official because of their pro-environmental stance	1	2	3	4	5
I have lots of enthusiasm for living an environmentally friendly lifestyle	1	2	3	4	5
I dislike it when environmental issues are brought into politics	1	2	3	4	5
I am not interested in signing petitions on an environmental issue	1	2	3	4	5
I do not feel a sense of personal obligation to take action to stop unnecessary use of energy	1	2	3	4	5
I should do whatever I can to prevent our houses from being energy hungry	1	2	3	4	5
I like to consider myself as 'environmentally friendly'	1	2	3	4	5
The government does not have a responsibility to prevent unnecessary energy use from houses	1	2	3	4	5
I believe environmental organisations are helping society	1	2	3	4	5
I feel a moral obligation to reduce the amount of energy my household uses	1	2	3	4	5
All households should be using as much energy as they can from renewable sources	1	2	3	4	5
The government should legislate to make our houses more energy efficient	1	2	3	4	5
'Greenies' are unusual people	1	2	3	4	5
I am likely to contribute financially to an environmental organisation	1	2	3	4	5
I dislike government suggesting that I should change my lifestyle	1	2	3	4	5
Changing my habits around the house is difficult	1	2	3	4	5
All households should be taking steps to reduce their energy consumption	1	2	3	4	5
It is too late to rectify the damage we have done to the environment	1	2	3	4	5
There is no point in making changes to reduce my household energy use, because the rest of the population will not change their behaviour	1	2	3	4	5

41. How many people usually live in your household? people
42. How many more years do you expect to live in your current house for?more years
43. Can you name an intersection close to your house? (E.g. Brown St. Vs Grey St.) (Do not write your address)
-

The following questions ask about your perception of the average New Zealand lifestyle

44. Please estimate the average New Zealand total <u>household income</u> (i.e. the total personal income of all members of the household)	\$..... ☐ Don't Know
45. Please estimate the percentage of homes in New Zealand with <u>double glazing</u>	% ☐ Don't Know
46. Please estimate the percentage of homes in New Zealand with <u>solar water heating panels</u>	% ☐ Don't Know

New Zealand is trying to reduce its Carbon Dioxide (CO₂) emissions by 2040. Suppose your power company supports this and wants to switch from thermal generation (e.g. coal or oil) to renewable energy sources such as hydro-electric power or wind generation.

47. Considering that around 1.4 million other households in New Zealand would contribute also, what is the most that you would be prepared to pay each month on top of your power bill towards the cost of building a new hydro-electric dam to replace an existing coal-fired power station (e.g. like the one at Huntly)?

\$.....per month (for indefinitely)

48. Indicate the degree of satisfaction you would receive from contributing towards New Zealand's switch to cleaner and renewable energy sources through the construction of a hydro-electric dam. *(Place an X on the line)*

Suppose instead that your power company recognises that their activities affect the natural habitat of some of New Zealand's rare and endangered species. To help these species, your power company has set up a fund for a community conservation project that will lead to significant restoration and rehabilitation of these rare and endangered species natural habitats.

49. Considering that around 1.4 million other households in New Zealand would contribute also, what is the most that you would be prepared to pay with your power bill each month to this fund to help restore and rehabilitate the natural habitats of some of New Zealand's rare and endangered species? *Note that this is instead of Q 49.*

\$.....per month (indefinitely)

50. Indicate the degree of satisfaction you would receive from contributing to this fund. *(Place an X on the line)*

51. Have you had any previous experience with 'sustainable' or 'energy efficient' housing?

☐ No ☐ Yes *(please tick all that apply below)*

- ☐ Previous or current houses I lived in had environmental features
- ☐ It is within my field of work
- ☐ I am doing or have had previous education on it (e.g. university, workshops, courses)
- ☐ I am/have been involved with non-profit or activist organisations
- ☐ I have personally researched it
- ☐ Other *(please state)*

52. Please rate your general level of concern for environmental issues *(Place an X on the line)*

53. When the 'Powersavers Group' (i.e. the power industry) calls for a national reduction in household energy use, do you make more of an effort, less, or about the same as a typical New Zealand household would?

☐ Less ☐ About the same ☐ More

54. Do you personally feel any pressure to reduce your household's energy use?

- ☐ I have never thought about it ☐ No pressure ☐ A little pressure ☐ Some pressure ☐ A lot of pressure

55. What type of area do you live in?

- ☐ Farm ☐ City of 10,000 to under 100,000 people
☐ Town less than 10,000 people ☐ Other (*please state*)
☐ City larger than 100,000

56. What best describes your current living situation?

- ☐ Single ☐ Retired (Single)
☐ Friends/Flatters ☐ Retired (Couple)
☐ Family ☐ Extended Family
☐ Family (children have left home) ☐ Other (*please state*)
☐ Couple no children

57. What best describes the tenure of your house?

- ☐ Owned without mortgage ☐ Rented ☐ Other (*please state*)
☐ Owned with mortgage ☐ Family Trust

58. What best describes the type of house you live in?

- ☐ A detached house (not joined to any other) ☐ A house or flat joined to a business or shop
☐ A house or flat joined to 1 other house or flat ☐ Non private dwelling (e.g. hostel, motel, or hotel)
☐ A house or flat joined to 2 or more houses or flats ☐ Other (*please state*)

59. In which region do you live?

- ☐ Northland ☐ Gisbourne ☐ Wellington ☐ Canterbury
☐ Auckland ☐ Hawkes Bay ☐ Marlborough ☐ Otago
☐ Waikato ☐ Taranaki ☐ Nelson/Tasman ☐ Queenstown Lakes/ Central Otago
☐ Bay of Plenty ☐ Wanganui / Manawatu ☐ West Coast ☐ Southland

60. Please indicate your gender

- ☐ Female
☐ Male
☐ Prefer not to say

61. Please indicate your age group

- ☐ 17-24 ☐ 55-64
☐ 25-34 ☐ 65-74
☐ 35-44 ☐ 75+
☐ 45-54 ☐ Prefer not to say

62. Please indicate your ethnicity

- ☐ New Zealander / Pakeha
☐ Maori
☐ Pacific Island
☐ Indian
☐ Asian
☐ European
☐ Other (*please state*)
☐ Prefer not to say

63. Please indicate your total combined household income (*before tax*)

- ☐ \$20,000 or less ☐ \$70,001-\$100,000
☐ \$20,001-\$30,000 ☐ \$100,001 or more
☐ \$30,001-\$50,000 ☐ Prefer not to say
☐ \$50,001-\$70,000

Thank-you for participating

Please place this survey in the prepaid return envelope supplied and drop it in the mail!

Appendix B: Study 2

Sample Selection Process

Figure B1: Meshblock Dwelling Density in the Auckland Region (Before Trimming)

Figure B2: Meshblock Dwelling Density in the Auckland Region (After Trimming)

Figure B3: Meshblock Dwelling Density in the Canterbury Region (Before Trimming)

Figure B4: Meshblock Dwelling Density in the Canterbury Region (After Trimming)

Appendix C: Selected Demographic Characteristics

This appendix provides a comparison of selected demographic characteristics of the responding sample to the '2006 Population Census'. Differences in question format meant that some characteristics could not be compared (for example ethnicity). Further, owner-occupiers in medium density dwelling areas, 'rented' properties and 'under 20 years', were excluded from '2006 Census' statistics so that they were more comparable to the target population sampled from.

Note that the regional break-down in the Census statistics did not always distinguish all cases, namely '75+' age-group, number of usual residents, and whether the house is owned with or without a mortgage or in a family trust.

Table C1: Comparison between Study 2 Responding Sample and the '2006 Census'

	Study 2			2006 Census		
Age	<i>Auckland</i>	<i>Canterbury</i>	<i>Total Sample</i>	<i>Auckland</i>	<i>Canterbury</i>	<i>National</i>
<i>20-24</i>	0%	0.40%	0.30%	11%	9%	9%
<i>25-34</i>	5%	7%	6%	21%	17%	18%
<i>35-44</i>	14%	19%	17%	23%	21%	22%
<i>45-54</i>	26%	26%	26%	19%	19%	19%
<i>55-64</i>	23%	19%	21%	13%	15%	14%
<i>65-74</i>	21%	16%	19%			9%
<i>75+</i>	12%	12%	12%	14%	19%	8%
Total	101%⁵⁵	99%	101%	101%	100%	99%
Gender	<i>Auckland</i>	<i>Canterbury</i>	<i>Total Sample</i>	<i>Auckland</i>	<i>Canterbury</i>	<i>National</i>
<i>Female</i>	49%	48%	48%	51%	51%	52%
<i>Male</i>	51%	52%	52%	49%	49%	48%
Total	100%	100%	100%	100%	100%	100%
Household Income	<i>Auckland</i>	<i>Canterbury</i>	<i>Total Sample</i>	<i>Auckland</i>	<i>Canterbury</i>	<i>National</i>
<i>\$20,000 or less</i>	6%	5%	5%	9%	7%	8%
<i>\$20,001-\$30,000</i>	10%	16%	13%	9%	12%	11%
<i>\$30,001-\$50,000</i>	15%	18%	16%	14%	18%	17%
<i>\$50,001-\$70,000</i>	20%	16%	18%	14%	18%	16%
<i>\$70,001-\$100,000</i>	18%	21%	20%	16%	17%	16%
<i>\$100,0001 or more</i>	21%	17%	19%	24%	16%	19%
<i>Prefer not to say</i>	10%	8%	9%	15%	12%	14%
Total	100%	101%	100%	101%	100%	101%
Household Tenure	<i>Auckland</i>	<i>Canterbury</i>	<i>Total Sample</i>	<i>Auckland</i>	<i>Canterbury</i>	<i>National</i>
<i>owned with mortgage</i>	43%	45%	44%	85%	93%	40%
<i>owned without mortgage</i>	54%	52%	53%	15%	7%	31%
<i>family trust</i>	4%	3%	3%			17%
<i>other</i>	0%	0%	0%			9%
Total	101%	100%	100%	100%	100%	97%
Number of Usual Residents	<i>Auckland</i>	<i>Canterbury</i>	<i>Total Sample</i>	<i>Auckland</i>	<i>Canterbury</i>	<i>National</i>
	2.68	2.8	2.75	-	-	2.7

⁵⁵ Rounding meant that in some cases total percentages are more than 100%

Appendix D: Study 2

Factor Analysis

Table D1: Final Factors Extracted from (PCA) Factor Analysis

Final Factors	Original Reference
Factor 1: 'Altruistic Obligation' (5 items, $\alpha = 0.75$)	
1. All households have a responsibility to prevent environmental problems	Moral Norm Others #3.
2. I should do whatever I can to prevent our houses from being energy hungry	Moral Norm Personal #2.
3. I feel a moral obligation to reduce the amount of energy my household uses	Moral Norm Personal #1.
4. All households should be using energy from renewable sources as much as they can	Moral Norm Others #2.
5. All households should be taking steps to reduce their energy consumption	Moral Norm Others #1.
Factor 2: 'Egoistic Protest' (6 items, $\alpha = 0.78$)	
1. I have more important concerns than environmental issues *	Protest Personal Capability #2.
2. I dislike it when environmental issues are brought into politics *	Protest Government #2.
3. I am not interested in signing petitions on an environmental issue *	Protest Environmental Organisation #2.
4. I do not feel a sense of personal obligation to take action to stop unnecessary use of energy within my home*	Moral Norm Personal #3.
5. The government does not have a responsibility to prevent unnecessary energy use from houses*	Moral Norm Government #3.
6. I dislike government suggesting that I should change my lifestyle *	Protest Government #1.
Factor 3: 'Green Identity' (4 items, $\alpha = 0.79$)	
1. I like to be associated with being 'green'	Protest Green Identity #1.
2. I am likely to vote for a public official because of their pro-environmental stance	Protest Government #3.
3. I have lots of enthusiasm for living an environmentally friendly lifestyle	Protest Personal Capability #1.
4. 'Greenies' are unusual people *	Protest Green Identity #2.

* Indicates items that were reverse scored

Table D2: Items Removed during Factor Analysis

Items	Original Reference
1. The government should legislate to make our houses more energy efficient (<i>factor 4 dropped - low internal reliability</i>)	Moral Norm Government #2.
2. I am likely to contribute financially to an environmental organisation (<i>factor 4 dropped - low internal reliability</i>)	Protest Environmental Organisations #1.
3. Changing my habits (around the house) is too difficult * (<i>factor 4 dropped - low internal reliability</i>)	Protest Personal Capability #3.
4. I like to consider myself as 'environmentally friendly' (<i>double loading</i>)	Protest Green Identity #3.
5. I believe environmental organisations are helping society (<i>< 0.5 loading criteria</i>)	Protest Environmental Organisations #3.
6. The government should take stronger action to reduce emissions from residential houses (<i>< 0.5 loading criteria</i>)	Moral Norm Government #1.

* Indicates items that were reverse scored

Figure D1: Scree Plot of Principal Components Analysis of Attitude Items

Appendix E: Study 2 Results Summary

Table E1: Potential Influences on Behaviour (All)

Variables	Statistical Significance (p-value)	
Individual Psychological Factors		
altruistic obligation	NS (p=.75)	
egoistic protest	NS (p=.98)	
moral satisfaction - hydro	NS (p=.65)	
moral satisfaction - habitats	NS (p=.53)	
concern environmental issues	NS (p=.12)	
Demographics		
gender	NS (p=.81)	
age	NS (p=.31)	
life-stage (living situation)	NS (p=.35)	
ethnicity	NS (p=.08)	
household income	NS (p=.41)	
Social Psychological Factors		
green identity	0.03*	
fatality	NS (p=.06)	
futility	0.02*	
'average-other' pay for DG	NS (p=.11)	
'average-other' pay for SWH	NS (p=.12)	
effort compared to 'average-other'	NS (p=.84)	
'average-other' household income	NS (p=.57)	
% homes with DG	NS (p=.59)	
% homes with SWH	NS (p=.27)	
Behavioural Economic Factors		
DG WTP per month	NS (p=.13)	
SWH WTP per month	NS (p=.12)	
DG length WTP	0.01*	
SWH length WTP	0.01*	
Characteristics of the Innovation		
DG increase house value	NS (p=.58)	
SWH increase house value	NS (p=.67)	
co-benefits:	DG	SWH
savings on power bill	NS (p=.68)	NS (p=.39)
reduced energy use	NS (p=.59)	NS (p=.80)
reduced CO2 emissions	NS (p=.61)	NS (p=.33)
clean, renewable supply of energy	NA	NS (p=.21)
increased comfort/warmth	NS (p=.21)	NA
reduced noise	NS (p=.65)	NA
reduced condensation	NS (p=.11)	NA
increased security	NS (p=.41)	NA
reduced reliance on power companies	NA	NS (p=.49)
other	NS (p=.27)	NS (p=.96)
Contextual Factors		
<i>Perceived Personal Capabilities</i>		
habits	NS (p=.52)	
pressure felt	NS (p=.48)	
previous experience	NS (p=.39)	
previous houses had DG	NS (p=.82)	
previous houses had SWH	NS (p=.69)	
extra-ordinary heating requirements	NS (p=.42)	
spent >\$500 to actively improve energy performance	NS (p=.41)	

Variables		Statistical Significance (p-value)
<i>Characteristics of the Household and Dwelling</i>		
power consumption		NS (p=.80)
# people resident		NS (p=.44)
region		NS (p=.66)
dwelling density		NS (p=.08)
dwelling type		NS (p=.42)
length planning to stay in house		NS (p=.61)
tenure		NS (p=.72)
house value		NS (p=.34)
% area glazing		NS (p=.97)
house have:	DG	NS (p=.53)
	SWH	NS (p=.09)
	ceiling insulation	NS (p=.46)
	wall insulation	NS (p=.88)
	under-floor insulation	NS (p=.88)
	heated swimming pool	NS (p=.25)
	heated spa pool	NS (p=.93)
	wet-back	NS (p=.15)
	instant electric or gas water heating	NS (p=.19)
	electric hot water heat pump	NS (p=.86)

* = result was significant at the 5% level ($p < .05$) of uncertainty.

NS = non-significant.

NA = test was not applicable

Appendix F: Study 3

Verbal Report Instructions

The same survey instrument as in Appendix A (study 2) was used for the 'Think-Aloud Interviews' (study 3). Only the instructions are presented here.

'THINK-ALoud' INSTRUCTIONS

Title of Project: Household Energy Consumption

One important purpose of this research is to find out what people are thinking when answering questions about energy use in their homes.

In order to do this, I want you to talk me through what you are thinking as you answer the questions in this survey. I don't want you to plan what to say or to explain what you are saying unless I probe you to do so. Just pretend you are alone in the room speaking to yourself!

*Remember, there are no right or wrong answers, and you should not feel that there is anything you should not say – I am interested in **anything** and **everything** that comes to your mind and helps you to determine your answer, no matter how unimportant it may seem to you. It is like being on the game show "Who Wants To Be A Millionaire" in that you have to let the host or presenter let you know what you are thinking when trying to decide which answer is correct!*

*It is important that you **keep talking**. If you fall silent for some time, I will prompt you to continue talking.*

Do you understand what I want you to do?

Now I will give you some practice problems. Can you please tell me what you are thinking as you name:

"5 different ways your house or its household members use energy?" Don't worry about counting, I will keep track for you.

Now, can you please think-aloud while you work out:

"How many windows there are in your house?"

And one last practice problem -

"What is 10% of 500?"

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Appendix G: Study 3

Thematic Analysis

Table G1: Frequency each *Jimmy* Expressed a Theme

	Respondent											
	#6	#8	#10	#12	#13	#15	#16	#21	#22	#23	#26	Total
'Angels and Demons'												
I'm Usual; I'm Unusual	6	6	7	12	4	4	4	10	9	7	4	73
Citizen; Consumer	9	11	12	16	1	9	7	6	10	11	7	99
I'll trust you; I don't trust you	3	3	4	5	0	3	7	5	4	3	1	38
Subtotal	18	20	23	33	5	16	18	21	23	21	12	210
'I'm sticking with what I know'												
It's not worth it	2	3	4	3	2	3	0	2	1	5	5	30
I can't think that far ahead	4	2	2	2	1	1	2	3	1	4	3	25
I need to weigh everything up	3	4	4	2	0	1	1	4	0	2	1	22
I don't know enough	1	0	1	7	4	7	1	2	0	3	6	32
Subtotal	10	9	11	14	7	12	4	11	2	14	15	109
'I will if you will'												
It's not just up to me	1	3	2	4	0	3	1	4	1	1	1	21
That's not fair!	0	1	2	1	2	0	3	0	0	1	1	11
What will others think?	0	1	7	3	0	1	3	2	1	2	3	23
...but don't control me!	0	2	1	1	0	0	3	1	2	1	0	11
Subtotal	1	7	12	9	2	4	10	7	4	5	5	66
TOTAL	29	36	46	56	14	32	32	39	29	40	32	385

Appendix H: Study 3

Content Analysis

Table H1: Frequency Each Consideration was referred to in the DG Scenario

Consideration		DG Scenario			
		<i>Jimmys</i> (11)	<i>Derricks</i> (1)	<i>Waynes</i> (7)	<i>Inconsistents</i> (11)
Reference to the good					
	<i>Perceived cost</i>	9% (1)	0% (0)	29% (2)	0% (0)
	<i>Potential savings</i>	18% (2)	0% (0)	14% (1)	0% (0)
	<i>Other benefits</i>	18% (2)	0% (0)	29% (2)	9% (1)
	<i>Perceived disadvantages</i>	0% (0)	0% (0)	0% (0)	9% (1)
	<i>Expected lifetime</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>'Real-life'/personal experience example</i>	0% (0)	0% (0)	0% (0)	9% (1)
Reference to economic reasoning					
Personal situation/ preferences	<i>Budget/Can afford</i>	64% (6)	0% (0)	14% (1)	18% (2)
	<i>Reasonable/Fair/Comfortable</i>	18% (2)	0% (0)	29% (2)	0% (0)
	<i>Other spending priorities</i>	9% (1)	0% (0)	14% (1)	9% (1)
	<i>Unknown future</i>	18% (2)	0% (0)	0% (0)	9% (1)
Mental accounting: expenditure and repayment	<i>Debt/commitments</i>	27% (3)	100% (1)	0% (0)	27% (3)
	<i>Power bill savings</i>	36% (4)	0% (0)	43% (3)	9% (1)
	<i>Other household bills (incl. mortgage)</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Other expenditures (incl. charities)</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Repayment characteristics</i>	27% (3)	0% (0)	43% (3)	36% (4)
	<i>Pay-back period</i>	36% (4)	0% (0)	29% (2)	36% (4)
Reference to household situation					
	<i>Characteristics of house</i>	9% (1)	0% (0)	0% (0)	36% (4)
	<i>Length plan to stay</i>	36% (4)	0% (0)	0% (0)	0% (0)
	<i>Recent/future improvements</i>	0% (0)	0% (0)	14% (1)	9% (1)
	<i>Other household members</i>	9% (1)	0% (0)	14% (1)	9% (1)
Reference to scenario details					
	<i>Government do/don't help</i>	0% (0)	100% (1)	0% (0)	0% (0)
	<i>Power bill</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>Doubts validity of scheme</i>	9% (1)	0% (0)	0% (0)	27% (3)
Reference to other solutions or considerations					
	<i>Comparison to other technologies</i>	9% (1)	0% (0)	0% (0)	18% (2)
	<i>Broader environmental concerns</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Broader social concerns (ref. to others)</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Personal feelings</i>	0% (0)	0% (0)	0% (0)	0% (0)
Miscellaneous					
	<i>Made up/guessed</i>	9% (1)	0% (0)	29% (2)	9% (1)
	<i>Needed more information</i>	0% (0)	0% (0)	14% (1)	9% (1)
	<i>'Don't know' (no response given)</i>	0% (0)	0% (0)	14% (1)	0% (0)

Table H2: Frequency Each Consideration was referred to in the SWH Scenario

Consideration		SWH Scenario			
		<i>Jimmys</i> (11)	<i>Derricks</i> (1)	<i>Waynes</i> (7)	<i>Inconsistents</i> (11)
Reference to the good					
	<i>Perceived cost</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>Potential savings</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Other benefits</i>	27% (3)	0% (0)	0% (0)	18% (2)
	<i>Perceived disadvantages</i>	9% (1)	0% (0)	14% (1)	9% (1)
	<i>Expected lifetime</i>	9% (1)	0% (0)	14% (1)	18% (2)
	<i>'Real-life'/personal experience example</i>	0% (0)	0% (0)	0% (0)	0% (0)
Reference to economic reasoning					
Personal situation/ preferences	<i>Budget/Can afford</i>	45% (5)	0% (0)	29% (2)	9% (1)
	<i>Reasonable/Fair/Comfortable</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Other spending priorities</i>	18% (2)	0% (0)	14% (1)	0% (0)
	<i>Unknown future</i>	9% (1)	0% (0)	0% (0)	0% (0)
Mental accounting: expenditure and repayment	<i>Debt/commitments</i>	27% (3)	100% (1)	14% (1)	18% (2)
	<i>Power bill savings</i>	27% (3)	0% (0)	29% (2)	64% (6)
	<i>Other household bills (incl. mortgage)</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Other expenditures (incl. charities)</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Repayment characteristics</i>	9% (1)	0% (0)	14% (1)	0% (0)
	<i>Pay-back period</i>	45%	0% (0)	14% (1)	55%
Reference to household situation					
	<i>Characteristics of house</i>	27% (3)	0% (0)	14% (1)	9% (1)
	<i>Length plan to stay</i>	36% (4)	0% (0)	0% (0)	9% (1)
	<i>Recent/future improvements</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>Other household members</i>	9% (1)	0% (0)	14% (1)	9% (1)
Reference to scenario details					
	<i>Government do/don't help</i>	9% (1)	100% (1)	14% (1)	0% (0)
	<i>Power bill</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>Doubts validity of scheme</i>	9% (1)	0% (0)	0% (0)	18% (2)
Reference to other solutions or considerations					
	<i>Comparison to other technologies</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Broader environmental concerns</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Broader social concerns (ref. to others)</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>Personal feelings</i>	9% (1)	0% (0)	0% (0)	9% (1)
Miscellaneous					
	<i>Made up/guessed</i>	0% (0)	0% (0)	29% (2)	0% (0)
	<i>Needed more information</i>	18% (2)	0% (0)	14% (1)	9% (1)
	<i>'Don't know' (no response given)</i>	0% (0)	0% (0)	0% (0)	9% (1)

Table H3: Frequency Each Consideration was referred to in the Public Infrastructure Scenario

Consideration		Public Infrastructure Scenario			
		<i>Jimmys</i> (11)	<i>Derricks</i> (1)	<i>Waynes</i> (7)	<i>Inconsistents</i> (11)
Reference to the good					
	<i>Perceived cost</i>	0% (0)	100% (1)	0% (0)	0% (0)
	<i>Other benefits</i>	0% (0)	100% (1)	14% (1)	9% (1)
	<i>Perceived disadvantages</i>	0% (0)	0% (0)	0% (0)	9% (1)
	<i>'Real-life'/personal experience example</i>	18% (2)	0% (0)	14% (1)	0% (0)
Reference to economic reasoning					
	<i>Budget/Can afford</i>	0% (0)	0% (0)	0% (0)	0% (0)
Personal situation/ preferences	<i>Reasonable/Fair/Comfortable</i>	18% (2)	0% (0)	0% (0)	18% (2)
	<i>Other spending priorities</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Unknown future</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Debt/commitments</i>	0% (0)	0% (0)	0% (0)	0% (0)
Mental accounting: expenditure	<i>Power bill savings</i>	9% (1)	0% (0)	0% (0)	9% (1)
	<i>Other household bills (incl. mortgage)</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Other expenditures (incl. charities)</i>	0% (0)	0% (0)	0% (0)	0% (0)
Reference to scenario details					
	<i>Fairness</i>	0% (0)	0% (0)	0% (0)	9% (1)
Agency providing the good	<i>Trust/scepticism</i>	9% (1)	0% (0)	14% (1)	0% (0)
	<i>Power company profits</i>	18% (2)	0% (0)	14% (1)	36% (4)
	<i>'Their fault/gain their problem'</i>	18% (2)	0% (0)	14% (1)	0% (0)
	<i>Government do/don't help</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Government profit</i>	18% (2)	0% (0)	0% (0)	0% (0)
Payment vehicle	<i>Power bill</i>	0% (0)	0% (0)	14% (1)	9% (1)
	<i>Indefinite repayment length</i>	36% (4)	100% (1)	0% (0)	9% (1)
	<i>Number of households contributing</i>	36% (4)	0% (0)	14% (1)	27% (3)
	<i>Doubts validity of scheme</i>	0% (0)	0% (0)	0% (0)	0% (0)
Reference to other solutions or considerations					
	<i>Comparison to other technologies</i>	9% (1)	0% (0)	29% (2)	27% (3)
	<i>Change behaviour elsewhere</i>	0% (0)	0% (0)	0% (0)	9% (1)
	<i>Different payment method</i>	9% (1)	0% (0)	14% (1)	9% (1)
	<i>Broader environmental concerns</i>	27% (3)	0% (0)	14% (1)	36% (4)
	<i>Broader social concerns (ref. to others)</i>	18% (2)	100% (1)	0% (0)	18% (2)
	<i>Personal feelings</i>	18% (2)	100% (1)	14% (1)	9% (1)
Miscellaneous					
	<i>Made up/guessed</i>	0% (0)	0% (0)	14% (1)	9% (1)
	<i>Needed more information</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>'Don't know' (no response given)</i>	0% (0)	0% (0)	14% (1)	0% (0)

Table H4: Frequency Each Consideration was referred to in the Public Habitat Scenario

Consideration		Public Habitat Scenario			
		<i>Jimmys</i> (11)	<i>Derricks</i> (1)	<i>Waynes</i> (7)	<i>Inconsistents</i> (11)
Reference to the good					
	<i>Perceived cost</i>	0% (0)	100% (1)	0% (0)	0% (0)
	<i>Other benefits</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Perceived disadvantages</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>'Real-life'/personal experience example</i>	18% (2)	100% (1)	14% (1)	9% (1)
Reference to economic reasoning					
	<i>Budget/Can afford</i>	0% (0)	0% (0)	0% (0)	0% (0)
Personal situation/ preferences	<i>Reasonable/Fair/Comfortable</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Other spending priorities</i>	18% (2)	0% (0)	0% (0)	0% (0)
	<i>Unknown future</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Debt/commitments</i>	0% (0)	0% (0)	0% (0)	0% (0)
Mental accounting: expenditure	<i>Power bill savings</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Other household bills (incl. mortgage)</i>	9% (1)	0% (0)	14% (1)	0% (0)
	<i>Other expenditures (incl. charities)</i>	9% (1)	0% (0)	29% (2)	9% (1)
Reference to scenario details					
Agency providing the good	<i>Fairness</i>	0% (0)	0% (0)	0% (0)	9% (1)
	<i>Trust/scepticism</i>	9% (1)	0% (0)	0% (0)	9% (1)
	<i>Power company profits</i>	9% (1)	0% (0)	14% (1)	27% (3)
	<i>'Their fault/gain their problem'</i>	18% (2)	0% (0)	0% (0)	27% (3)
	<i>Government do/don't help</i>	9% (1)	0% (0)	14% (1)	9% (1)
	<i>Government profit</i>	0% (0)	0% (0)	14% (1)	0% (0)
Payment vehicle	<i>Power bill</i>	9% (1)	0% (0)	0% (0)	0% (0)
	<i>Indefinite repayment length</i>	18% (2)	0% (0)	0% (0)	0% (0)
	<i>Number of households contributing</i>	27% (3)	100% (1)	0% (0)	18% (2)
	<i>Doubts validity of scheme</i>	9% (1)	0% (0)	0% (0)	0% (0)
Reference to other solutions or considerations					
	<i>Comparison to other technologies</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>Change behaviour elsewhere</i>	0% (0)	0% (0)	14% (1)	0% (0)
	<i>Different payment method</i>	36% (4)	0% (0)	0% (0)	9% (1)
	<i>Broader environmental concerns</i>	18% (2)	0% (0)	14% (1)	0% (0)
	<i>Broader social concerns (ref. to others)</i>	9% (1)	0% (0)	0% (0)	9% (1)
	<i>Personal feelings</i>	9% (1)	0% (0)	14% (1)	9% (1)
Miscellaneous					
	<i>Made up/guessed</i>	0% (0)	0% (0)	14% (1)	9% (1)
	<i>Needed more information</i>	0% (0)	0% (0)	0% (0)	0% (0)
	<i>'Don't know' (no response given)</i>	0% (0)	0% (0)	0% (0)	0% (0)