Prepared for

The Energy Efficiency and Conservation Authority (EECA)

The Energy Efficiency Characteristics of New Zealand Houses and Householder Receptivity to a Home Energy Rating Scheme (HERS)–

Final Report

By

East Harbour Management Services (EHMS) with the Centre for Research, Evaluation and Social Assessment (CRESA)

9 July 2007

Executive Summary

The aim of this project is to identify the energy efficiency characteristics of New Zealand houses and in doing so, to inform the design of a home energy rating scheme (HERS) for New Zealand, being developed by EECA. The project was carried out in phases.

This report is the final project report and presents the findings from the following project phases:

- Phase One - a literature review of previous or existing work on the topic (energy efficiency characteristics and receptivity to a HERS).
- Phase Two - an analysis of currently available data to determine the best approach to improve knowledge of energy efficiency characteristics of New Zealand houses. This data analysis in turn was used to identify the 'best' Area Units in which to conduct new Survey work.
- Phase Three – undertaking a Telephone Survey and Physical Surveys and the analysis of the resulting data.
- Phase Four - presentation of the results in a final report from all phases with discussion, conclusions and recommendations where appropriate.

Phase One – Part A – Establishing the Baseline Data - Energy Efficiency Characteristic of New Zealand Houses

A study of existing energy efficiency and housing data indicates that there is good quality time series data available on dwellings and household demographics. There is limited data available on the energy efficiency characteristics of New Zealand houses. Currently there is no publicly available information that correlates the energy efficiency characteristics of households with the demographic details of the household occupants at a national level. Some international experiences on energy efficiency characteristics and household demographics were noted.

Detailed information is available on the age of the housing stock throughout New Zealand.

There is little information available on the condition of New Zealand houses on a regional basis and more specifically the energy efficiency characteristics of houses throughout New Zealand.

The information which is currently available is not correlated with other demographic data.

Reports identified in Phase One that were particularly useful include:

- New Zealand House Condition Survey, BRANZ
- Changes in the Structure of the New Zealand Housing Market, CHRANZ
- Insulation Trends in New Zealand Houses, EECA

- An Assessment of the Current Levels of Home Insulation in Christchurch, CEA

In general, the older cities with more stable populations have the oldest housing stock. This includes areas such as Dunedin, Wanganui and Wellington.

There is good data available from Statistics New Zealand and Quotable Value Limited, which includes information on house age and the demographic details of the occupants. These data sources have no information on house condition (other than age) and do not provide any direct information on the energy efficiency characteristics of houses.

Two surveys which collect data on house condition, including the energy efficiency characteristics of houses are the New Zealand House Condition Survey and the Household Energy End-use Project (HEEP).

Currently there is no comprehensive publicly available information that correlates the energy efficiency characteristics houses with the demographics details of the household occupants.

More is known about the energy efficiency characteristics of houses in Christchurch than any other main population centre. Christchurch is also unique in terms of household energy efficiency characteristics. Further surveying in Christchurch was considered unlikely to provide meaningful additional information about the energy efficiency characteristics of New Zealand houses as a whole and therefore was not considered in subsequent phases of this project.

Information of the age of the housing stock throughout New Zealand was used to select the Area Units that were included in the new Survey work.

Phase One – Part B – Establishing the Baseline Date - Receptivity to a Home Energy Rating Scheme

Information from previous New Zealand based studies shows that householder interest in a Home Energy Rating Scheme (HERS) is low and that a voluntary scheme may not significantly influence householder's decisions in terms of property purchase or rental. The studies indicated that as energy efficiency issues are not yet at the forefront of buyers or renters in their search for properties it is unlikely that the introduction of HERS in New Zealand would have a significant impact as a voluntary scheme. In areas where the housing market is tight (low supply) for potential owners and renters alike, simply being able to secure a property is reported as the key concern. Increasingly affordability is also reported as an issue for most New Zealanders. The reports indicate that the success of a HERS is likely to be linked to the level of incentives provided to owners to upgrade their property.

The New Zealand studies suggest that New Zealand households are not so different to those of several other countries overseas who already have or are currently planning to implement a rating scheme. The commonality between New Zealand and overseas studies indicate that New Zealand's advantage is being able to learn from the experiences of these countries, what worked and what didn't and what they would do differently.

New Zealand studies so far have not specifically matched receptivity or interest in energy efficiency issues to the demographics of a household. Surveys carried out as part of this

project have included questions of this nature in order to provide an indication if whether income and other demographic features of households are linked to receptivity and interest / awareness of energy efficiency issues.

There is no indication in the studies of the role that Real Estate Agents could have in the implementation of a HERS but potentially, securing their enthusiasm and support for HERS could be a useful communication channel to householders.

Phase Two – Locating the Pre-77 Homes and Selection of Area Units for New Surveys

Where are the older houses?–The regions with the highest *proportions of older houses* are those in the lower parts of the North and South Islands i.e. Gisborne, Hawkes Bay, Taranaki, Manawatu-Wanganui and Wellington in the North Island and West Coast, Canterbury, Otago and Southland in the South Island.

If the regions are considered in terms of the *number of older houses*, different results emerge with the three main centres standing out as regions on which to focus.

It was agreed with EECA that a combined approach would be pursued with the focus being on regions with a high proportion of older houses and/or more than 50,000 older houses. This resulted in a focus on the following regions:

- Auckland
- Waikato
- Bay of Plenty
- Hawkes Bay
- Taranaki
- Manawatu-Wanganui
- Wellington
- Canterbury
- Otago
- Southland.

The regions included in the new Survey work were then limited to four due to the constraints of the available budget. Auckland was included because of its size, rate of growth and diversity of housing stock. Bay of Plenty provided a good opportunity to Survey rural houses and has often not been included in other Survey i.e. the New Zealand House Condition Survey. Otago provided an opportunity to Survey in Dunedin which has a high proportion of older housing stock. Otago also has a relatively cold climate and has not often been included in other Surveys. Wellington was selected because it has relatively old housing stock, a diverse range of stock and is within easy reach of one of the companies involved in completing the Physical Surveys thus allowing a larger sample size.

How many uninsulated houses remain?–From the previous studies and the results of this project it is estimated that there are between 220,000 and 310,000 houses with inadequate ceiling insulation and approximately one million houses with inadequate wall and floor insulation. More detail on the location and number of uninsulated houses is provided in section 7.1.

Selection of Area Units for new Surveys–Statistically, in order to maximise the confidence level of the data as many Area Units as possible (given time and resources available) have been included, even at the expense of sample size within an Area Unit.

Area Units were selected based on specific characteristics. This selection was based firstly on households most likely to purchase a HERS rating; balanced by selection of other households to ensure that the overall sample was reasonably representative of the total New Zealand population.

Table 0.1 shows the final selection of the Area Units included in the Telephone and Physical Surveys. Alongside the Area Unit Name, specific details are provided on the characteristics of the households (for example ownership, income level, type of house or location) and the houses (whether old or new).

These Area Units were selected and agreed in consultation with EECA.

Within the 4 Regions, a total of 15 Area Units were selected.

Area Unit Name	**Territorial Authority**	**Regional Council**	**Characteristics**	
Wadestown	Wellington City	Wellington	High Income (74%)	Old houses (89%)
Endeavour	Porirua City	Wellington	High Income (80%)	New houses (99%)
Stanley Bay	North Shore City	Auckland	High Income (66%)	New houses (90%)
Waldronville	Dunedin City	Otago	Owner occupier (88%)	Old houses (94%)
Cannons Creek North	Porirua City	Wellington	Rentals (78%) / Low Income (72%)	Old houses (98%)
Bethlehem	Tauranga City	Bay of Plenty	Owner occupier (72%)	New houses (78%)
Matukituki	Queensland Lakes District	Otago	Owner occupier (69%)	New houses (72%)
Stuart Street-Frederick St	Dunedin City	Otago	Rentals (81%)	Old houses (92%)
Point England	Auckland City	Auckland	Rentals (79%)	Old houses (86%)
Auckland Central East	Auckland City	Auckland	Rentals (80%)	New houses (88%)
Waihemo	Wataki District	Otago	Rural Area	
Edgecumbe Community	Whakatane District	Bay of Plenty	Rural Area	
Bethlehem East	Tauranga City	Bay of Plenty	Family houses (89%)	New houses (98%)
Normandale	Lower Hutt City	Wellington	Family houses (81%)	Old houses (79%)
Aro Street-Nairn Street	Wellington City	Wellington	Not separate houses (68%)	Old houses (82%)

Table 0.1 Area Units selected for Telephone and Physical Surveying

Phase Three – Part A – Telephone and Physical Surveys

A Telephone Survey was developed by the project team in consultation with EECA. Telephone calls were made over the period February / March 2007 in the 15 Area Units selected. Random telephone numbers were purchased for each Area Unit. A target of 350 completed Telephone Surveys was agreed with EECA. 359 completed Surveys were achieved. The Telephone Survey in part sought views and opinions about energy efficiency in general, and an indication of a householder's knowledge and understanding about energy efficiency. In addition, the Telephone Survey sought views on the proposed Home Energy Rating Scheme (HERS). The Telephone Survey noted responses to energy efficiency issues alongside key demographic information such as income, age, and property ownership.

Householders who took part in the Survey were asked if they would agree to have their contact details provided to a local energy efficiency company with a view to having a Physical Survey carried out on their home. On average, just over 23 willing householders were secured in each Area Unit from the Telephone Survey.

The Physical Survey used in the project was developed by the project team in consultation with EECA. Surveys were carried out in April / May 2007. A target number of 150 Physical Surveys was agreed with EECA. A total of 135 Surveys were completed. The Survey provided a snapshot of the energy efficiency state of New Zealand houses across the country (from the 15 Area Units selected). The project team aim was to secure at least 10 households in each of these Areas to complete a Physical Survey. The Survey also enabled a check against what householders said in the Telephone Survey.

Considerable difficulties were experienced in securing householder participation in both the Telephone Survey and the Physical Survey.

Phase Three – Part B – Summary of Survey Findings

The Telephone and Physical Survey work undertaken in this project provides some interesting but not surprising findings that are largely, in the view of the project team, consistent with existing national and international observations on householder understanding and activity with respect to energy efficiency.

While in general it could be said that energy and environmental awareness is increasing, New Zealand householders are (as evident from these Surveys) still missing opportunities to install even the most basic measures in their homes and so reduce their energy use and improve their comfort. Many appear unaware of if or how their homes are insulated, many don't have draught proofing, hot water cylinders are largely unwrapped (as are pipes) and many hot water cylinders are very old indeed (some as old as 50 years old in this Survey). These are all relatively straightforward issues that can be addressed with measures of minimal cost and often by the householder themselves. The Survey showed that many homes suffer from mould and condensation problems and several appear to be inadequately heated (a judgement made on the size of the property and the number of heaters reported). For many homes it was identified that water temperature at the tap was excessively high (for example 80 °C was measured in one household) as were some shower flow rates (in one household with three showers, they measured 22, 24 and 28 litres / minute).

For those householders who have addressed these issues the analysis notes that they are more likely to report their homes as energy efficient. Ceiling insulation and energy

efficient light bulbs come through in the Survey as two areas where progress is being made. High proportions of both were reported by participants.

The study showed that 80% of the telephone participants indicated that warmth and comfort was a consideration when choosing a house. However, considerably fewer it seems systematically assessed whether the house had features associated with energy efficiency.

There appears to be some limitation in the ability of householders to assess the energy and water efficiency of their homes. They tend to perceive their homes as efficient and energy costs as average. These perceptions appear however largely unconnected to the energy or water performance that they are likely to achieve in their homes.

On the other hand, householders who reported no or little insulation were more likely to see their home as not energy efficient indicating a measure of understanding. Interestingly householders were more likely to characterise their home as energy efficient if there was:

- A higher proportion of energy efficient light bulbs used,
- A higher proportion of double glazing used,
- A lower proportion of windows and doors are draughty.

The explanation for this could be 'visibility' - these measures are more visible than some others perhaps. It could also be that for light bulbs in particular, there have been several strong campaigns (Government and retailer) promoting their use and the fact that they are widely available.

Interestingly householders in the study appeared less likely to connect energy efficiency to insulating their hot water cylinder and the age of their cylinder.

In terms of receptivity to the proposed Home Energy Rating Scheme, in general the phone Survey participants appeared to be very receptive to the idea of a scheme, unsurprisingly less willing to pay for it and not particularly willing to pay for improvements suggested by it.

The Surveys revealed that the participants felt that the rating could have a positive impact on choice of renting or buying a property with renters slightly more likely than owner occupiers to think property choice would be favourably influenced by a higher energy rating.

Of the owner occupiers surveyed however over half said they would pay something for a rating, if only a small amount. Willingness to pay is limited to income and age with younger higher income earners more interested. Two thirds of the owner occupiers also said that they would be willing to spend some money to carry out recommended measures to increase the energy efficiency of their homes.

Key Findings and Conclusions

The results of this survey suggest that householders have a good understanding of the energy features of their houses, such as the insulation status, use of double glazing, heater types in use etc.

Information is available at a national level on the energy efficiency characteristics of houses.

This survey has provided some useful insights into the connection between energy use, perceptions of energy efficiency, the demographic characteristics and the energy efficiency characteristics of the survey participants.

More information could be collected on the energy efficiency of houses and the demographic characteristics of the occupants by supplementing current survey work with additional and regular (say bi-annual) telephone survey of households outside the three main centres to ***improve regional information on the energy efficiency characteristics*** of houses. This would also provide a method for ongoing monitoring of progress to improve the energy efficiency of the New Zealand housing stock.

Homes surveyed show, in terms of insulation, highest levels in the ceilings and few properties with all three – ceiling, walls and floor – insulated. Heating (for space and water) is dominated by electricity. Use of double glazing appears still to be low. Some Participants in general were aware of energy efficiency issues at a high level and many were able to ascertain whether their property was or wasn't energy efficient. ***Householders are in general still missing opportunities to make cost savings by implementing even the most basic energy efficiency improvements to their homes*** – adjusting water temperatures and shower flow rates, using new efficient hot water cylinders, wrapping cylinders and pipes, draught proofing etc. householders have gone to considerable lengths to improve the energy efficiency of their homes but these are the exceptions to the rule.

Existing information on energy efficiency and householder demographics is limited. New surveys in this project provide an interesting snapshot. The small sample size in the surveys conducted often meant that relationships could not be proved in this data however, for tenure, property age and income levels, some interesting findings were established. In particular, the positive relationships between ownership and double glazing, gas water heating, heat pumps and under floor heating, and cylinder and pipe insulation. Rentals are often poorly insulated with inefficient heating. Higher income households are linked positively with ceiling and wall insulation and gas heating. Lower income homes with electricity for heating. Older houses tend to have electric space and water heating and poor insulation. Newer homes have heat pumps and draught proofing.

Research accessed as part of this project suggests that uptake is generally low for voluntary home energy rating schemes, encouraging responses from the Telephone Survey indicate that ***the majority of householders do see the merits in the proposed HERS***. Cost is likely to be a barrier to uptake. Younger householders appeared to be most keen. Over half of participants indicated a willingness to pay for a rating (if only a small amount) but these results should be noted with caution. At this stage it is difficult for the householder to put a value on a 'rating' that does not yet exist.

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East Harbour Project # EH251
Document Status: Final
Filename: 070709 Housing Characteristics Final Report

1 Introduction

Residential energy use currently accounts for 13% of New Zealand's consumer energy use, and this is projected to grow to reach an annual total consumption of 93 PJ by 2030. New and effective measures will need to be identified and implemented if this growth is to be kept in check.

Achieving energy efficiency improvements in the residential sector is notoriously difficult despite the obvious advantages of reduced energy costs and enhanced home comfort as a result of often low cost and easy to install measures.

The identification of pre-1977 homes in New Zealand (i.e. those without insulation) is one part of a strategy to deliver energy efficiency improvements in the residential sector. But achieving a step change in attitude to home energy efficiency (by all New Zealand householders) and turning this into positive energy efficiency activity (i.e. the actual installation on measures) is another key component.

Changing attitudes and encouraging energy efficiency activity is a key step in preparing the ground for the introduction of a scheme that 'rates' the energy performance of a home and embeds the energy efficiency of a residential property as a key selling feature. The introduction of a Home Energy Rating Scheme (HERS) in New Zealand is imminent and it will be important to gauge its likely receptivity. It is of value to observe how this receptivity varies (if at all) with demographic information of householders and indeed also of interest to observe the current energy performance of a range of homes of varying type, income, tenure and age.

In order to know what strategies are required and are likely to be most successful it's essential to firstly take stock of what information exists already and how it can best be enhanced. This project adopted such an approach in four phases as follows:

- Phase One involved a review of existing data with a view to establishing a baseline data set and identifying the gaps in this data set.
- Phase Two of the project involved establishing a robust sampling procedure to fill the most significant gaps identified in Phase One.
- Phase Three of the project involved executing the survey methodology established in Phase Two.
- Phase Four of the project is in effect this report – a presentation of all project Phases noting the project findings and conclusions.

The First Phase of the project had the aim of establishing a clear picture of the extent and magnitude of the data that currently exists on the status of New Zealand houses with respect to energy efficiency. It therefore established a baseline of current data, identified the gaps and outlined possible steps to fill these gaps. Of particular interest was previous work (if any) that relates energy efficiency to demographic information (for example, householder age, income, home ownership status) and what existing studies on rating schemes noted about their likely take up and the response to energy efficiency advice aimed at improving the rating.

The Second Phase of the project focussed on locating the older ("pre-77") housing and also on the development of a robust sampling procedure to fill the most significant data gaps identified in Phase One. New surveys, both Telephone and Physical were planned and a key part of this process was the selection of Area Units for where the additional data gathering would focus. Area Units were selected with a dual purpose – in part on the basis of their location and also in part on the need to canvas the receptivity of a range of householders (varying demographics such as income, tenure for example) to the proposed Home Energy Rating Scheme.

Phase Three of the project involved the development of a Telephone Survey and a Physical Survey. Phone calls and Surveys were undertaken in the Area Units selected. The Surveys were developed in consultation with EECA. Collectively their aim was to secure information – perceived and actual – about the energy efficiency characteristics of a sample of New Zealand homes. This information was supported with demographic information. The Telephone Survey in particular sought an indication of the receptivity of householders to the proposed Home Energy Rating Scheme[a].

Phase Four of the project is this report. It presents the findings from all Phases and sets out a discussion of the key findings and conclusions.

This report is set out as follows:

Section 2 sets out the aims of the project.

Section 3 sets out, for each Phase of the project, the methodology applied.

Section 4 sets out the results for Phase One of the project – a review of existing data sources and identification of gaps. Full details are however presented in Appendix 1.

Section 5 sets out the results for Phase Two of the project – firstly, identification of where the pre-1977 houses are, and secondly, the selected Area Units (and their characteristics) on which the new Telephone and Physical Surveys would focus.

Section 6 sets out the results and analysis from the Telephone Surveys and Physical Surveys conducted in the selected Unit Areas (i.e., the outcome of Phase Three of the project).

Section 7 sets out the project discussions and conclusions.

[a] It is noted that the original EECA RfP expressed interest in "householder, tenant and landlord receptivity" to a HERS. Following discussion with EECA the project was modified to focus on home owners and tenants only. Additional EECA projects specifically address the views of landlords.

2 Project Aim

The overall aim of this project was to undertake research on the nature of the energy efficiency of New Zealand houses and in doing so to inform the design of a Home Energy Rating Scheme (HERS) for New Zealand. The aims of this project were four fold:

1. The first aim was to establish what was known about the status of energy efficiency in New Zealand homes. Information already exists on energy efficiency, housing stock, and house condition. While detailed information is available on housing stock numbers and age, there is little information on the energy efficiency characteristics of the current housing stock and how these vary with house age, household income, tenure and locations. It is also unclear how householders' decisions and actions on energy efficiency vary in relation to the demographic characteristics of those householders. All available existing information was to be reviewed to determine the current status and the key information gaps.

2. The second aim was to establish where the un-insulated or "pre-1977" homes are in New Zealand providing an indication of where, on a regional basis, insulation programmes should be focussed.

3. The third aim was to undertake an assessment of the energy efficiency of a specific selection of New Zealand households. In particular, through a combination of Telephone Surveys and Physical Surveys, a snapshot picture of the energy efficiency characteristics of New Zealand houses was to be established. Of particular interest was how these characteristics varied with parameters such as age of housing, type of housing, income (high / low) and ownership (owner occupier / tenant).

4. The fourth aim was (as part of the Survey process) to carry out a preliminary 'attitude' Survey of the householders selected in *3.* In order to gauge their views on the introduction of a Home Energy Rating Scheme – a new initiative currently underway at EECA. This work was considered essential to inform the development of an effective and accepted HERS for national implementation.

All of these exercises are essential components of a broad strategy not only to improve the energy efficiency of homes but also to achieve a step change in attitude to home energy efficiency (by all New Zealanders, irrespective of property age and household demographics) and prepare the ground for the introduction of a Rating Scheme that embeds the energy efficiency of a residential property as a key feature.

3 Project Methodology

This section of the report sets out the methodology used in each phase of the project.

3.1 Phase One – Establishing the Baseline Data

Phase One involved desk-based research complemented by discussions with project team members and EECA.

The first step was to compile a list a possible data sources. This list was based on data sources identified in the original East Harbour/CRESA proposals and subsequently enhanced based on information in the listed reports and the knowledge of the project team. This list was then circulated within the project team and to key EECA staff to ensure all known information had been identified.

The identified reports and data sets were divided into four categories as follows:

- Key primary data sources,
- Key secondary data sources,
- Other data sources, and
- Reports on Home Energy Rating Schemes (HERS) in New Zealand.

The first three categories of these data sources are focused on documenting the energy efficiency characteristics of New Zealand houses. The last category is focused on determining initial findings with respect to the receptivity of New Zealanders to a Home Energy Rating Scheme.

The key primary data sources include national studies and Surveys, which themselves involved primary data collection and reporting.

The key secondary data sources include national studies based on existing data sets which identify significant trends. These studies often identify data gaps and areas for further research.

Other data sources include studies that are focused on a particular area, region or demographic group.

Each study or data set was reviewed. Subsequent sections in this report present a brief description of each source, together with information (where possible) on sample size, representation, publication details and conclusions including strengths, limitations and usefulness/relevance for this current project.

Finally, having established the nature and scope of data currently available, the key gaps in the data have been identified. The Survey sampling methodology developed in Phase Two of this project focuses on filling these identified data gaps.

3.2 Phase Two – Locating the pre-77 houses, Estimating the number of houses with inadequate insulation and Identifying the Area Units for further Surveying

This phase of the project consisted of three key aspects. The first was to locate the pre-1977 houses. The second was to estimate the number of houses with inadequate insulation and the third was to identify and select areas across the country that had specific characteristics of interest. These so called 'Area Units' would then be used in a programme of Telephone and Physical Surveying.

3.2.1 Locating the pre-1977 houses

Available data was examined in order to determine the number of residential properties in each region that were built before insulation became mandatory, typically this is referred to as "pre-1977". 1977 is referred to because this is the year that the first New Zealand Standard NZS 4218P:1977 Minimum Thermal Insulation Requirements for Residential Buildings was published. However it did not become a legal requirement to build new houses throughout New Zealand to this performance requirement until 1978.

There are two main sources of housing stock data. These are Statistics New Zealand and Quotable Value New Zealand. The data from Statistics New Zealand is based on Census data while the data from Quotable Value New Zealand is based on records of rateable units.

Census data from Statistics New Zealand has been used to establish the general age characteristics of the housing stock and to determine the proportion of residential properties in each region that were built before insulation became mandatory.

The data that has been analysed is specifically of private occupied dwellings. This excludes public institutions such as homes for the elderly, prisons, hotels, motels etc and all non-private dwellings. It has been assumed that this is the data that would be of most interest to EECA in terms of developing a Home Energy Rating Scheme and the ability to target householders with the scheme with maximum impact and success.

Table 3.1 shows the trends in the number of private dwellings by region. This data is from the national Census and was sourced from Statistics New Zealand.

This data was then analysed in terms of the number and proportion of older houses i.e. pre and post 1981.

1981 was the date used because all houses built since 1981 are required to be insulated. The New Zealand Standard requiring insulation (NZS4218) was published in 1977 and became a mandatory requirement in 1978 for new houses. 1981 was the first Census completed after this requirement came into force. The earlier Census data is from 1976, houses built at this time were not required to be insulated and data from this census is not available in an electronic form. Therefore the data from the 1981 Census has been used as a basis for comparison.

Table 3.1: The Number of Private-Occupied Dwellings by Region (Census Data)

Region/Year	1981	1986	1991	1996	2001	2006
Northland Region	33,816	39,432	43,623	48,165	51,612	55,527
Auckland Region	264,858	288,468	319,986	355,365	393,261	437,988
Waikato Region	93,927	103,407	112,812	121,650	129,021	140,265
Bay of Plenty Region	53,238	61,680	70,851	79,638	87,891	96,168
Gisborne Region	13,470	14,211	14,586	15,210	15,399	15,663
Hawke's Bay Region	42,531	45,720	48,306	51,117	52,776	55,227
Taranaki Region	32,928	35,844	37,299	38,769	38,880	40,281
Manawatu-Wanganui Region	68,346	73,221	77,613	81,090	81,870	84,768
Wellington Region	127,011	133,464	141,462	149,559	157,299	168,849
Tasman Region	9,711	10,986	12,411	14,163	15,741	17,271
Nelson Region	11,349	12,345	13,566	15,279	16,125	17,187
Marlborough Region	10,275	11,463	12,804	14,310	15,321	16,842
West Coast Region	10,422	11,172	11,550	12,264	12,078	12,768
Canterbury Region	142,506	151,284	161,052	175,254	186,426	201,660
Otago Region	58,173	61,617	64,629	68,745	70,626	75,234
Southland Region	32,745	34,053	34,848	35,499	35,232	35,802
Area Outside Region	180	231	264	255	279	249
Total	**1,005,486**	**1,088,598**	**1,177,662**	**1,276,332**	**1,359,837**	**1,471,749**

Source: Census Data, Statistics New Zealand

3.2.2 Estimating the number of houses with inadequate insulation

Existing studies were reviewed to estimate the number of houses which currently have inadequate insulation.

This involved using a previous study commission by EECA to determine Insulation Trends in houses. This study estimated the number of pre-77 houses remaining to be insulated with ceiling insulation. The estimates were based on data from the House Condition Surveys completed in 1994 and 1999 together with data from Tasman Insulation, EECA and House New Zealand Corporation.

Three scenarios were developed to show the rate of improvement: a pessimistic scenario; a central scenario and an optimistic scenario. These scenarios project trends based on assumptions of the rate of ceiling insulation retrofit from 2001 to 2012.

These trends were updated based on data from the more recent House Condition Survey. Estimates of the number of houses with inadequate insulation in the walls and floors are also based on the House Condition Survey percentages and the 2006 Census data.

3.2.3 Identifying the Area Units for new Data Collection

This part of Phase Two involved the identification of key characteristics of interest for further data gathering and the selection of 15 Area Units with these characteristics.

Definition of an Area Unit

Statistics New Zealand defines an Area Unit as follows:

"Area units are aggregations of meshblocks with unique names. They are non-administrative areas intermediate between meshblocks and territorial authorities. Area units must either define or aggregate to define urban areas, rural centres, statistical areas, territorial authorities and regional councils. Each area unit must be a single geographic entity with a unique name. Area units of main or secondary urban areas generally coincide with communities of interest or parts thereof. Area units within urban areas normally contain 3,000-5,000 population."

A more simplistic definition is that an Area Unit within urban areas is often represented by a suburb. However, because each Area Unit is limited to a population size of 5,000, larger suburbs may include 2-3 Area Units.

Rationale for using Area Units

Area Units were selected for this project because they are sufficiently large to allow a sample to be selected from them and are often sufficiently small to have reasonably well defined house/householder characteristics i.e. rental/owner occupied properties, high/low income households, old/ new houses.

Overview of the Process

Four regions were selected to give a good representation of the different Building Code zones, a reasonable representation of houses in New Zealand and a good rural urban mix.

Two data sets were then combined. The data is an extract from information from the Quotable Value database and was provided by EECA. This data was then supplemented with additional information from Statistics New Zealand to determine the location of each Area Unit in terms of Region and territorial authority area.

The final data set was sorted to determine which Area Units had the characteristics that EECA was most interested in investigating, in particular age of property, income of the householders, type of property, and tenure.

The regions included in the Survey were limited to four, due to the constraints of the available budget and the number of surveys that needed to be completed.

The location of the Unit Areas selected was determined by the housing/householder characteristics that needed to be investigated. The location of project team resources to complete physical inspections was also a factor that was considered when selecting Area Units.

3.3 Phase Three – New Surveys

Phase Three of the project was the development and execution of a Telephone Survey and a Physical Survey. A telephone Survey company - NRB Ltd – an Auckland-based research and surveying company - was engaged to undertake the telephone calls. Two leading energy efficiency companies, Energy Options of Whakatane and EnergySmart of Tawa near Wellington were engaged to undertake the subsequent householder Physical Surveys.

The target was to complete 150 Physical Surveys and 350 Telephone Surveys. Due to the budgetary constraints of the project it was necessary to group the Physical Surveys into regions, rather than to have them scattered randomly throughout the country. The Telephone Surveys were used to identify the participants in the Physical Survey. Therefore the Telephone Survey participants also had to be concentrated into several regions. Telephone calls were made within the selected Area Units as were the subsequent Physical Surveys.

Options to increase the sample size were considered in December 2006. A proposal including several options was prepared in response to a request from EECA. Due to insufficient funds being available the opportunity to increase the sample size was not taken up.

3.3.1 Telephone Survey

A Telephone Survey was developed by the project team in consultation with EECA. An accompanying script for the call was also developed.

Telephone calls were made over the period February/March 2007 in the 15 Area Units selected. Random telephone numbers were purchased for each Area Unit. A target of 350 completed Telephone Surveys was agreed.

The main aim of the Telephone Survey was to secure answers to a specific set of questions. In particular the Telephone Survey sought the householders' views and opinions on energy efficiency. It sought information on the householders understanding of energy efficiency ideas and concepts and their activity (for example, if energy efficiency was something they considered in renting or buying a property and if their current property has any energy efficiency measures). The Survey noted these responses alongside key demographic information such as income, age, and property ownership. The caller also tried to secure interest and agreement from as many householders as possible to take part in a Physical Survey of their home.

The Telephone Survey also asked for the householder's views on the merits of a Home Energy Rating Scheme and their willingness to pay for energy efficiency measures that would be recommended as part of a rating of their home. A copy of the telephone survey form is included in Appendix 5.

Householders who took part in the Survey were asked if they would agree to have their contact details provided to a local energy efficiency company with a view to having a Physical Survey carried out on their home. Householders were advised that they would be presented with a semi-tailored energy report of their home after the Surveyors visit and also that they would be entered into a prize draw for up to $3,000 worth of energy efficiency improvements to their home.

The data gathered in this process has been subject to a data 'cleaning' process which involves quality control and spot checks with householders who took part in the Survey. The analysis of the data collected as part of the Telephone Survey is presented in Section 6.

3.3.2 Physical Surveys

The Physical Survey was developed by the project team in consultation with EECA. The Survey had specific questions on insulation, heating (space and water), power bills and draught proofing of windows and doors.

In order to keep the project within budget (and to facilitate householders' availability) it was necessary to limit the questions in the Physical Survey to ensure that the Survey would take no longer than one hour.

The Survey focussed on the two most significant energy sources, i.e., space and water heating. Information on lighting was collected in the telephone Survey but not in the Physical Survey. In addition, questions on swimming pools and spa's were not part of the Survey as the BRANZ House Condition Survey provides such information - 7% of households Surveyed had a spa, 4% an unheated pool and less than 1% a heated pool. A copy of the physical survey form is included in Appendix 6.

Surveys were carried out in April / May 2007. A target number of 150 Physical Surveys was agreed with EECA.

The analysis of the data collected as part of the Survey is presented in Section 6.

4 Results – Phase One - Establishing the Baseline Data

This section presents a summary of the data sources and information reviewed and the key observations made.

Full details (specific reports and references) of the individual sources and their relevance to this project are presented in Appendix 1.1 – 1.3. A summary table of the sources reviewed is presented in Appendix 2.

Four sets of data were reviewed as follows:

- Primary Data Sources
- Secondary Data Sources
- Other Data Sources, and
- Specific Reports and Market Research on HERS.

4.1 Key Primary Data Sources

Primary data was sourced from the following organisations:

1. Statistics New Zealand
2. Quotable Value Limited (QV), New Zealand
3. BRANZ – Building Research Association New Zealand, and
4. CRESA – Centre for Research Evaluation and Social Assessment.

Very good data is available on dwellings and households demographics from Statistics New Zealand[18, 19] and Quotable Value Limited. Both sources provide good demographic data and enable the determination of the age of the housing stock and the correlation of this with other demographic details. Neither source however provides comprehensive data on house condition (other than house age) or direct information on the energy efficiency characteristics of houses.

The two Surveys which do collect some data on the condition of houses and the energy efficiency characteristics of those houses are the New Zealand House Condition Survey[20] and the Household Energy End-use Project (HEEP).[21] While both of these Surveys have a nationally representative sample, the New Zealand House Condition Survey involves the three main regions of New Zealand and is restricted to owner occupied houses. HEEP has a similar sample size, but the sample is considered to more representative because it covers a broader geographical area and includes rental properties.

Data in these Surveys can show the energy efficiency characteristics of New Zealand houses at a national level. The detailed results of the House Condition Survey are currently more readily available than those from HEEP. The results from the House Condition Survey also provide time series data, so trends over the past 15 years can be identified.

In conclusion there is good quality primary data available on dwellings and household demographics from specific sources. In addition, there is also some good quality data

available on the condition and energy efficiency characteristics of New Zealand houses on a national basis. Data at a regional level is limited, with the only noted exception being Christchurch.[2]

Currently however there is no publicly available information that correlates the energy efficiency characteristics of households with the demographics of the household occupants.

The new Survey work carried out for this current project addresses both interest/awareness in energy efficiency issues and receptivity to a HERS while also looking at the demographics of a household. Questions in the Telephone Survey are intended to provide an indication as to whether householder interest in energy efficiency progresses to actual activity.

The Census presents one opportunity to collect data on the energy efficiency of New Zealand households along side demographic data on an ongoing basis and this opportunity should be considered.

The studies undertaken by CRESA provide a series of useful 'snapshots' of energy efficiency experiences and views/opinions, in particular in rural areas and amongst low income households.[23,24,25,26,27]

The data collected by Quotable Value could also be enhanced by the addition of energy efficiency categories. In the future, as a Home Energy Rating Scheme becomes more widespread, the Quotable Value database could be a useful way to record and store the results of Home Energy Ratings and so enable changes/improvements to be recorded on a national basis.

4.2 Key Secondary Data Sources

There are numerous secondary sources of data that have been identified based on the primary data available. The secondary data sources accessed are as follows:

- The Centre for Housing Research Aoteroa New Zealand (CHRANZ)
- Housing New Zealand Corporation
- The Ministry of Social Development
- BRANZ – Building Research Association – New Zealand
- EECA – Energy Efficiency and Conservation Authority, and
- MfE – The Ministry for the Environment.

The Review of Statistical Housing Data provides a very good starting point for this report, because it identifies several useful data sources.

The CHRANZ report titled "*Changes in the Structure of the New Zealand Housing Market*" is perhaps one of the most useful reports identified - particularly Section 7 of this report titled "Stock of Housing".[30] Figure 7.5 in this CHRANZ report provides details on the proportion of the house stock constructed since 1980 throughout New Zealand.

The New Zealand Housing Strategy[1] provides some general information about housing highlighting significant trends, such as recent significant changes in home ownership,

observations on the historical aspects of housing in New Zealand's cities and the most likely locations of older housing.

The BRANZ insulation report estimates trends[34] in the rate that ceiling insulation is being installed in pre-1977 houses, based on the results from the first two New Zealand House Condition Surveys. Generally, the most important data identified from this set of reports is the age of the housing stock in different centres throughout New Zealand. It is suggested that EECA consider updating the BRANZ report on Insulation trends in houses with data from the most recent New Zealand House Condition Survey.

Ministry for the Environment reports (from the Warm Homes Project)[37,39] provide a useful indicator of drivers to encourage New Zealanders to embark on energy efficiency improvements in their homes. While focussed predominantly on home heating types and air quality issues, the reports do make a link with energy efficiency. The first report examined usefully identifies the perception that a HERS would encourage investment in energy efficiency initiatives to add value to a home. The second report considered presents some interesting data in relation to home heating choices in homes and relative income levels although other data likely to be of most interest to this study (insulation and home income level and insulation and house age) was not presented.

4.3 Other Data Sources

Other data sources accessed are both primary and secondary and targeted at a particular region or demographic group. The studies have been carried out by the following organisations:

- UMR Research Ltd
- Community Energy Action, and
- Building Research Association of New Zealand (BRANZ).

From this group of targeted primary and secondary research there are reports of interest with useful information. However only one of these reports - '*The Assessment on the levels of insulation in Christchurch houses'* - contains any significant information on the energy efficiency characteristics of New Zealand houses.[2] It is a comprehensive study of the insulation characteristics of Christchurch houses. This study provides very good information on the insulation status of houses in Christchurch.

UMR Research indicates a positive change in attitude with 70% of New Zealanders surveyed declaring that they make an effort to be energy efficient around their home. The research showed the increase in energy costs during the last few years has resulted in New Zealanders being more receptive to energy efficiency messages. There has been strong interest from consumers in receiving information on energy efficiency actions at home and on the road.[3]

Also of note is the report by BRANZ on the results from the first large scale Home Energy Rating Scheme pilot in New Zealand, which took place in the Wanganui area in 1991 and involved 700 houses.

The data from this Survey is held by BRANZ and ECNZ (the Electricity Corporation of New Zealand). While the data is now out of date the general findings are of interest. Wanganui is of particular interest because it is one of New Zealand's older cities with a

stable population.[41] This results in a housing stock which is older than average and therefore, perhaps greater potential to improve energy efficiency.

Finally, some reference was made to international studies on demographics and householder energy efficiency.[42,43] Studies also show that in general, most householders irrespective of demographics know little about their energy use and how it might be affected by their actions or inactions. One study in particular noted that higher income houses and those on the lowest incomes changed their behaviour less after receiving energy efficiency advice. The study concluded in this case that for higher income households it was probably because they can afford not too, and low income households because some may already do much to save energy and may have few options remaining.

4.4 Research on Home Energy Rating Schemes

The research reviewed for this part of the project were essentially the key studies that have so far focussed on the development and implementation of a Home Energy Rating Scheme (HERS) in New Zealand. Details of the specific reports are presented in Appendix 1.4. In addition to these studies, international 'experiences' in relation to rating schemes and attitudes to home energy efficiency were also considered, specifically in the UK and Australia. These experiences are noted in this section. They have been included in the report to illustrate similar experiences in countries that have already introduced a HERS or are currently considering doing so.

New Zealand Experiences

In general, New Zealand studies suggest that interest in and uptake of HERS has appeared to be relatively low amongst householders. The Warm Home Energy Check (WHEC) in Christchurch[4] and two subsequent projects to review its effectiveness[5,6] noted that most participants had implemented or were going to implement the measures recommended as part of the survey. They identified cost as the main barrier to making changes while they identified warmth, cost savings and trustworthy advice as the key driving factors that made them act on the recommendation. Interestingly as cost can be a motivating factor in making savings in energy consumption and so reduced power bills, so too can it be a deterrent when it comes to making energy efficiency improvements. This is particularly the case to those who feel that they cannot afford to invest in an energy audit or to make energy efficiency improvements such as installing cavity wall insulation or a new boiler. People may prefer to spend their money on something that has a greater visual impact, such as re-decorating (or a new kitchen or bathroom).

Increased warmth and comfort appeared to be of more relevance to participants than what rating their home received while some participants expressed doubt over the benefit of the WHEC at all. Though small in size, the study covered a mix of age, genders and income levels. The post project review identified that older females on low incomes were most receptive to the idea of a WHEC.

The WHEC also canvassed the views of 100 real estate agents. The agents indicated that they were generally not opposed to the idea of a Home Energy Rating Scheme being made mandatory in the future for houses at the time of sale, as they would see it as a progressive step from a voluntary scheme. They noted that it was likely that only those owners of properties with a good HERS rating would want to use it to sell their property and that it

was important for the public to be educated about how a good rating could help sell their property.

A Dunedin based study[7], also small in size, again reported largely favourable feedback from householders on the idea of an energy rating scheme and a willingness to improve the energy efficiency of their homes. High ratings were noted (by householders and real estate agents) as likely to make the property more attractive for sale. The report noted the ultimate need for a mandatory HERS and this idea seemed to be supported by most of the home owners questioned. This report noted the view from those interviewed that generally it was not felt that a high rating would make a property more attractive for sale.

The Dunedin real estate agents questioned about their views on the merits of a HERS were cautious. They indicated a 'wait and see' approach to the introduction of a HERS and its potential to promote energy efficiency within homes.

The final piece of research reviewed was a study of international rating schemes commissioned by EECA.[8] The authors also note that voluntary HERS tend to have low levels of uptake and while some homeowners do act on recommendations on how to increase the energy rating, in general uptake is low. The authors noted further that energy efficiency programmes linked to a HERS can be successful but again, uptake is low. Finally the authors identified policy options for the introduction of a HERS in New Zealand including energy efficiency incentive programmes, home energy audits, HERS (voluntary and mandatory) and housing standards with the advantages and disadvantages of each option presented.

At this point it is worth commenting on the 'environment' into which the proposed HERS scheme will be introduced. It is fair to say that there is generally a greater degree of awareness amongst the general public about environmental and energy issues. Over the last 20 years as academia, the media and politicians have brought issues such as global warming to their attention. Energy, its production and its potential impact (for example on health and well being) receives extensive media coverage and has become mainstream news.

A recent poll by ShapeNZ run by the New Zealand Business Council for Sustainable Development confirms this change in attitude. The poll shows that 80% of New Zealanders think that climate change is a problem to be dealt with now or urgently. They are also making a link between climate change and energy efficiency. The polling shows overwhelming support for climate change policies like insulating homes and paying cash incentives to buyers of fuel efficient, low emission vehicles.[9]

As noted in section 4.3, UMR Research in 2006 also confirms this positive change in attitude to energy efficiency around the home and an increase in receptivity to energy efficiency messages.

Despite this change in attitude however, the evidence reviewed in this work still suggest that interest in energy efficiency rating schemes is generally low and that uptake of voluntary initiatives is also generally low. Evidence also suggests that the introduction of any scheme (voluntary or mandatory) could benefit from a strong marketing and information campaign and could further benefit from support, at least in the early stages, from an energy efficiency incentive programme (for example, grants or rebates).

Studies so far have not specifically matched receptivity or interest in energy efficiency issues to the demographics of a household although some indication of receptivity was given in the Christchurch study.[4, 5, 6] Surveys carried out as part of this current project have included questions of this nature and will provide an indication if whether income and other demographic features of households are linked to receptivity to a HERS, interest / awareness of energy efficiency issues and a willingness to act on recommendations.

A recent article by a New Zealand author makes an interesting comparison between the attitudes of New Zealanders to their homes and their cars. He notes that while our homes cost more than our cars we pay less attention to their efficiency and maintenance.[10]

Other International Experiences

Some experiences and outcomes from surveys and reports in the UK and Australia are noted here as additional information of relevance and interest - in particular, public perceptions of the value of home energy ratings and more generally, public attitudes to household energy efficiency.

A 2004 study on behalf of the UK's Energy Saving Trust (EST) and Central Office of Information (COI) Communications shows that energy efficiency is a low priority both on a day-to-day basis and over the longer term. Energy saving actions are not always seen as a priority since many people live in houses that are already warm and comfortable and do not cost a fortune to heat, despite the promise of lower energy bills if the energy savings were made.[11]

Recent surveys and research in the UK on rating schemes offer an interesting insight to the apparent change in awareness and attitude to energy efficiency.

One survey revealed that only 14% of those questioned said that they would not take the energy efficiency rating into consideration when looking at a house or flat. Three quarters of those questioned said that running costs and energy efficiency are important when choosing one property over another, with just 3% saying that it is not important at all. [12]

Other research in the UK showed that consumers want to know more about energy efficiency, with the majority supporting the idea of energy ratings. According to '*You Gov*'[b], more than two thirds of people (72 %) want more information about the energy efficiency of the homes they are buying. The recent poll also reveals that 71 % of people think it is a good idea to rate the energy efficiency of homes. Nearly half (47 %) said they would make their home more energy efficient if they had more information on what to do.[13]

The added value that a HERS might add to a property (in terms of saleability) was touched on briefly in the Dunedin study where participants generally felt that it would not affect the sale. The findings of recent research in the UK by the country's main mortgage lender – the Halifax Building Society - identified the features of a home that are considered to add value and create good, first impressions. Almost one third of respondents believe that a fitted, modern kitchen is the main feature to improve the monetary value of a home.[14] While central heating is now considered to be a standard

[b] *You Gov* are a British internet-based market research company.

'must have' in a UK home only 6% of respondents believed that central heating was the main feature that would improve the monetary value of a home.

Valuers from the Halifax considered that loft and cavity wall insulation added little to the actual value of the home, but acknowledged that it would save money in running costs. Getting prospective owners to think about the short and long term (in terms of initial capital outlay and then running costs – somewhat like the energy ratings on appliances) would be a key step.

Despite this apparent change in attitude and awareness, it seems that home energy efficiency is still something that many householders do not prioritise. The authors of the Sustainable Cities Report in Australia suggest that while a system of star energy ratings for properties may seem like an excellent idea, simple to communicate and understand, it only has value if consumers are aware of, and concerned about, residential energy ratings. As the recent New Zealand article noted earlier highlighted a comparison between our attitudes to the energy efficiency of our houses relative to our cars, so too does this Australian study. The authors similarly note that Australians know more about the energy ratings of their cars and their appliances but not their buildings. The authors note that there is a need to "do more to educate the public". The need identified is perhaps to make energy efficiency issues main stream and so raise public awareness about the homes in which they live, increasing the awareness to the point where decisions are influenced in the same way that decisions are made on, for example, cars.[15, c]

International evidence suggests that mandatory schemes may be the key to success. This is particularly the case in ACT in Australia with new homes and potentially in Europe where a step change in energy efficiency is expected as a result of the implementation of the EU Directive 'Energy Performance of Buildings' (in varying stages of implementation across Europe). This Directive requires all residential and commercial properties to have an Energy Performance Certificate (EPC) at the point of sale or letting.

[c] Professor Lindsay Johnston Royal Australian Institute of Architects, (Transcript of Evidence, 11 March 2004, p. 8.) indicates that houses could be, much like cars, 'road-tested' in magazines, because issues such as air-conditioning and heating costs are currently 'not actually penetrating in the housing market'.

Professor Johnston also notes, "If you think about the public buying cars, they are pretty well informed not just on price but on performance, reliability and depreciation of a vehicle, but you never see them thinking about those things when they buy a house."

5 Results – Phase Two - Locating the pre-77 houses and Identifying the Area Units for further Surveying

5.1 Where are the older houses?

The aim of this part of the project was to identify the location of pre-1977 or 'older' houses. As noted in Section 3, the key sources of information used for this exercise were Statistics New Zealand Census Data and New Zealand 2005 House Condition Survey and Insulation trends in Houses[34].

Numbers of Pre 1981 Houses by Region

Table 5.1 below shows the number and proportion (%) of houses built before and after 1981, listed in order of size per region. The table shows that the Pre 1981 houses are concentrated in the three main centres – Auckland, Canterbury and Wellington (the numbers in Auckland clearly dominate the totals.

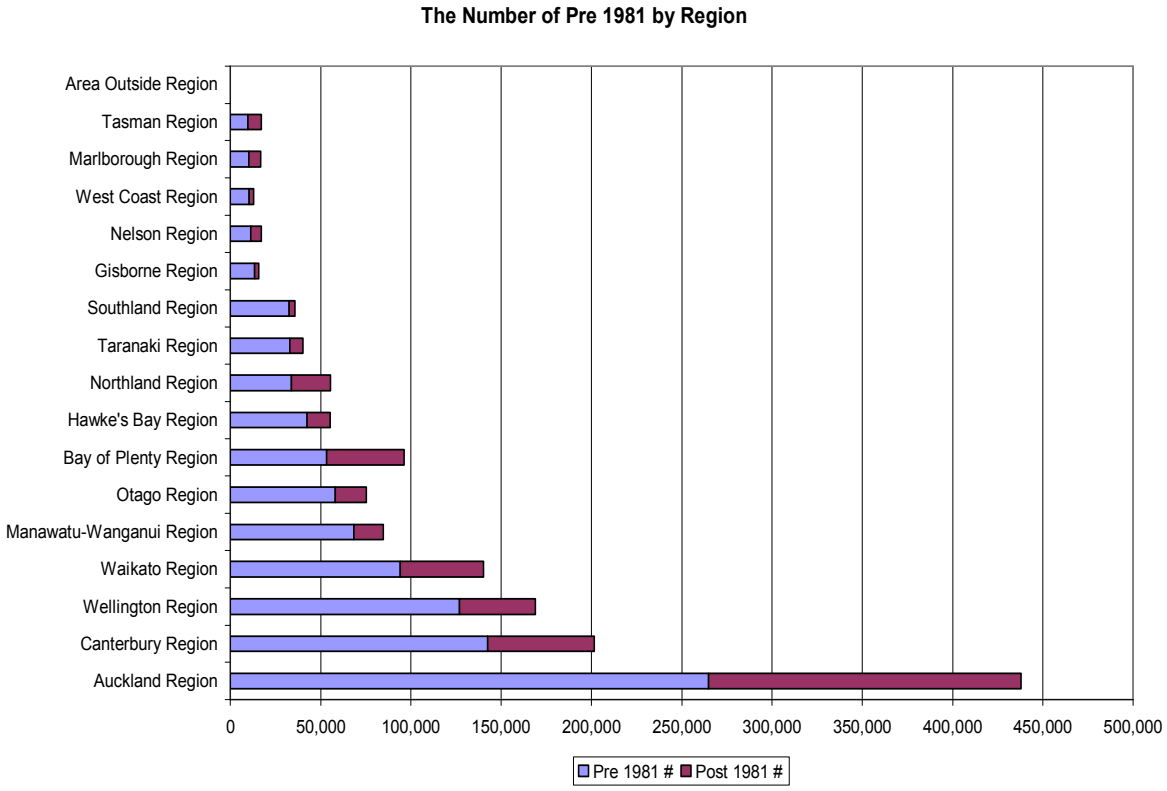
Table 5.1: The number and proportion of Pre 1981 houses (ordered by number)

Region	Pre 1981 (number)	Post 1981 (number)	Pre 1981 (%)	Post 1981 (%)
Total	**1,005,486**	**466,263**	**68%**	**32%**
Auckland Region	264,858	173,130	60%	40%
Canterbury Region	142,506	59,154	71%	29%
Wellington Region	127,011	41,838	75%	25%
Waikato Region	93,927	46,338	67%	33%
Manawatu-Wanganui Region	68,346	16,422	81%	19%
Otago Region	58,173	17,061	77%	23%
Bay of Plenty Region	53,238	42,930	55%	45%
Hawke's Bay Region	42,531	12,696	77%	23%
Northland Region	33,816	21,711	61%	39%
Taranaki Region	32,928	7,353	82%	18%
Southland Region	32,745	3,057	91%	9%
Gisborne Region	13,470	2,193	86%	14%
Nelson Region	11,349	5,838	66%	34%
West Coast Region	10,422	2,346	82%	18%
Marlborough Region	10,275	6,567	61%	39%
Tasman Region	9,711	7,560	56%	44%
Area Outside Region	180	69	72%	28%

Source: Statistics New Zealand

Figure 5.1 following presents the number of pre 1981 houses by region. Again this illustrates the dominance of the Auckland region and the comparatively small numbers in the smallest sized regions i.e., Gisborne, Nelson, West Coast, Marlborough and Tasman.

Figure 5.1: The number of pre 1981 houses by region – Bar Chart



Proportion of Pre 1981 Houses by Region

Table 5.2 shows the same data as that in presented in Table 5.1, but the data in Table 5.2 is ordered based on the proportion of pre 1981 houses in each region. It shows that on average 68% of all houses were built before 1981 and 10 regions have a higher proportion of older houses than this average, while 7 regions have a lower proportion.

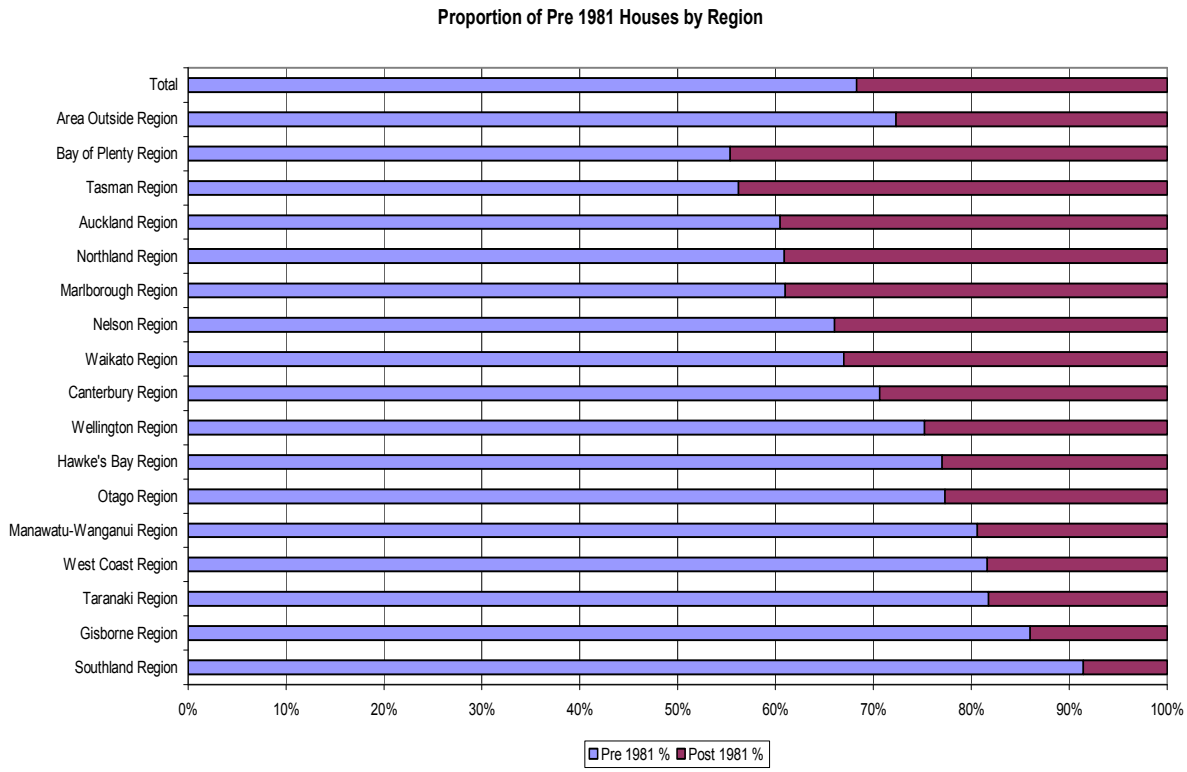
Table 5.2: The proportion and number of Pre 1981 houses (ordered by proportion)

Region	Pre 1981 #	Post 1981 #	Pre 1981 %	Post 1981 %
Southland Region	32,745	3,057	91%	9%
Gisborne Region	13,470	2,193	86%	14%
Taranaki Region	32,928	7,353	82%	18%
West Coast Region	10,422	2,346	82%	18%
Manawatu-Wanganui Region	68,346	16,422	81%	19%
Otago Region	58,173	17,061	77%	23%
Hawke's Bay Region	42,531	12,696	77%	23%
Wellington Region	127,011	41,838	75%	25%
Area Outside Region	180	69	72%	28%
Canterbury Region	142,506	59,154	71%	29%
Total	**1,005,486**	**466,263**	**68%**	**32%**
Waikato Region	93,927	46,338	67%	33%
Nelson Region	11,349	5,838	66%	34%
Marlborough Region	10,275	6,567	61%	39%
Northland Region	33,816	21,711	61%	39%

Auckland Region	264,858	173,130	60%	40%
Tasman Region	9,711	7,560	56%	44%
Bay of Plenty Region	53,238	42,930	55%	45%

Figure 5.2 below presents the proportion of pre-1981 houses per region.

Figure 5.2: The Proportion of Pre 1981 Houses by Region – Bar Chart



The regions with the highest *proportions of older houses (pre 1981)* are those in the lower half of the North and South Islands i.e. Gisborne, Hawkes Bay, Taranaki, Manawatu-Wanganui and Wellington in the North Island and West Coast, Canterbury, Otago and Southland in the South Island.

The regions with the lowest proportion of older houses (post 1981) are those in the northern parts of the North and South Islands i.e. Northland, Auckland and Bay of Plenty in the North Island and Marlborough, Tasman and Nelson in the South Island.

Proportions and numbers

If the regions are considered in terms of the *number of older houses*, the three main centres stand out as regions on which to focus. For example the Auckland region has over 250,000 pre 1981 houses, even though only 60% of the houses in the region were built before 1981.

Focusing on regions with a high number and a high proportion of pre 1981 houses is the recommended starting point for the introduction of a Home Energy Rating Scheme. This approach would enable targeting the largest numbers of pre 1981 in the most cost effective way, by target regions with high numbers of older houses and higher concentrations (proportions) of older houses.

It could be suggested that the initial focus for a Home Energy Rating Scheme is on regions with a high proportion of older houses and more than 50,000 older houses. This results in a focus on the following regions:

- Auckland
- Waikato
- Bay of Plenty
- Hawkes Bay
- Taranaki
- Manawatu-Wanganui
- Wellington
- Canterbury
- Otago
- Southland.

While it is appreciated that EECA is committed to a national scheme, these regions perhaps deserve more attention in terms of promotion, marketing, monitoring uptake and perhaps targeted subsidies as part of a Home Energy Rating Scheme.

This process has enabled the identification, within the limits of existing available data, of the **location** of the 'older' houses nationwide and indeed those most likely to be in need of basic energy retrofits.

It is important to appreciate that there is no indication since the last House Condition Survey what degree of activity there has been in terms of retrofitting these older houses with insulation. EECA's programmes recently celebrated the insulation of the 30,000th home under the Energy Wise Grant Programme (it's unclear where these 30,000 homes are located).[d] Further, there is no obvious way to track incremental improvements in insulation in dwellings that are being privately insulated as part of renovation projects (i.e., outside of EECA programmes).

5.2 How Many Houses Have Inadequate Insulation?

Many of the older houses in New Zealand no longer have inadequate insulation due to:

- programmes run by EECA and others (including Housing New Zealand Corporation), and
- renovation of older houses by homeowners.

Therefore the number of houses with inadequate insulation is significantly less than the number of pre 1981 houses.

It has previously been estimated that there were approximately 310,000 houses with inadequate ceiling insulation in 2001.[34] This study estimated the number of houses with

[d] 30 March 2007, 30,000 New Zealand homes have now benefited from insulation and energy efficiency measures under the government's EnergyWise home grants programme. http://www.eeca.govt.nz/news/media-releases/30000th-home.html

inadequate ceiling insulation and was based on the results of the House Condition Surveys completed in 1994 and 1999.

The same study includes scenarios showing the number of houses with inadequate ceiling insulation from 2001 to 2012. The three scenarios are described as pessimistic; a central and optimistic. These projections estimate that there are 130,000 (optimistic), 180,000 (central) and 240,000 (pessimistic) houses yet to be retrofitted. This report was published in 2003.

Since early estimates were calculated additional source data has been collected in the New Zealand 2005 House Condition Survey. This survey shows similar results to those of the 1999 survey. The survey states that "*While the proportions with no insulation have reduced, this does not reflect additional work to existing houses, but rather the increasing numbers of newer houses in the survey*." Based on the findings of these last two House Condition Surveys it could be argued that the pessimistic scenario may be the most realistic.

The number of houses with inadequate ceiling insulation has been calculated using updated data from the New Zealand 2005 House Condition Survey and the 2006 Census data. The results are presented in Table 5.3 below.

Table 5.3: Estimates of the number of houses with inadequate insulation.

	Percentage of houses with more than 50% insulation cover	Number with more than 50% insulation cover	Total Number remaining to be insulated (ie with less than 50% insulation cover)	Percentage accessible with 0% - 50% insulation cover	Number accessible with 0% - 50% insulation cover
Ceiling	79%	1,160,000	310,000	15%	220,000
Wall	34%	500,000	970,000	66%	970,000
Floor	21%	310,000	1,160,000	70%	1,030,000

While the results of the House Condition Surveys completed in 1999 and 2005 suggest only slight improvement in the levels of ceiling insulation in houses, progress has been made, due to the efforts of EECA, a range of other organisations (including Housing New Zealand Corporation) and private individuals.

The number of houses with inadequate ceiling insulation is likely to be between 220,000 and 310,000. It should be noted that the definition of "adequate" with respect to insulation is houses with 50% to 100% insulation cover. If a more onerous definition were applied i.e., "100% insulation cover", the number of houses with inadequate insulation would be much greater.

With respect to wall insulation, while there are a high number of houses with inadequate wall insulation, this is a difficult building element to improve unless other work is being undertaken, for example major renovation work.

5.3 Where are the Houses with Inadequate Insulation?

It is likely that additional information on the number and insulation status of older homes exists at a regional level. It has been noted in this report that due to the efforts, for example, of local agencies in Christchurch much is known about the status of insulation in Christchurch homes.

The 2005 House Condition Survey shows a general increase in the use of insulation with increasing severity of winter temperatures i.e. north to south. This is shown with the data presented in Table 5.4.

Table 5.4: Ceiling Insulation in Pre 1980 houses

	Fully insulated	More than 50% insulated (based on cover)	No insulation
Auckland	70%	80%	14%
Wellington	52%	85%	12%
Christchurch	91%		3%

Source: New Zealand 2005 House Condition Survey

This shows that Christchurch houses stand out as being better insulated than houses in the other two main centres. This finding is confirmed by other information found in Phase One about Christchurch houses.[2]

5.4 Selection of Houses for Further Data Collection

As part of the process to undertake further data collection it was necessary to identify where the surveying (Telephone and Physical Surveys) should take place. The process of identifying these regions is presented in Section 3.2.

The following four regions were selected for further data collection:

- Auckland
- Bay of Plenty
- Wellington, and
- Otago.

Regions were selected to:

- give a good spread throughout New Zealand,
- include areas where the Survey teams operate,
- include the faster growing and highest populated regions,
- include an area with the oldest housing stock.

In general, the older cities with more stable populations have the oldest housing stock. This includes areas such as Dunedin, Wanganui and Wellington.

There is more information available on the energy efficiency characteristics of houses in Christchurch than perhaps any other location. Christchurch is also atypical in that insulation requirements in Christchurch houses came into effect earlier than the remainder of the country. There is also significant insulation activity going on in Christchurch in

response to the new National Environmental Standard on air quality. For these reasons further surveying in Christchurch is unlikely to provide meaningful information of the energy efficiency characteristics of New Zealand houses on a national basis. Christchurch was therefore excluded.

The Auckland region has been identified as an area which should be included in new Surveys, because of its size and the rate of growth. The Otago region was selected because Dunedin has a very high proportion of older houses and this is one of the colder regions of the country. The Wellington region was selected because of the high proportion of older housing, the diversity of the housing stock and to minimise Survey costs i.e. it is close to one of the companies which will complete the Surveys. The Bay of Plenty region was also selected. This region has a high proportion of new housing and a wide range in age and quality of housing stock. This region facilitated surveying in rural locations that are distant from a main urban centre. Using the Bay of Plenty also minimised Survey costs i.e. it is close to one of the companies that were engaged to undertake the surveys.

Available data was sorted to select the housing and householder characteristics which were of most interest to EECA. The selection parameters which were of most importance to EECA were household income, tenure (rental/owner occupier) and dwelling age. EECA also expressed an interest in a spread throughout New Zealand, covering houses in each of the New Zealand Building Code climate zones and rural and urban areas.

For the proposed HERS EECA was also interested in the difference in the energy efficiency characteristics of older and newer houses and the receptivity of a range of householders to the proposed HERS.

Definitions for low and high income and old and new houses, and rural areas are presented in Appendix 3. The full lists of characteristics for each Area Unit are reproduced in Appendix 4.1 and 4.2. Those characteristics most influential on the decision to select a particular Area Units are highlighted.

The following table, Table 5.5, presents the Area Units selected including the key characteristic of interest:

Area Unit Name	**Territorial Authority**	**Regional Council**	**Characteristics**	
Wadestown	Wellington City	Wellington	High Income (74%)	Old houses (89%)
Endeavour	Porirua City	Wellington	High Income (80%)	New houses (99%)
Stanley Bay	North Shore City	Auckland	High Income (66%)	New houses (90%)
Waldronville	Dunedin City	Otago	Owner occupier (88%)	Old houses (94%)
Cannons Creek North	Porirua City	Wellington	Rentals (78%) / Low Income (72%)	Old houses (98%)
Bethlehem	Tauranga City	Bay of Plenty	Owner occupier (72%)	New houses (78%)
Matukituki	Queensland Lakes District	Otago	Owner occupier (69%)	New houses (72%)
Stuart Street-Frederick St	Dunedin City	Otago	Rentals (81%)	Old houses (92%)
Point England	Auckland City	Auckland	Rentals (79%)	Old houses (86%)
Auckland Central	Auckland City	Auckland	Rentals (80%)	New houses (88%)

East				
Waihemo	Wataki District	Otago	Rural Area	
Edgecumbe Community	Whakatane District	Bay of Plenty	Rural Area	
Bethlehem East	Tauranga City	Bay of Plenty	Family houses (89%)	New houses (98%)
Normandale	Lower Hutt City	Wellington	Family houses (81%)	Old houses (79%)
Aro Street-Nairn Street	Wellington City	Wellington	Not separate houses (68%)	Old houses (82%)

Table 5.5: Area Units selected for Telephone and Physical Surveying

6 Results - Phase Three - New Surveys

This section sets out the results from the new Telephone Survey and Physical Surveys conducted as part of the project.

A target of 350 completed Telephone Surveys was agreed with EECA and a total of 359 completed Surveys were achieved. The response rate for the Telephone Survey is 42 %. The Survey is reproduced in Appendix 5. NRB were provided with a final working draft of the Survey to transform into a field version and a set area units to drawn the Survey sample from. Using the meshblock specification provided to them NRB purchased a set of phone numbers for each Area Unit. Householders were called randomly in each area unit until the target number of households (23-24 households in each area unit) had been achieved. The phone Survey was in the field late February through to mid March 2007.

Householders who took part in the Survey were asked if they would agree to have their contact details provided to a local energy efficiency company with a view to having a Physical Survey carried out on their home.

A target number of 150 Physical Surveys was agreed with EECA and a total of 135 Surveys were completed. The Physical Survey used in the project was developed by the project team in consultation with EECA. It is reproduced in Appendix 6. Surveys were carried out in April / May 2007. The project team aim was to secure at least 10 households in each of these Areas to complete a Physical Survey. The Survey also enabled a check against what householders said in the Telephone Survey providing to some extent an insight into what householders think they know about their homes and what is actually the case.

The energy efficiency companies conducting the Physical Surveys reported a general difficulty in getting householders to participate despite having indicated in the telephone Survey their initial willingness. Several expressed cynical views on what could be gained from the Survey. Despite this, those who did take part in the Survey felt it to be a worthwhile exercise.

The following sub-sections present the main findings from the Telephone Survey and Physical Survey.

6.1 Survey Responses

Frequency tables for the answers to the questions posed in the Telephone Survey and on-site or 'Physical' Survey are presented in Appendices 7 and 8 respectively. These tables present the responses made by the 359 participants in the Telephone Survey and 135 participants in the Physical Survey.

6.2 Specific Analysis Undertaken

Table 6.1 following sets out the high level and detailed analysis undertaken on the data gathered. The analysis of the survey data identified three broad topic areas and eight key questions.

Table 6.1: Key Questions for Analysis

Patterns	1. What can we say about the demographics of the people we surveyed? 2. What relationship is there (if any) between energy efficiency characteristics and: ▪ House age ▪ Household income ▪ Tenure ▪ Region ▪ Urban/Rural houses
Energy Efficiency Views/Attitudes/Perceptions	3. What relationship is there (if any) between the householders perception of the condition of their house (in terms of energy efficiency characteristics) and the actual condition? Were the telephone and physical data collected consistent (is there an indication that people understand the issues)? 4. What relationship (if any) is there between the perceptions of household energy use and the actual energy use (power bills)? 5. What do people see as the barriers to improving energy efficiency or acting on energy efficiency advice?
HERS Receptivity and Willingness to Pay	6. Are householders receptive to a HERS? What relationship, if any, is there between receptivity to HERS and: ▪ House age ▪ Household income ▪ Tenure ▪ Region ▪ Urban/Rural houses 7. Is there a link between energy efficiency attitudes/Activity and receptivity to a HERS?

The sample structure for the analysis was comprised of Area Units selected on the basis of specific characteristics. Statistically, in order to maximise the confidence level of the data, as many Area Units as possible should be included, even at the expense of sample size within an Area Unit. Therefore the number of Area Units was maximised within the available budget.

The response rate for the telephone survey is 42%. A total of 359 householders participated. An analysis of the implications of those response rates in relation to sample bias are set out later in this Section. A calculation for the response rate for the on-site survey has not been undertaken but it is understood that of the 23-24 names collected by the telephone survey in each Unit Area, most were called to secure at least 10 householders in each Unit Area who were willing to have a physical survey of their home. The discussion later in this section shows that the samples for the telephone survey and the on-site survey are broadly similar.

The Datasets and Data Analysis

The surveying undertaken for this project generated three separate datasets. Those datasets are as follows:

- The ***Telephone Survey dataset*** – responses from 359 individual householders to the telephone survey conducted by NRB.
- The ***On-site or 'Physical' Survey dataset*** – data from 135 dwellings subject to physical inspections. Data reported in tables headed Physical Survey or Physical Dwelling Survey refers to physically observed data collected by the surveyors.

- The ***Matched Dwelling dataset*** – a sub-set of 135 responses from the telephone survey dataset which correspond to the 135 dwellings surveyed in the Physical Survey. Only the Matched Dwelling dataset allows data gathered by way of the telephone survey to be analysed in relation to observed data.

Data from NRB (the Telephone Survey dataset) was forwarded in CSV format. Data was imported into SPSS and subsequently cleaned. Data from the groups contracted to undertake onsite surveying (the On-site Survey dataset) was received via East Harbour in Excel spreadsheet format. This was imported into SPSS subsequent to extensive configuration of the data coding.

For the purpose of this report, data from the three datasets has been subject to univariate and bivariate analysis[e]. Statistical testing – usually chi-square tests – was also undertaken to establish whether there was systematic and statistically significant relationships between key variables. The majority of the data collected through the telephone survey and the on-site survey is categorical data rather than measurement data. Chi-square tests establish whether the pattern between two variables is statistically significant or simply arises randomly. Chi-square tests do not establish causality or the strength of the relationship between variables.

6.3 The Survey Participants: Socio-demography and Dwellings

The Telephone Survey involved 359 participants. Of those, 135 also participated in the Physical surveying of their dwellings. In this section we comment on:

- The socio-demographic and dwelling characteristics of the participants in the Telephone Survey and provide comparative data between the Telephone Survey participants and the participants with matched data from Physical surveying.
- Issues around the representativeness of the Telephone Survey and the Dwelling Survey respectively.

Socio-demographic Characteristics as Reported by Telephone Survey Respondents

The Telephone Survey collected socio-demographic data related to:

- householder age
- household income
- household size
- dependent household members.

The largest single category of respondent householders in the Telephone Survey was those aged 25 years to 49 years. Almost a third, however, were aged 50 years to 64 years.

[e] The univariate and bivariate analysis consisted nearly exclusively of frequency and cross-tabulation tables. For readers unfamiliar with these terms, a *frequency table* is a straight count of the answers in each variable or question; a *cross-tab* is a matrix table matching the answers from two variables/questions.

The sub-set of the telephone sample, the matched dwelling sample, has a very similar age profile (Table 6.2).

Table 6.2: Age Profile of Telephone Survey Sample and Matched Dwelling[f] Sample

Ages	Telephone Survey Respondents		Matched Dwelling Sample	
	n	%	n	%
24 years and under	19	5.3	2	1.5
25-49 years	158	44.0	61	45.2
50-64 years	112	31.2	44	32.6
65 years or over	70	19.5	28	20.7
Total	*359*	*100*	*135*	*100*

Unfortunately, the extent of sample bias or lack of it in relation to age of householder cannot be estimated at this point. Disaggregated age data has not yet been released from the 2006 census.

There appears to be some sample bias in relation to household income. There is under-representation of low income groups and considerable over-representation of high income groups. In particular, 20.1 % of the Telephone Survey respondents reported household incomes in excess of $100,000 compared to 16.2 % of the households reported in the 2006 census. That over-representation is somewhat more pronounced among the matched dwelling sample (Table 6.3).

Table 6.3: Household Income Profile of Survey Respondents Compared to the 2006 Census

Household Income	Telephone Survey Respondents		Matched Dwelling Sample		2006 Census	
	n	%	n	%	n	%
$20,000 or Less	46	12.8	16	11.9	200,790	13.8
$20,001 - $30,000	42	11.7	14	10.4	155,661	10.7
$30,001 - $50,000	64	17.8	22	16.3	238,431	16.4
$50,001 - $70,000	48	13.4	22	16.3	197,868	13.6
$70,001 - $100,000	41	11.4	17	12.6	189,720	13.0
$100,001 or More	72	20.1	29	21.5	235,644	16.2
Not Stated	46	12.8	15	11.1	235,992	16.2
Total	359	100	135	100.1	1,454,106	99.9

The average household size of the Telephone Survey respondents was 2.8. The average household size of the participants in the Dwelling Survey is 3.0. Table 6.4 compares the household size of the telephone survey sample and the matched dwelling sample with the national profile of household size apparent in the 2006 census. There is a distinct sample bias towards larger households in the telephone survey sample. This is even more pronounced among the matched dwelling sample.

[f] See Section 6.2 (The Datasets and Data Analysis) for an explanation of the different datasets generated by the research and the analysis the datasets were subject to.

Table 6.4: Household Size Profile of Survey Respondents Compared to the 2006 Census

Household size	Telephone Survey Respondents		Matched Dwelling Sample		2006 Census	
	n	%	n	%	n	%
1 person	51	14.2	15	11.1	328,313	22.6
2 person	149	41.5	53	39.3	494,044	34.0
3 person	47	13.1	18	13.3	240,291	16.5
4 person	64	17.8	28	20.7	221,667	15.2
5 or more person	48	13.4	21	15.6	169,860	11.7
Total	*359*	*100*	*135*	*100*	*1,454,175*	*100*

The geographical spread of households was determined by the sample frame decided upon by the project team in discussion with EECA. The regions included in the survey were limited to four due to the constraints of the available budget. Within the four regions, a total of 15 Unit Areas were selected for surveying. The geographical data presented in Appendix 4.1 is provided merely as a description of the sample. The samples do not necessarily represent the areas from which those participants were drawn because of the way they were selected and because of the small sample size.

Dwelling Characteristics as Reported by Telephone Survey Respondents

The following standardised data in relation to dwelling characteristics was collected in the Telephone Survey:

- dwelling age
- dwelling tenure
- number of bedrooms.

The proportion of the Telephone Survey participants that owned their own home exceeded the proportion of dwellings identified in the 2006 census as owned directly or through trusts by the occupier. Around 72 % of the Telephone Survey participants were owner occupiers compared to 67 % of occupied dwellings in 2006. Again this sample bias is more pronounced in the Matched Dwelling Sample with 85.9 % of the sub-sample living owner occupied dwellings. This bias is consistent with the sample bias noted in relation to the socio-demographic characteristics of the participant households.

As Table 6.5 shows, the majority of dwellings (68 %) in the Telephone Survey are either 3- or 4- bedroom houses. This is consistent with the national profile. There is a slight sample bias towards larger dwellings among the full sample participating in the Telephone Sample compared to the 2006 Census. This bias is more pronounced in the matched dwelling sample. This bias is of some importance given that the Household End-Use Energy Project shows that higher energy consumption is associated with larger dwellings as well as with larger households.

Table 6.5: Bedroom Profile of Dwellings in the Surveys Compared to the 2006 Census

Household size	Telephone Survey Respondents		Matched Dwelling Sample		2006 Census	
	n	%	n	%	n	%
1 bedroom	21	5.8	4	3.0	81,246	5.8

2 bedroom	59	16.4	18	13.3	278,145	19.8
3 bedroom	149	41.5	55	40.7	651,066	46.3
4 bedroom	94	26.2	40	29.6	303,804	21.6
5+ bedroom	36	10.0	18	13.3	91,902	6.5
Total	*359*	*99.9*	*135*	*99.9*	*1,406,163*	*100*

Sample Representativeness

Overall, the Telephone Survey sample size would provide a margin of error of ±5.3 % at the 95 % confidence interval if it had been chosen randomly. The Area Units from which the sample was drawn were discussed and agreed with EECA. This process is outlined in Section 3. This selection means that survey participants are by definition clustered into a small number of localities.[g] A priori this is not a random sample because not all area units had an equal chance of selection. Effectively the sample was a clustered selection to allow Physical surveying. The sample biases which have been noted above means that the representativeness of the Telephone Survey data needs to be treated with some caution. The sample size of participants in the Dwelling Survey is small and should be treated as a quota sample.

6.4 Energy Characteristics of Dwellings

A variety of data was collected around the energy characteristics of dwellings through the Telephone and Physical Dwelling Surveys respectively.

The Telephone Survey collected data related to:

- dwelling construction and amenities
- thermal envelope and insulation characteristics
- heating sources and appliances used for managing temperature and humidity
- water heating
- lighting.

The Physical Dwelling Survey collected data related to:

- dwelling construction and amenities
- thermal envelope and insulation characteristics
- heating sources and appliances used for managing temperature and humidity
- water heating and water usage
- mould and condensation
- average household expenditure on energy, and
- energy issues of interest/concern to the householder.

Dwelling Construction and Amenities

[g] **Cluster sampling** is a sampling technique used when "natural" groupings are evident in the population. The total population is divided into these groups (or clusters), and a sample of the groups is selected. The advantage of using clusters is that it can be cheaper than other methods (with fewer travel expenses), the disadvantage is it results in higher sampling error which is difficult to measure.

Just under half (47.4 %) of the Telephone Survey participants reported that their houses were built on concrete slabs. Almost 9 % did not know whether their house was on a concrete slab or not. Of the 135 dwellings surveyed in the Physical Dwelling Survey, 47 % were observed as being built wholly or partly on concrete slabs by assessors. This was consistent with the reported results from the matched dwelling sample indicating householders generally had good awareness of whether their home was on a concrete slab or not.

The majority (57.9 %) of the participants in the Telephone Survey reported that they had one bathroom. As Table 6.6 shows, almost a third had two bathrooms and a very small proportion had more than two bathrooms. Forty % of the dwellings in the Physical Dwelling Survey had two bathrooms.

Table 6.6: Bathroom Profile of Dwellings in the Phone Survey and the Physical Dwelling Survey

Number of Bathrooms	Telephone Survey Respondents		Physical Dwelling Survey Households	
	n	%	n	%
1 bathroom	208	57.9	68	50.4
2 bathroom	117	32.6	54	40.0
3 or more bathroom	34	9.5	13	9.6
Total	*359*	*100*	*135*	*100*

There is a statistically significant relationship between the number of bathrooms that participants reported and their perception of whether they live in a water efficient house. Householders living in dwellings with one bathroom were more likely to perceive their house as water efficient than householders in households with 2 or more bathrooms. Newer houses are more likely to have multiple bathrooms (Table 6.7).

Table 6.7: Bathroom Profile of Dwellings by Year House Built (Telephone Survey)

Number of Bathrooms	Year House Built					
	1980 or earlier		1981-2000		2001 or later	
	n	%	n	%	n	%
1 bathroom	141	72.3	28	36.8	13	22.0
2 bathroom	45	23.1	34	44.7	35	59.3
3 or more bathroom	9	4.6	14	18.4	11	18.6
Total	*195*	*100*	*76*	*99.9*	*59*	*99.9*

* 29 missing cases

Dwelling Typology

Because of the already lengthy size of the questionnaire, dwelling typology was not explored with participants in the telephone survey. Data on dwelling typology was collected for the 135 dwellings involved in the Physical Survey. The vast majority of these were stand-alone fully detached dwellings (88.1 %) with only 2.2 % semi-detached. There were a small number of apartments (4.4 %) and seven dwellings (5.2 %) were part of a block of flats.

Fifty-seven percent of dwellings were configured on a single storey. One dwelling was described as configured in 1.5 storeys. Over a third of dwellings (35.6 %) were 2-storey dwellings. The remaining 9 dwellings (6.5 %) were three storeys or more or were in buildings that were three storeys or more.

Insulation

While the majority (70.8 %) of Telephone Survey participants reported that they had insulation in their roof space, less than half (46.8 %) reported exterior wall insulation. Around a quarter (26.5 %) of participants reported under floor insulation (Table 6.8). In all only 18.7 % of participants in the Telephone Survey reported insulation in the roof space, in exterior walls and under floor – i.e. that their house was fully insulated.

Telephone Survey results indicate relatively high proportions of survey participants are unsure of the current insulation levels in their dwelling. Over a quarter (26.5 %) of participants did not know whether their walls were insulated or not, 15.6 % of respondents reported not knowing whether they had insulation in their roof space and nearly a fifth (19.2 %) did not know whether they had under floor insulation. However, where respondents do report insulation, these reports are in general similar to insulation levels observed during the Physical surveying. The Physical Survey shows slightly higher levels of roof and wall insulation than reported by participants in the Matched Dwelling Sample but lower levels of under floor insulation.

Table 6.8: Insulation Profile – Comparison of Telephone Survey, Matched Dwelling Sample and the Physical Survey Sample

Insulation	Telephone Survey Respondents (n=359)		Matched Dwelling Sample (n=135)		Physical Dwelling Survey Households (n=135)	
	n	%	n	%	n	%
Roof Space	254	70.8	111	82.2	113	83.7
External Walls	168	46.9	64	47.4	67	49.6
Under Floor	95	26.5	37	27.4	33	24.4

In addition to collecting information on the presence or not of insulation the Physical Surveying has provided considerable detail with regard to the extent, type and quality of insulation.

Ceiling Insulation

Of the 113 dwellings with ceiling insulation, 96 (84.9 %) were fully insulated. Fibreglass is the predominant insulation material used (81.4 %). Most dwellings showed insulation of more than 50mm thick in the ceiling (Table 6.9).

Table 6.9: Thickness of Ceiling Insulation (Physical Dwelling Survey)

Insulation Thickness	Physical Dwelling Survey	
	n	%
50mm	21	18.6
75mm	31	27.4
100mm	40	35.4

150mm	19	16.8
200mm	1	0.9
Missing	1	0.9
Total	*113*	*100*

External Wall Insulation

Of the 135 dwellings subject to Physical surveying, 51 dwellings had all walls insulated and 16 had some walls insulated. The external wall insulation of 31 dwellings out of the 135 was unable to be established. Of the 67 dwellings with wall insulation, 76.1 % (51 dwellings) were fully insulated while around a quarter were only partially insulated.

Under Floor Insulation

Forty-nine dwellings were on concrete slabs. A further 53 dwellings (39.3 %) had no under floor insulation. Of the remaining 33 dwellings, 72.7 % used foil and 24.2 % have polystyrene insulation. Two dwellings used an alternative form of insulation. Of the 33 dwellings with under floor insulation, 18 dwellings (54.5 %) had full under floor insulation and 10 dwellings (30.3 %) had partial insulation, the coverage of insulation in the other five dwellings was unable to be established.[h]

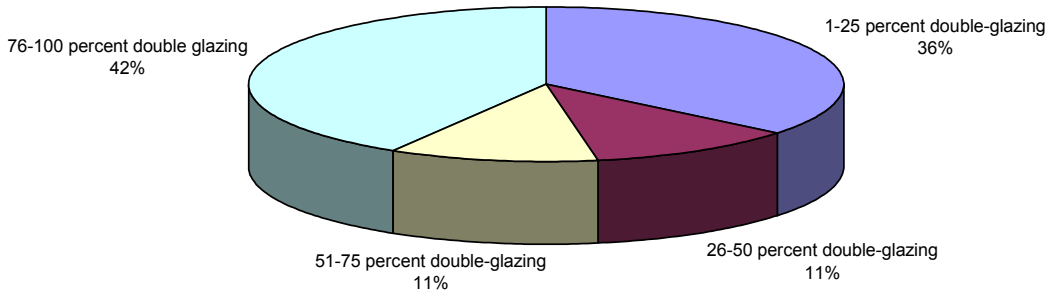
There is survey data in relation to the condition of under floor insulation for 28 dwellings. The majority of those dwellings (17 dwellings, 60.7 %) had insulation in excellent repair. A minority of dwellings (2 dwellings, 7.1 %) had their under floor insulation in poor condition requiring repair or replacement.

Double-glazing and the Integrity of the Thermal Envelope

Only a small proportion (53 respondents, 14.8 %) of the Telephone Survey participants reported some level of double glazing. Almost half of those Telephone Survey respondents reported that double glazing was used in less than 50 % of their dwelling's windows (Figure 6.1). Those participants with higher proportions of double glazing are more likely to report their house as energy efficient.

[h] Note - While it is possible to insulate concrete slabs at the point of construction, the focus of the survey was to identify the presence of under floor insulation or opportunities to install it. Timber floors without under floor insulation can benefit from a retrofit but concrete slabs cannot be retrofitted with insulation.

Figure 6.1: Proportion of Windows Double Glazed for Dwellings with Double-Glazing - Telephone Survey Respondents (n=53)

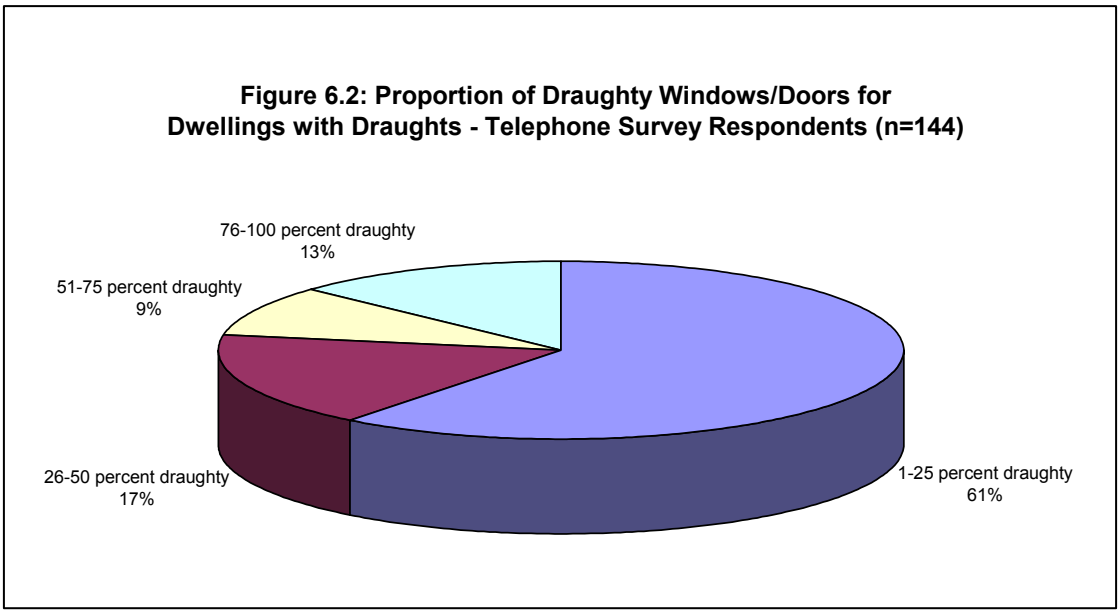


Analysis of the Matched Dwelling Sample and the Physical Dwelling Survey found reports of double-glazing by survey participants matched what was observed Physical. Both datasets show 19 out of 135 dwellings (14.1 %) with double-glazing. Of those dwellings, the Physical Dwelling Survey showed only 7 dwellings were fully double-glazed. This tends to agree with reported levels of double-glazing from the Matched Dwelling Sample with eight respondents saying between 76 % and 100 % of their windows are double glazed.

A considerable proportion of Telephone Survey participants (40.9 %) report that they have draughty windows or doors. As Figure 6.2 shows, more than a fifth of those participants reported that over half of their doors and windows are draughty. Analysis of Telephone Survey results shows a statistically significant relationship between respondents' perceptions of the energy efficiency of their home and self-reports of draughtiness. Those participants reporting lower proportions of draughty doors and windows are more likely to characterise their dwelling as energy efficient.

The Physical Dwelling Survey found that the majority of windows in the surveyed dwellings were not fully draught proofed. Indeed, 41.5 % of dwellings had no windows draught-proofed. A further 8.9 % of dwellings only had some windows draught proofed while 49.6 % of dwellings had all or most windows draught proofed. Where Physical Dwelling surveying indicated one or more windows were draught proofed, respondents in the Matched Dwelling Sample were less likely to report that their house had draughty doors and/or windows.

Data from the Physical Dwelling Survey shows doors are more likely to be draught-proofed than windows. Only 28.7 % of dwellings surveyed had no draught-proofing.



Heating Sources

Electric heaters such as fan, bar, convection or night store heaters are most likely to be reported by the Telephone Survey participants as a source of space heating. As Table 6.10 shows, around a third of the survey participants report that they use fixed wall electric heaters with similar proportions using enclosed wood burners.

Table 6.10: Space Heating Used in Dwellings (Telephone Survey)

Heater Type	Heater Used* (n=344)		Heater Mainly Used for Heating	
	n	%	n	%
Electric heater e.g. fan, bar, convection heater	167	48.5	67	18.7
Fixed electric radiator or oil column heater	115	33.4	31	8.6
Enclosed woodburner	107	31.1	87	24.2
Fixed gas heater	79	23.0	53	14.8
Portable gas heater e.g. LPG	65	18.9	24	6.7
Open fire	51	14.8	17	4.7
Heat pump	49	14.2	27	7.5
Underfloor heating	40	11/6	12	3.3
Other	7	2.0	26	7.2
No heating used	15	4.4	*15*	*4.2*
			359	*100*

* Multiple response

The Physical Dwelling Survey of 135 dwellings shows that 16.3 % have fixed electric heaters. The majority (85.7 %) are convection heaters. Almost half (47.6 %) have thermostats while 38.1 have nothing but a manual control. In addition, 51.4 % of dwellings were observed to have portable heaters. A third of dwellings have one or two heaters. A small proportion (16.2 %) of dwellings had three or more portable heaters. The

largest single category of portable heaters is radiators (42.9 %). A third (33.9 %) of dwellings surveyed for the Physical Dwelling Survey have convection heaters. Over half (64.2 %) are controlled by thermostat while 15.7 % are timer controlled.

The Physical Dwelling survey found only a minority of dwellings (29.1 %) have fixed gas heaters. Of those, 73.9 % are flued. 14.8 % of dwellings had unflued portable gas heaters. A smaller minority, 11.1 %, had heat pumps. A similar proportion (11.1 %) of dwellings had under floor heating. Gas and electricity are both fuels used for under floor heating. Smaller proportions again, 6.6 %, had ducted central heating systems evenly divided between heat pump technology and gas.

Very few dwellings had open fires (13.3 %), but 40 % of dwellings had an enclosed burner. These were predominantly fuelled by wood. As might be expected analysis of the Matched Dwelling Sample shows that self-reported data on the profile of heating appliances was broadly consistent with the actual profile of heater types observed during the Physical Dwelling Survey.

Analysis of the Telephone Survey results in relation to the use of different heater types shows there are statistically significant relationships between the use of some heating appliance types and householders perceptions around the energy efficiency of their home. Householders that report using heat pumps or under floor heating are more are more likely to characterise their home as energy efficient, while householders that report using fixed or portable electrical appliances are less likely to characterise their home as energy efficient.

Cooling

Overall, over two-fifths (45.7 %) of participants in the Telephone Survey reported that they used summer cooling devices. The most common of those was a fan (34.3 %) followed by small proportions of people using heat pumps (8.9 %), dehumidifiers (6.7 %) and air conditioning (4.2 %). A higher proportion of respondents in the Matched Dwelling Sample reported that they used summer cooling devices (51.9 %). The surveyors in the Physical Dwelling Survey also asked householders whether they used any cooling appliances during summer. Lower proportions of dwellings using summer cooling were found in the Physical Dwelling Survey (37.0 %). Given that the data in relation to cooling appliances for both the Matched Dwelling Sample and the Physical Dwelling Survey is self-report data it is unclear why the reported figures on usage are different. Where summer cooling devices were reported as being used, fans were the predominant appliance type (Table 6.11).

Table 6.11: Appliances Used for Cooling in Summer*

Cooling Appliance	Telephone Survey Respondents (n=359)		Matched Dwelling Sample (n=135)		Physical Dwelling Survey (n=135)	
	n	%	N	%	n	%
Fans	123	34.3	51	37.8	36	26.7
Heat pumps	32	8.9	13	9.6	12	8.9
Dehumidifier	24	6.7	9	6.7	8	5.9
Air conditioning	15	4.2	5	3.7	2	1.5
Other	6	1.7	3	2.2	0	0.0
No cooling appliances	195	54.3	65	48.1	85	63.0

used						

* Multiple response

Other Space Heating and Cooling

Only 12.6 % of dwellings were observed to have whole house ventilation systems in the Physical Dwelling Survey. In addition reports from the Physical Dwelling Survey indicate 14.5 % dwellings using a dehumidifier sometimes and another 8.3 % using dehumidifiers frequently.

Hot Water

Most Telephone Survey participants report a single mode of heating water. As Table 6.12 shows, the predominant method of water heating is electricity. Ninety-two dwellings were reported as using no electricity for hot water heating. Of the electricity users, five dwellings had no electric hot water cylinder. Those participants that used some form of alternative form of water heating or boosted their water heating with an alternative source were more likely to see their home as energy efficient.

Table 6.12: Fuels Used for Heating Hot Water (Telephone Survey)*

Source of Water Heating	Telephone Survey Respondents	
	n	%
Electricity	267	74.4
Gas	96	26.7
Instantaneous gas or electricity	51	14.2
Wood wetback	29	8.1
Solar	13	3.6
Other	4	1.1

* Multiple response

Of the 262 dwellings with electric hot water cylinders identified by Telephone Survey participants as their main cylinder a significant proportion were more than ten years old. As Table 6.13 shows, 12.2 % of participants did not know the age of their electric hot water cylinder. Only 3.4 % of cylinders were less than a year old. Survey participants did not associate the age of their cylinder with the energy efficiency of their dwelling.

Table 6.13: Age of Hot Water Cylinder (Telephone Survey)

Age of Hot Water Cylinder	Telephone Survey Respondents	
	n	%
Less than 1 year	9	3.4
1-4 years	51	19.5
5-10 years	61	23.3
More than 10 years	109	41.6
Don't know	32	12.2
Total	*262*	*100*

The Physical Dwelling Survey collected a range of information in relation to hot water cylinders. This data was collected for both gas and electric hot water cylinders, where

present, in a surveyed dwelling. Table 6.14 shows the age profile of hot water cylinders observed in the Physical Dwelling Survey.

Table 6.14: Age of Hot Water Cylinder (Physical Dwelling Survey)

Size of Cylinder	First HWC		Second HWC	
	n	%	n	%
Less than 1 year	2	1.8	0	0.0
1-4 years	16	14.0	1	5.6
5-10 years	29	25.4	5	27.8
More than 10 years	54	47.4	4	22.2
Unclear	13	11.4	8	44.4
Total	*114*	*100*	*18*	*100*

The Physical Dwelling Survey found that the most common size for hot water cylinder is 171-185 litres (Table 6.15). Although the median size for first and second cylinders is the same - 171-185 litres - analysis of those households with two hot water cylinders shows that the second cylinder tends to be the same size or smaller than the first hot water cylinder.

Table 6.15: Size of Hot Water Cylinders (Physical Survey)

Size of Cylinder	First HWC		Second HWC	
	n	%	n	%
<100 litres	6	5.3	3	16.7
100-120 litres	8	7.0	1	5.6
121-137 litres	13	11.4	1	5.6
138-170 litres	17	14.9	1	5.6
171-185 litres	49	43.0	3	16.7
185-290 litres	15	13.2	3	16.7
> 290 litres	3	2.6	2	11.1
Missing data	3	2.6	4	22.2
Total	*114*	*100*	*18*	*100*

Only 72 participants (27.5 %) in the Telephone Survey with a hot water cylinder reported that their cylinder was wrapped, a further 16 participants were unsure whether their cylinder was wrapped or not. Of the 72 participants who reported a wrapped cylinder, 18.1 % reported that it was insulated with hard foam and just over half (55.6 %) reported it was wrapped with a well-fitted jacket. Of the remainder, 9.7 % said the cylinder was wrapped with an older jacket and 12.7 % were unsure what type of cylinder wrapping they had.

Among the dwellings surveyed in the Physical Survey, 25.9 % of the main hot water cylinders were insulated. The Physical Survey found that second hot water cylinders had a higher likelihood of insulation with 44.4 % of the 18 second cylinders were insulated. Hard foam was most commonly used for insulation followed by a well-fitted jacket.

Of the 262 dwellings in the Telephone Survey with at least one hot water cylinder, only a third (32.8 %) of participants reported that the pipes from the cylinder were lagged, a further 18 % of participants were unsure whether or not their pipes were lagged. Where pipes were lagged, over three-quarters reported that the lagging was new and well-fitted. Observations from the Physical Dwelling Survey showed over a third (35.1 %) of the first cylinder were lagged. Second cylinders were less likely to have lagged pipes. The

Physical Dwelling Survey found that the vast majority of pipe wrapping and lagging was in good condition.

Hot water temperatures measured in the Physical Dwelling Survey were found to average 55.6°C and ranged between 40.0°C and 80.0°C. Table 6.16 sets out the temperature profile for surveyed dwellings as measured at the tap. The recommended temperature at the hot water tap for safety is 55.0°C.

Table 6.16: Hot Water Temperature (Physical Dwelling Survey)

Temperature	Physical Dwelling Survey	
	n	%
40-49°C	18	13.8
50-54°C	42	32.3
55°C	21	16.2
56-59°C	13	10.0
60-69°C	27	20.8
70°C or more	9	6.9
Total	*130*	*100.0*

* 5 missing cases

Energy Efficient Light Bulbs

Well over half (61 %) of the Telephone Survey participants reported using energy efficient light bulbs. However, only around a fifth of those reported that energy efficient light bulbs made up 75 % or more of the light bulbs in their dwelling. Almost two thirds (64.4 %) of energy efficient light bulb users report that half or less of their light bulbs are energy efficient. The Physical Dwelling Survey did not collect data on energy efficient light bulbs.

Participants using higher proportions of energy efficient light bulbs (51 % or more) are more likely to report their house as energy efficient than participants with lower proportions of energy efficient light bulbs.

Water Management

The Physical Dwelling Survey found that 7.4 % of surveyed dwellings had dripping taps. It also found that while the majority of houses had one-shower. Forty-four percent of the 134 dwellings with a shower in the Physical Survey had two showers. A small set of dwellings (6.4 %) had three or more showers. There were some observed differences in the flows in first and second showers (Table 6.17).

Table 6.17: Shower Flows (Physical Dwelling Survey)

Shower flow	First Shower		Second Shower	
	n	%	N	%
Low - 9 litres/minute or less	59	44.0	13	22.0
Medium - 10-15 litres/minute	47	35.1	25	42.4
High - 15 litres/minute or more	28	20.9	21	35.6

Total	*134*	*100.0*	*59*	*100.0*
Mean flow rate	11.7 litres/minute		13.8 litres/minute	
Median flow rate	11.5 litres/minute		12.0 litres/minute	

Energy Costs

The Physical Dwelling Survey gathered information in relation to average household expenditure on gas and electricity for summer and winter. Where possible, householders were asked to supply copies of the relevant energy bills at the time of surveying. If bills were unavailable householders were asked to estimate their energy expenditure. The results presented here are therefore from one of two sources: self-reported estimates from the householder, or actual energy bills costs recorded by the surveyor directly from the bill but checked with the householder to ensure the bill represents an average summer or winter month. For the purposes of analysis where a household had both gas and electricity the amounts were added together to represent a total average for summer or winter. The energy expenditure reported is limited to electricity and gas and does not include expenditure on other fuels, for instance wood or coal.

The average monthly winter energy bill as recorded in the Physical Dwelling Survey is $241.04 while the median is $209.64. The average monthly summer energy bill is $146.73 and the median is $140.00. Table 6.18 shows that the majority of participants do not exceed 10 % of income as energy outgoings.

It is noted that for the information available, 16.5 % would be considered as 'Fuel Poor' or in 'Fuel Poverty'[i,j].

Table 6.18: Average Winter Monthly Energy Bill as a Proportion of Gross Monthly Household Income

Energy Expenditure	Physical Survey Dwellings	
	n	%
Energy costs are less than or equal to 10% of gross monthly household income	86	83.5
Energy costs are more than 10% of gross monthly household income	17	16.5
Total	*103*	*100*

* 32 missing cases

6.5 Household/Dwelling Characteristics

Statistical testing was undertaken to establish whether there is any statistically significant association between household and dwelling characteristics and the likely efficiency and

[i] Fuel Poverty - Where a combination of poor housing conditions and low income mean that the household cannot afford sufficient warmth for health and comfort. The widely accepted definition of fuel poverty is where a household needs to spend 10% or more of income to meet fuel costs. Fuel Poverty is a concept widely used in the UK, more so than in New Zealand.

[j] For further details on Fuel Poverty in New Zealand see - Bob Lloyd, '*Fuel Poverty in New Zealand'*, (http://www.msd.govt.nz/publications/journal/27-march-2006/27-pages142-155.html); Murray Ward in http://www.eds.org.nz/content/documents/EDSnews%20V7_2.pdf; and FRST Funding for Social Research: **Ageing in Place – Centre for Research Evaluation and Social Assessment,** http://www.frst.govt.nz/news/2007/BIS_results_Apr07.cfm.

performance of the dwelling in which they live. That analysis was undertaken in relation to the self-report data generated by the Telephone Survey and then the Matched Dwelling Sample using the observed data from the Physical Dwelling Survey.

The household and dwelling characteristics that were tested are:

- tenure
- dwelling age
- household income.

Self-Report Data – Telephone Survey

In the Telephone Survey a number of variables indicated that the dwelling might be expected to perform efficiently. Those were:

- self-reported insulation
- perceptions of dwelling efficiency
- heating
- cooling
- double glazing
- water heating

Insulation

Statistically significant associations were found between:

- ***Dwelling age and:***
  - roof space insulation
  - wall space insulation
  - under floor insulation
  - insulation coverage

  Older houses are less likely than newer houses to be insulated and are less fully insulated i.e. newer houses are more likely to have whole house insulation than older houses.

- ***Tenure and:***
  - roof space insulation
  - wall space insulation
  - under floor insulation
  - insulation coverage

  Tenanted houses are less likely than owner-occupied houses to be insulated and are less fully insulated.

- ***Household income***
  - roof space insulation
  - wall space insulation
  - under floor insulation

  Higher income households are more likely to be insulated than lower income households but the insulation coverage or the areas insulated does not show a statistically significant relationship with household income.

Perceptions of Dwelling Efficiency – Energy and Water

Dwelling age and household income are statistically significant in relation to perceptions of energy efficiency. Tenure is not statistically significant. Older dwellings are less likely than newer dwellings to be characterised as energy efficient. However, lower income households are more likely to characterise their dwelling as energy efficient than higher income households.

With regard to perceptions of water efficiency, only household income shows a statistically significant association with perception of water efficiency. Tenure and dwelling age are not associated at a statistically significant level. With regard to perceived water efficiency, low income households are over-represented among the households that report their dwellings to be water efficient.

Heating

There are statistically significant associations between dwelling/household characteristics and heating sources:

- ***Dwelling age:***
  - newer dwellings are more likely than older dwellings to use heat pumps
  - newer dwellings are more likely than older dwellings to use under floor heating
  - older dwellings are more likely than newer dwellings to use electric heaters
  - older dwellings are more likely than newer dwellings to use enclosed wood burners.

- ***Tenure:***
  - rented dwellings are more likely to use electric heaters than owner-occupied dwellings
  - owned dwellings are more likely than rented dwellings to use under floor heating
  - owned dwellings are more likely than rented dwellings to use enclosed wood burners
  - owned dwellings are more likely than rented dwellings to use open fires.

- ***Household income:***
  - households with incomes less than $100,000 per annum are more likely to heat using unflued gas heaters than households with incomes of $100,000 or more per annum
  - higher income households are more likely to heat using fixed gas heaters than lower income households
  - households with annual incomes in the $30,000-$70,000 range are more likely to heat using enclosed wood burners than lower or higher income households.

Cooling

In relation to cooling, there are relatively few associations of statistical significance[k]. Those household and dwelling characteristics that are statistically significant are:

- heat pump use is associated with:
  - newer dwellings
  - owner occupation.
- dehumidifier use is associated with tenure with renters over-represented among users.

Double-Glazing

Use of double-glazing is statistically associated with tenure with owner occupiers over represented among households with some proportion of their dwelling double glazed. No other variable has a statistically significant association. The sample is too small to test associations with the extent of double glazing.

Water-Heating

In relation to water heating, there is a statistically significant relationship with:

- ***tenure:***
  - rented dwellings are more likely than owner-occupied dwellings to use electricity for water heating
  - owned dwellings are more likely than rented dwellings to use gas or a wood wetback for water heating.

- ***household income:***
  - lower income households are more likely to use electricity for water heating
  - higher income houses are more likely to use gas for water heating

The propensity to wrap and lag the pipes from hot water cylinders is also statistically associated with tenure with owner occupiers over-represented among dwellings with lagged pipes.

Observed Data – Physical Dwelling Survey

The Physical Dwelling Survey contained a number of questions that collected the same or similar data through surveyor observation as was collected through participant self-reports in the Telephone Survey. Those variables were

- insulation
- heating
- cooling

[k] Statistical significance - In statistics, a result is called **significant** if it is unlikely to have occurred by chance. "A statistically significant difference" simply means there is statistical evidence that there is a difference; it does not mean the difference is necessarily large, important or significant in the usual sense of the word.

- double glazing
- water heating

In addition to these variables there was also a variable on levels of draught proofing.

For the purposes of statistical testing the household and dwelling characteristics data was taken from the Matched Dwelling Sample dataset. Where a statistically significant association was found it is noted below. The associations found in relation to the observed data match those identified above for the Telephone Survey Data. However, the data presented here must be treated with some caution. The smaller sample size for the Physical Dwelling Survey means a number of variables failed key testing criteria in relation to cell size so could not be tested but this should not necessarily be taken to mean there is no association. For comparative purposes with the findings of the Telephone Survey, detailed above, where a test failed this has been noted.

Insulation[1]

Statistically significant associations were found between:

- ***Wall space insulation and:***
  - Dwelling age - older houses are less likely than newer houses to have wall spaces insulated.
  - Tenure - tenanted houses are less likely than owner-occupied houses to have insulated wall spaces.
  - Household income - households with incomes of $50,001 and above are more likely than households with lower incomes to have wall spaces insulated.

- ***Roof space insulation and:***
  - Tenure - tenanted houses are less likely than owner-occupied houses to have ceiling insulation.

Perceptions of Dwelling Efficiency – Energy and Water

Perceptions of dwelling efficiency and the characteristics being tested for association are all self-report variables. For the purpose of this analysis the Matched Dwelling Sample sub-set of data has been used. Dwelling age and household income are statistically significant in relation to perceptions of energy efficiency. Tenure is not statistically significant. Older dwellings are less likely than newer dwellings to be characterised as energy efficient. However, lower income households are more likely to characterise their dwelling as energy efficient than higher income households. With regard to perceptions of water efficiency, dwelling age is not associated with perception of water efficiency at a statistically significant level. The tests in relation to household income and tenure with regard to perceived water efficiency failed.

[1] Significance tests on the following variables failed due to small cell sizes: tenure and insulation coverage; dwelling age and roof space insulation, under floor insulation and insulation coverage; and household income and roof space insulation, under floor insulation and insulation coverage.

Heating

In most cases the sample sizes were too small to test individual heating types. Testing was possible in relation to portable electric heaters, enclosed wood burners and fixed gas heaters. The only statistically significant association found was between tenure and the presence of enclosed wood burner. Owner-occupied dwellings are more likely than rented dwellings to have enclosed wood burners.

Cooling

The small sample size meant statistical testing was not possible on individual appliance types. No statistically significant association was found in relation to dwelling age, tenure or household income between households that use some kind of cooling appliance in summer and households that use none.

Double-Glazing & Draught-proofing

The sample is too small to test associations with between dwelling age, tenure and household income with the presence of double glazing. A statistically significant association was found between household age and draught proofing. Newer dwellings are more likely than older dwellings to have some or all of their windows draught proofed.

Water-Heating

The sample was too small to test for statistically significant relationships with tenure, dwelling age or household income. The propensity to wrap and lag the pipes from hot water cylinders or to have cylinder insulation was not statistically associated with age of dwelling and the test failed in relation to tenure and household income due to small sample sizes.

6.6 Attitudes and Perceptions

Attitudes to energy efficiency are indicated by a variety of data collected in the Telephone Survey as are perceptions of the energy efficiency of their dwellings. This section considers:

- The extent to which energy efficiency is an important consideration among the participants when purchasing a home.
- The extent to which perceptions of the performance of a home is reflected in its likely performance.

Reported Factors in Choosing a Home

One of the most powerful indicators of the value that householders place on home energy efficiency is the extent to which they considered energy efficiency when buying, building or renting their current home. Survey participants were asked to respond to a fixed set of efficiency enhancing features as well as performance outcomes in terms of whether they were considerations when seeking a home.

As Table 6.19 shows, the most common consideration among the Telephone Survey participants was their perception of the warmth and comfort of their home. Of the participants, 79.1 % reported that this was a consideration when choosing a home. Considerably fewer, however, systematically assessed whether the house had features associated with energy efficiency:

- Just over half (55.7 %) were considered the presence of roof or under floor insulation
- 46.8 % considered draught-proofing, and
- a fifth (20.3 %) considered double glazing.

Only small proportions of the respondents considered heating sources (14.8 %), energy sources (11.7 %) or opportunities to reap solar gain through orientation to the sun (10.9 %).

Table 6.19: Energy Issues Considered when Choosing/Building a Home

Energy issues	Telephone Survey Respondents		Matched Dwelling Sample	
	n	%	n	%
"Your warmth and comfort within the home"	284	79.1	110	81.5
"Whether it had insulation in the roof space or under the floor"	200	55.7	76	56.3
"Whether the windows and doors were tight-fitting or draught-proofed"	168	46.8	68	50.4
"What the energy bill might be like"	121	33.7	49	36.3
"Whether it had double glazing"	73	20.3	27	20.0
Other energy issues	53	14.8	22	16.3

It is very notable that while a third (33.7 %) of Telephone Survey participants did report that possible energy bills were a consideration when they selected their current home, this is significantly less of a consideration that considerations of warmth and comfort. Both the Telephone Survey and the Matched Dwelling sample data reveal the dissonance.

The dissonance evident between the factors that householders state are a consideration in house selection and the actual features of their dwellings can be interpreted in one or more of the following ways:

- Firstly, affective factors in house selection such as comfort are clearly predominant for householders. Efficiency and performance features of a house may contribute to comfort. However, it is clear that householders are making complex, possibly sub-conscious, calculations and trade-offs between the different physical and performance attributes of a house when purchasing which can not be reduced to efficiency and performance features. Dwelling aesthetics, size and factors outside the dwelling itself such as the qualities of the neighbourhood in which the dwelling is located, are all part of the dwelling selection process. Under those circumstances, this apparent dissonance between considered factors and the actual features of a dwelling is readily explicable.

- Second, it may be a manifestation of an under-supply of dwellings that have the efficiency and performance features sought. As a consequence, while those features may be desired, the householder is unable to express their demand in the dwelling market.
- Third, it may reflect an inability among householders to differentiate between dwellings with efficiency and performance features and those without.

Perceived and Probable Dwelling Performance

There appears to be some limitation in the ability of householders to assess the energy and water efficiency of their homes. This is manifest in the tendency for householders to perceive their dwelling as efficient while assessing the energy costs of their households as average. Perceptions of efficiency appear to be largely unconnected to the energy or water performance that householders are likely to achieve in their dwellings.

Water Efficiency

Over two thirds (67.4 %) of the Telephone Survey participants reported that their house was water efficient. Among the Matched Dwelling Sample the proportion was similar (66.7 %). There is no evidence that householders have any real sense of their dwelling's water efficiency. If they did it could be expected that a relationship would emerge between shower flows and householders' water efficiency assessments

It could be expected that those who assessed their dwellings as water efficient would have lower shower flows than those householders that reported their dwellings as not water efficient. This was not, however, the case.

Energy Efficiency

Householders are much more realistic about the energy efficiency of their dwellings than they are about water efficiency. This is, almost undoubtedly, a reflection of:

- The differential effort that has been placed in raising public awareness of energy efficiency through Government initiatives.
- Relatively high industry involvement in promoting energy efficiency products relative to water efficiency products.
- Direct exposure of householders to fluctuations in energy cost either through consumption or price changes.
- Direct exposure of householders to electricity shortages.

Only 55.7 % of householders in the Telephone Survey reported their house as energy efficient. Among the Matched Dwelling Sample, the proportion that reported their house as energy efficient was even lower at 48.9 %. This suggests that participation in the Physical surveying may have been prompted by a desire among those householders to have more expert assessment of their home.

In addition, there does appear to be, both in the Telephone Survey participants and from the Physical Dwelling Survey data some relationship between views around energy efficiency and the state of house insulation. As Table 6.20 shows, among the Telephone

Survey participants, those with no or little reported insulation were more likely to see their dwelling as not energy efficient.

Table 6.20: Perception of Home's Energy Efficiency by Insulation Levels (Telephone Survey)

Self-reported Insulation Level	Respondent Perception			
	Home is Energy Efficient		Home is Not Energy Efficient	
	n	%	n	%
Roof only insulated	33	19.0	38	36.9
Roof insulation plus one or more other areas insulated	119	68.4	44	42.7
No roof insulation by one or more other areas insulated	9	5.2	8	7.8
No insulation	13	7.5	13	12.6
Total	174	100.1	103	100

* 82 missing cases

As might be expected given the similarity between reported and observed insulation levels noted in Section 6, a similar pattern is found when the observed insulation levels from the Physical Dwelling Survey are compared with perceptions of energy efficiency from the Matched Dwelling Sample (Table 6.21).

Table 6.21: Perception of Home's Energy Efficiency by Observed Insulation Levels (Matched Dwelling Sample and Physical Dwelling Survey)

Insulation Level (Physical Dwelling Survey)	Respondent Perception (Matched Dwelling Sample)			
	Home is Energy Efficient		Home is Not Energy Efficient	
	n	%	n	%
Roof only insulated	15	24.6	16	28.6
Roof insulation plus one or more other areas insulated	43	70.5	32	57.1
No roof insulation by one or more other areas insulated	1	1.6	2	3.6
No insulation	2	3.3	6	10.7
Total	61	100	56	100

* 8 missing cases

Householders are also more likely to characterise their house as energy efficient if:

- a higher proportion of light bulbs are used
- higher proportions of double glazing is used
- 'most' or 'all' of their windows have draught proofing (Table 6.22).

Table 6.22: Perception of Home's Energy Efficiency by Level of Draught-proofing (Physical Dwelling Survey and Matched Dwelling Sample)

Windows with Draught Proofing (Physical Dwelling Survey)	Respondent Perception (Matched Dwelling Sample)			
	Home is Energy Efficient		Home is Not Energy Efficient	
	n	%	n	%
None	21	31.8	31	52.5
Some	3	4.5	8	13.6

Most	4	6.1	1	1.7
All	38	57.6	19	32.2
Total	66	100	59	100

* 10 missing cases

Householders, however, are less likely to connect energy efficiency, however, to the repair of their insulation, insulation on hot water cylinders, the age of hot water cylinders, or the use of different heating types.

Energy costs as identified in the Physical Dwelling Survey and perception of energy costs are also associated with perceptions of energy efficiency. As Table 6.23 shows, those households who spend more on energy, whether in summer or winter, are more likely to see their dwelling as energy inefficient.

Table 6.23: Perception of Home's Energy Efficiency by Energy Expenditure

Average Energy Expenditure[m] (Physical Dwelling Survey)	Respondent Perception (Matched Dwelling Sample)			
	Home is Energy Efficient		Home is Not Energy Efficient	
	n	%	n	%
Summer*				
$0-$100	23	38.3	13	24.5
$101-$150	17	28.3	15	28.3
$151-$200	11	18.3	12	22.6
$201-$250	6	10.0	8	15.1
$251-$300	1	1.7	2	3.8
$301-$350	2	3.3	1	1.9
$351+	0	0.0	2	3.8
Total	60	99.9	53	100
Winter^				
$0-$100	11	19.3	5	10.0
$101-$150	11	19.3	5	10.0
$151-$200	10	17.5	10	20.0
$201-$250	9	15.8	8	16.0
$251-$300	8	14.0	8	16.0
$301-$350	4	7.0	7	14.0
$351+	4	7.0	7	14.0
Total	57	99.9	50	100

* 22 missing cases ^ 28 missing cases

Similarly, where householders have a belief that their energy costs are above average, they are more likely to consider their dwelling as energy inefficient (Table 6.24).

Table 6.24: Perception of Home's Energy Efficiency by Perception of Own Household's Energy Consumption Compared to Other Households (Telephone Survey)

[m] As reported to surveyor in physical survey (refer Section 6.4, Energy Costs). Householders were requested to show their electricity and gas bills for summer and winter.

Perception of Household Energy Consumption	Respondent Perception (Telephone Survey)			
	Home is Energy Efficient		Home is Not Energy Efficient	
	n	%	n	%
Very high	4	2.0	14	12.3
High	22	11.2	16	14.0
About average	116	59.2	66	57.9
Low	45	23.0	16	14.0
Very low	9	4.6	2	1.8
Total	196	100	114	100

* 49 missing cases

In general households appear to be able to make fairly accurate assessments of their energy consumption compared to other households. The average monthly winter energy bill as recorded in the Physical Dwelling Survey for all dwellings physically surveyed is $241.04 while the median is $209.64. The average monthly summer energy bill for all dwellings physically surveyed is $146.73 and the median is $140.00. The figures in Table 6.25 show these averages are very similar to the averages for respondents who perceive their household energy compared to other households to be 'about average' – particularly in relation to summer energy expenditure.

Table 6.25: Average Winter Energy Expenditure by Perception of Own Household's Energy Consumption Compared to Other Households

Perception of Household Energy Consumption (Matched Dwelling Sample)	Average Energy Expenditure (Physical Dwelling Survey)			
	Summer*		Winter^	
	Mean	Median	Mean	Median
Very high	$234.41	$220.00	$552.64	$375.00
High	$193.37	$190.00	$299.83	$280.56
About average	$145.60	$140.85	$225.64	$207.85
Low	$88.96	$80.00	$158.91	$120.00
Very low	$124.33	$70.00	$120.40	$70.00
Don't know	$144.36	$110.00	$214.80	$215.00

* 12 missing cases ^ 18 missing cases

In addition, Table 6.25 suggests that in general households that perceive their energy consumption to be high compared to other households tend to have higher average energy bills than households that perceive their energy consumption to be low compared to other households.

6.7 HERS and Willingness to Pay

In general, the participants of the Telephone Survey appear to be very receptive to the idea of a Home Energy Rating Scheme. Certainly, a Home Energy Rating Scheme was seen as a potentially valuable tool for assisting in the selection of a property to rent/buy and in the re-sale of property. However, survey participants showed themselves:

- less willing to pay for such an assessment
- not particularly willing to pay for the costs of energy efficiency improvement identified by such an assessment.

There are some associations between householder characteristics and both the interest that they have in an energy rating scheme and their willingness to pay for either energy assessments or for energy efficiency improvements.

Impact of HERS on Property Acquisition and Re-Sale

Over two-thirds of Telephone Survey participants (70.5 percent) said they would be more likely to buy or rent a property if it had a high energy rating. A similar proportion of homeowners (70.8 percent) said if they were selling their home they would see an advantage in advertising an energy rating.

There is some distinction between renters and owner occupiers regarding whether property choice would be enhanced by such a scheme. Renters appear slightly more likely than owner-occupiers to think property choice would be favourably influenced by a high energy rating but the differences were not statistically significant (Table 6.26).

Table 6.26: Impact of Energy Rating on Choice of Property by Tenure (Telephone Survey)

Tenure	Impact of High Energy Rating					
	More likely to Choose Property		No Impact on Property choice		Unsure of Impact on Property Choice	
	n	%	n	%	n	%
Own	181	69.6	55	21.2	24	9.2
Rent	72	72.7	15	15.2	12	12.1

There is a complex pattern in relation to perceived impact and age. The pre-retirement age group aged 50-64 years are significantly more resistant to the idea that a rating tool might have an impact on property choice. Householders less than 50 years, particularly those aged less than 25 years are most likely to see the utility of an assessment tool (Table 6.27).

Table 6.27: Impact of Energy Rating on Choice of Property by Age (Telephone Survey)

Age Group	Impact of High Energy Rating					
	More likely to Choose Property		No Impact on Property choice		Unsure of Impact on Property Choice	
	n	%	n	%	n	%
24 years or under	16	84.2	2	10.5	1	5.3
25-49 years	122	77.2	25	15.8	11	7.0
50-64 years	68	60.7	31	27.7	13	11.6
65 years or older	47	67.1	12	17.1	11	15.7

Differentiation between different income clusters is muted. Except that very high income households are more likely to report a high energy rating tool would have no impact on their property choice (Table 6.28).

Table 6.28: Impact of Energy Rating on Choice of Property by Household Income (Telephone Survey)

Gross Household Income	Impact of High Energy Rating		
	More likely to	No Impact on	Unsure of Impact

	Choose Property		Property choice		on Property Choice	
	n	%	n	%	n	%
$20,000 or less	30	65.2	7	15.2	9	19.6
$20,001-$30,000	33	78.6	7	16.7	2	4.8
$30,001-$50,000	49	76.6	9	14.1	6	9.4
$50,001-$70,000	39	81.3	7	14.6	2	4.2
$70,001-$100,000	29	70.7	8	19.5	4	9.8
$100,001 or more	49	68.1	18	25.0	5	6.9

* 46 missing cases

The picture is somewhat different, however, when participants are asked to consider the impact of a high energy rating on the re-sale of their homes. As Table 6.29 shows, it is the younger age groups that see such a scheme as having little impact for them. This probably reflects the life stage of young people in relation to home ownership. Most will be at the stage of recent first entry into the market. Participants in the 25 to 49 year age group were most likely to see an energy rating as an advantage in re-sale of their home.

Table 6.29: Impact of Energy Rating When Selling Property by Age (Telephone Survey)

Age Group	Advertising Energy Rating					
	Advantage when Selling Property		No Advantage when Selling Property		Unsure if Advantage or not	
	n	%	n	%	n	%
24 years or under	3	60.0	2	40.0	0	0.0
25-49 years	81	76.4	22	20.8	3	2.8
50-64 years	65	68.4	26	27.4	4	4.2
65 years or older	35	64.8	15	27.8	4	7.4

Table 6.30 shows a complex pattern in relation to household income with low income as well as some higher middle income households seeing an energy rating as giving a selling advantage.

Table 6.30: Impact of Energy Rating when Selling Property by Household Income (Telephone Survey)

Gross Household Income	Advertising Energy Rating					
	Advantage when Selling Property		No Advantage when Selling Property		Unsure if Advantage or not	
	n	%	n	%	n	%
$20,000 or less	18	72.0	5	20.0	2	8.0
$20,001-$30,000	21	87.5	3	12.5	0	0.0
$30,001-$50,000	28	68.3	11	26.8	2	4.9
$50,001-$70,000	34	82.9	5	12.2	2	4.9
$70,001-$100,000	23	69.7	7	21.2	3	9.1
$100,001 or more	43	71.7	17	28.3	0	0.0

* 135 missing cases

Willingness to Pay

Over half the owner-occupiers surveyed (56.2 %) said they would be willing to pay something for an audit to produce an energy rating for their home. Over a third (36.2 %)

said they would be unwilling to pay for an energy audit (Table 6.31). The vast majority of those who are willing to pay wish to pay relatively small amounts. Only 8.8 % are willing to pay in excess of $200 compared to 9.6 % that will only pay up to $50. Just under one fifth (18.5 %) report being willing to pay up to $100 and a similar proportion (18.1 %) reported being willing to pay up to $200.

Table 6.31: Amount Owner-occupier Willing to Pay for Energy Audit (Telephone Survey)

Amount Willing to Pay for Energy Audit	Owner-Occupiers	
	n	%
Nothing	94	36.2
Up to $50	25	9.6
Up to $100	48	18.5
Up to $200	47	18.1
Up to $300	12	4.6
Up to $400	11	4.2
More than $400	3	1.2
Unsure	20	7.7
Total	*260*	*100.1*

Willingness to pay is associated with income and with householder age. As Table 6.32 shows low income households with $20,000 annual income or less are hesitant to pay. So too are middle income households. Table 6.34 shows that younger people are more likely to be willing to pay. This is consistent with their higher interest in selecting dwellings on the basis of energy performance than other age groups.

Table 6.32: Willingness to Pay by Household Income (Telephone Survey)

Gross Household Income	Paying for Energy Audit			
	Willing to Pay		Not Willing to Pay	
	n	%	n	%
$20,000 or less	12	52.2	11	47.8
$20,001-$30,000	15	62.5	9	37.5
$30,001-$50,000	21	56.8	16	43.2
$50,001-$70,000	26	66.7	13	33.3
$70,001-$100,000	22	73.3	8	26.7
$100,001 or more	40	72.7	15	27.3

* 52 missing cases

Table 6.33: Willingness to Pay by Age (Telephone Survey)

Age Group	Paying for Energy Audit			
	Willing to Pay		Not Willing to Pay	
	n	%	n	%
24 years or under	4	80.0	1	20.0
25-49 years	75	73.5	27	26.5
50-64 years	50	56.2	39	43.8
65 years or older	17	36.2	27	63.8

* 20 missing cases

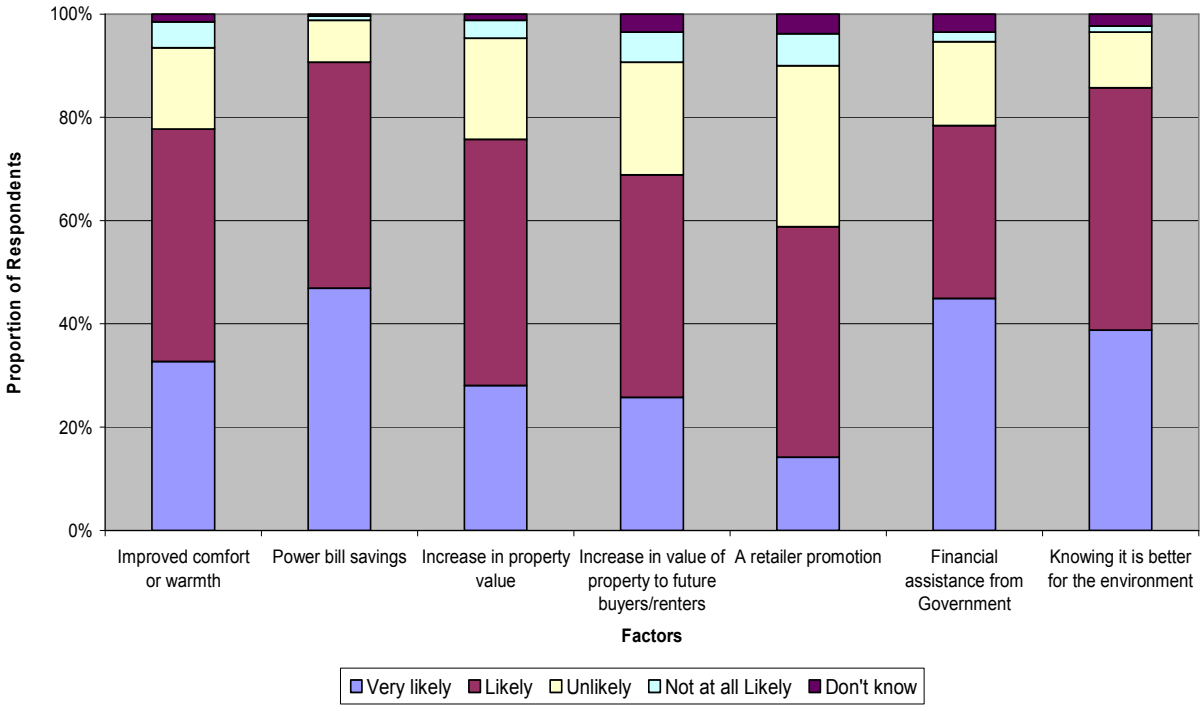
Responding to an Energy Audit

Owner-occupiers were asked how likely a range of things were to prompt them to improve the energy efficiency of their homes. Responses from the telephone survey show financial considerations and improving the environment are key drivers for owner-occupiers to make energy efficiency changes (Figure 6.3).

The proportion of owner-occupiers reporting each factor as 'likely' or 'very likely' to prompt them to make changes were as follows:

- Power bill savings 90.7 %
- Knowing it's better for the environment 85.7 %
- Financial assistance from the government 78.5 %
- Improved comfort or warmth 77.7 %
- Increase in property value 75.8 %
- Increase in value of property to future buyers/renters 68.9 %
- A retailer promotion 58.8 %.

Figure 6.3: Likelihood of Owner-Occupiers' being Prompted to Improve Energy Efficiency in Their Homes by Selected Factors (Telephone Survey)



Two thirds of owner-occupiers (65.8 %) said they would be willing to spend some money to carry out recommended measures to increase the energy efficiency of their home (Table 6.34).

Table 6.34: Amount Owner-occupier Willing to Spend on Recommended Energy Efficiency Measures following an Energy Audit (Telephone Survey)

Amount Willing to Pay on Energy Efficiency Measures	Owner-Occupiers	
	n	%
Nothing – unlikely to act on any recommendations	36	13.8

Less than $100	34	13.1
Between $100 and $299	51	19.6
Between $300 and $999	50	19.2
Over $1,000	36	13.8
Unsure	53	20.4
Total	*260*	*99.9*

Around a fifth of owner-occupiers were unsure whether they would act on recommendations from an energy audit or how much they would be willing to spend. Around 14 % said they would be unlikely to act on recommendations. The association between willingness to spend on energy efficiency measures and household income was unable to be tested due to small sample sizes. However, as Table 6.35 shows, very low income households (under $20,000 per annum) were least likely to report willingness to spend on energy efficiency measures.

Table 6.35: Willingness to Pay for Energy Efficiency Measures by Household Income (Telephone Survey)

Gross Household Income	Willingness to Pay for Energy Efficiency Measures					
	Willing to Pay		Not Willing to Pay		Unsure	
	n	%	n	%	n	%
$20,000 or less	12	48.0	7	28.0	6	24.0
$20,001-$30,000	16	66.7	2	8.3	6	25.0
$30,001-$50,000	28	68.3	6	14.6	7	17.1
$50,001-$70,000	30	73.2	6	14.6	5	12.2
$70,001-$100,000	26	78.8	3	9.1	4	12.1
$100,001 or more	42	70.0	5	8.3	13	21.7

* 36 missing cases

There was a statistically significant association between willingness to pay for an energy audit and reported likelihood of spending on recommended energy efficiency measures. Telephone Survey respondents who reported being unwilling to pay for an energy audit were more likely to say they were unlikely to act on recommendations to improve energy efficiency than respondents who were willing to pay something for an energy audit.

6.8 Summary of Key Findings (Telephone and Physical Surveys)

Table 6.36 presents a summary of the results of the analysis undertaken.

Key Issue	Findings
Socio-demography and Dwellings	Participants Surveyed were in the main 25 – 49 years age group, a third were aged 60 and over. The Survey had a bias towards larger houses (typically stand alone ones with 3 – 4 bedrooms) with 72% (Telephone Survey) and 86% (Physical Survey) of participants being owner-occupiers. The sample had a high representation of higher income households.
Energy Characteristics of the Dwellings	Insulation - The majority of telephone participants (71%) reported insulation in their roof space, only 49% reported exterior wall insulation and 27% reported underfloor insulation. Only 19% reported all three. A high proportion of participants were not able to

	report on their insulation. A quarter of the sample didn't know if they had wall insulation with only 16% not knowing if they had roof insulation. Surveys showed that participants appeared to know what was insulated in their homes as there was a good match between Telephone and Physical Survey data (see Table 6.8). Glazing and draughts – Only 15% reported some double glazing. Those with double glazing were more likely to report their home as energy efficient. Around 41% of phone Survey participants reported draughty windows and doors. While the Physical Survey showed no draught proofing of windows in 42% of dwellings. 50% reported all or most windows draught proofed and overall 29% of dwellings had no draught proofing at all. Heating/cooling sources – these were predominantly electric (as reported in the phone Survey). Growth in underfloor and heatpump use is evident (both at 11%). A third of dwellings have only one or two heaters in the whole house. Householders linked efficient households to enclosed burners and use of heatpumps. Fans were predominantly used for cooling. Water heating – this was predominantly by electricity HWC (74%) with 27% using gas. For households with HWC almost half were more that 10 years old (some as old as 50 years). Over 10% of householders didn't know how old the cylinder was and participants didn't connect the age of their cylinder with energy efficiency. Most HWC's and pipes from them were unwrapped. Hot water at the tap was on average 55.6 °C but ranged from 40 to 80 °C. Flow rates for showers averaged at 11.5 litres/min but some were as high as 28 litres/min. Light bulbs – 61% of householders reported using energy efficient light bulbs but only 20% of those had 75% or more such bulbs in their home. 65% indicated that half of less of their light bulbs were energy efficient. Power bills – The average monthly bill in summer and winter was $147 and $241 respectively. Some bills were excessively high (e.g., $800 per month in winter time) while others were sufficiently low as to warrant the householder being on a low fixed charge tariff for electricity supply.[n]
Household/ Dwelling Characteristics and Efficiency	The following statistically significant associations were identified: • Older houses are less likely to be insulated and are less fully insulated • Tenanted houses are less likely to be insulated and are less fully insulated. • Higher income households are more likely to be insulated. • Dwelling age and household income are statistically significant in relation to perceptions of energy efficiency – older houses are

[n] Householders with low electricity bills were advised in follow up reports to contact their retailers to check if they were eligible for the low user fixed charge option.

	less likely to be characterised as efficient and lower income households more likely to characterise their dwelling as energy efficient. • Newer dwellings are more likely to have heatpumps and underfloor heating; older ones are more likely to have electric heaters and enclosed wood burners. • Rented dwellings are more likely to have electric heaters; owned dwellings are more likely to have underfloor heating, enclosed wood burners and open fires. • Higher income households are more likely to heat using fixed gas fires. • Heatpumps for cooling are associated with new and owned dwellings. • Double glazing is associated with property ownership. • Rented dwellings are more likely to use electricity for water heating; owned dwellings are more likely to use gas or a wet back. • High income households are more likely to use gas for water heating; low income households use electricity. • Owners are more likely to wrap HWC and lag the pipes.
Attitudes and Perceptions	80% of participants (phone Survey) indicated warmth and comfort was a factor in choosing a home. Considerably fewer systematically assessed whether the house had features associated with energy efficiency. For those issues that were considered, insulation figured highly relative to heating and orientation to the sun. There appears to be some limitation in the ability of householders to assess energy and water efficiency but some householders are more realistic about the energy efficiency. 56% of phone Survey participants identified their house as energy efficient. Both Surveys indicated that householders in homes with little or no insulation reported them as energy inefficient. Interestingly, reported indicators of energy efficiency tended to be visible ones including light bulbs, glazing and draught proofing but less so good quality insulation, cylinder wrapping and age of cylinder.
HERS and willingness to pay	In general phone Survey participants were very receptive to the concept of a HERS. They were less willing to pay for a rating however and not too willing to spend on improvements suggested by a Survey. 75% of phone Survey participants said they would be more likely to rent or buy a home with a high energy rating. 71% of homeowners could see the advantage in the rating as a selling feature. Renters seemed slightly more likely to think property choice would be favourably influenced by a high energy rating. Over half of owner-occupiers said they would be willing to pay something for an audit though most would only pay a small amount. Willingness to pay is associated with age and income (younger and higher earners showed more interest). Power bill savings was a key driver to take action closely followed by environmental influences and government assistance. 75% of owner-occupiers said they would be willing to spend some money on the measures

	recommended.

Table 6.36: Summary of Telephone Survey and Physical Survey Findings.

7 Project Discussion and Conclusions

This section of the report summarises the key findings from each phase of the project noting particular findings of interest. They are presented in the following subsections:

- Energy Efficiency Characteristics of New Zealand Houses – A National Picture
- Energy Efficiency and Demographics, and
- HERS Receptivity and Willingness to Pay.

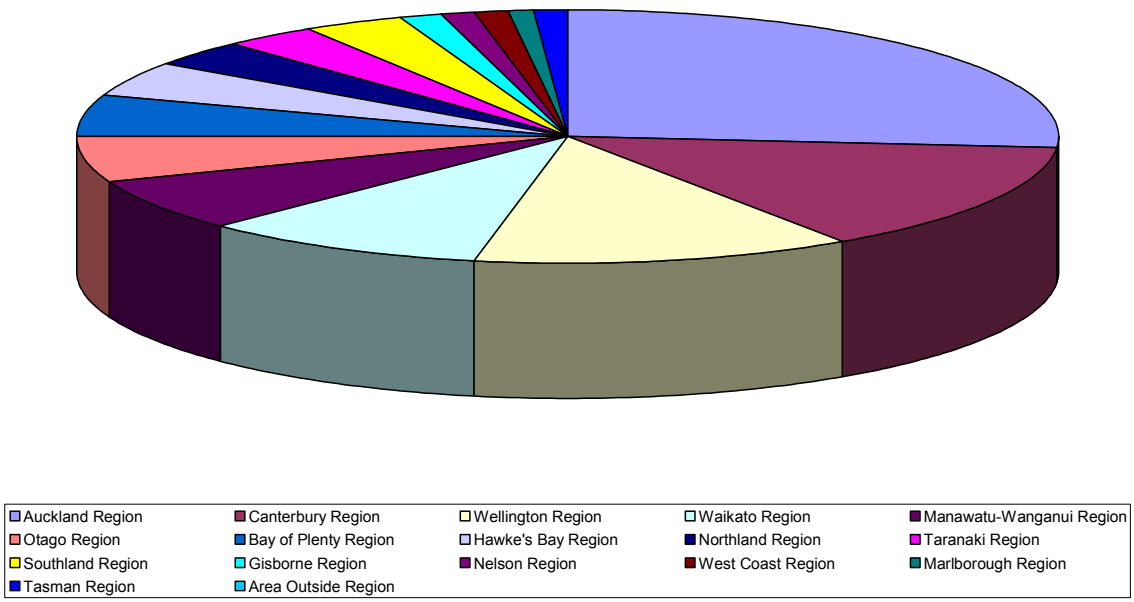
7.1 Energy Efficiency Characteristics of New Zealand Houses – A National Picture

Where are the older houses?

There is a marked difference in population growth patterns in different regions throughout New Zealand. The age of houses is closely linked to economic and population growth in each region. These differences in economic and population growth result in significant differences in the age profile of houses in different regions. The age profile of houses in each region has been examined to determine the location of older houses.

In terms of the number of pre77 houses; there are approximately 940,000 throughout New Zealand.[34] These houses are concentrated in the three main population centres (Auckland, Wellington and Canterbury), which account for more than half of all pre-77 houses. The Auckland region stands out with more than a quarter of all pre-77 houses.

Figure 7.1: The number of Pre 1981 Houses by Region



From census data Figure 7.1 shows the number of pre 1981 houses in each region. This illustrates the comparative scale of pre77 houses in each region and in particular the significance of Auckland.

Approximately 68% of all New Zealand houses were built before 1981.

The other regions with the highest *proportions of older houses (pre 1981)* are those in the lower half of the North and South Islands i.e. Gisborne, Hawkes Bay, Taranaki, Manawatu-Wanganui and Wellington in the North Island and West Coast, Canterbury, Otago and Southland in the South Island.

The regions with the lowest proportion of older houses (pre 1981) are those in the northern parts of the North and South Islands i.e. Northland, Auckland and Bay of Plenty in the North Island and Marlborough, Tasman and Nelson in the South Island.

The Auckland region is a key region in terms of the high number of older houses within the region. 10 regions have been identified as most important as far as targeting a HERS with regard to using the scheme as a tool for identifying where energy efficiency initiatives should be targeted. This approach would allow the Scheme to initially focus on areas with a high number and/or a high concentration of older houses. These regions are listed below:

- Auckland
- Waikato
- Bay of Plenty
- Hawkes Bay
- Taranaki
- Manawatu-Wanganui
- Wellington
- Canterbury
- Otago
- Southland.

How many un-insulated houses remain?

Many of the older houses in New Zealand no longer have inadequate insulation due to various previous government and community initiatives and renovations completed by homeowners.

Data from several studies has been used to estimate the number of houses with inadequate insulation. Older are houses are most likely to have ceiling insulation installed and least likely to have underfloor insulation installed. The number of houses with inadequate ceiling insulation is estimated to be between 220,000 and 310,000. Approximately one million houses are likely to have inadequate wall and underfloor insulation that can be improved.[o] More detailed results are presented in Table 5.3.

[o] It should be noted that the definition of adequate insulation is a house with greater than 50% insulation cover. If a more onerous definition were applied, the number of houses with inadequate insulation would be much higher.

What Else is Known about the Location of the Un-insulated Houses in New Zealand?

There is little regional information available on insulation in houses. What is know is that houses in Christchurch are more likely to have adequate ceiling insulation and are less likely to have no ceiling insulation than houses in Auckland or Wellington.[20] Christchurch also stands out as a main centre where there is better understanding of the number of houses with inadequate insulation than perhaps any other city in New Zealand.[2]

New survey data on energy efficiency characteristics of New Zealand Homes

As part of this current project, data was collected around the energy characteristics of dwellings from the Telephone and Physical Dwelling Surveys related to:

- dwelling construction and amenities
- thermal envelope and insulation characteristics
- heating sources and appliances used for managing temperature and humidity
- lighting.
- water heating and water usage
- mould and condensation
- average household expenditure on energy, and
- energy issues of interest/concern to the householder.

The most important information on the energy efficiency characteristics of the houses surveyed is summaries below. More detailed information is included in section 6 of this report.

Insulation

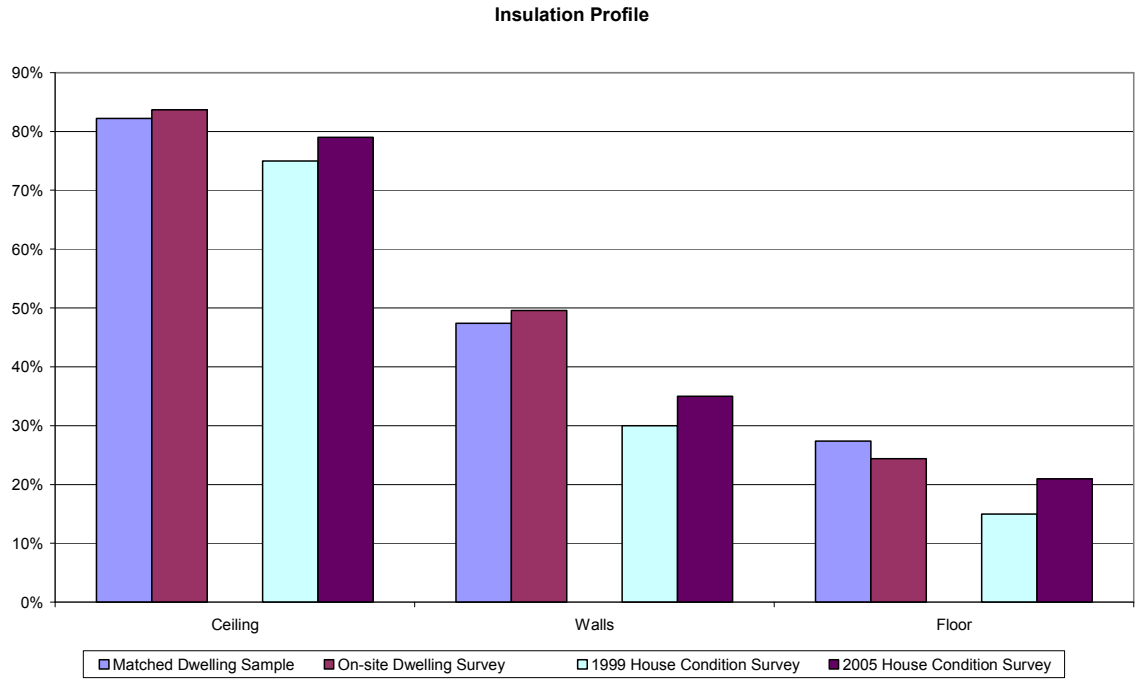
Most houses in the survey reported that they had insulation in their roof space. The Physical Survey shows similar levels of ceiling, wall and floor insulation to that reported by participants in the Telephone Survey Matched Dwelling sample.

Figure 7.2 compares the insulation of ceilings, walls and floors for the physical survey with those from the matched telephone survey. This shows that the survey participates accurately report the insulation status of their home, which suggests that a Telephone Survey is a useful monitoring tool to determine the presence of insulation.

Figure 7.2 also compares the results from this survey with results from the 1999 and 2005 House Condition Surveys. The results from the two surveys are similar and show the same pattern i.e., ceiling insulation is most common and floor insulation is least common

In all only 18.7 % of participants in the Telephone Survey reported insulation in the roof space, exterior walls and under floor – i.e. that their house was fully insulated.

Figure 7.2: Insulation of house components



In addition to collecting information on the presence or not of insulation the Physical Surveying provided detail on the type and quality of insulation. 37.8% of the houses inspected had some wall insulation, while around one quarter of these were only partially insulated. In 23% of the houses inspected the presence of wall insulation was unable to be determined.

Participants in the survey indicated that the ceiling space is most likely to be insulated. Participants seemed to know most about the status of the insulation in their ceiling and least about insulation in their walls. Few homes were fully insulated (i.e., all three – ceiling, walls and floor). The most popular type of insulation was fibreglass, where ceilings were insulated they were mostly insulated completely and to a depth of greater than 50 mm.

Double-glazing and the Integrity of the Thermal Envelope

As expected, only a small proportion of households have some level of double-glazing. 5.2% of houses in the Physical Survey were fully double glazed. There is a good match between the self-reports of double glazing and what was identified in the Physical Survey (see Section 6.4). Data suggests that only a small proportion of participants consider double glazing as a 'must have' when buying a property but more did consider draught proofing (see Table 6.19).

A considerable proportion of Telephone Survey participants (40.9 %) report that they have draughty windows or doors. The Physical Survey confirmed that 41.5% of dwellings did not have draught-proofed windows (see Appendix 8 Table 104). Householders appear to associate the presence of draught proofing and double glazing with better energy efficiency.

As might be expected, the surveys showed that the Physical Survey results were consistent with the self report data on glazing and draught proofing and so suggests that Telephone Survey methods could be relied upon to determine the types of heaters in use in New Zealand households.

Low levels of double glazing were reported in the survey. Households with high proportions of double glazing are more likely to report their house as energy efficient. Those participants reporting lower proportions of draughty doors and windows are more likely to characterise their dwelling as energy efficient

Heating Sources

The Telephone Survey suggests that only a small number of participants indicated that they considered the heating when looking for a property (Table 6.19). Electric heaters such as fan, bar, convection or night store heaters are most commonly used with the majority being convection heaters (see Table 6.5). Other studies have also found that more houses have portable electric heaters than any other type and that convection heaters are the most common.[20]

About half of the houses surveyed in this study had portable electric heaters. The use of thermostats and timers is relatively low (over half of the portable convection heaters have thermostats, while approximately 16% are controlled by a timer).

Around a third of the houses surveyed had fixed gas heaters, the majority of which were flued. Approximately 15% of houses inspected have unflued portable gas heaters. Heat pumps and underfloor heating were found in 11% of the houses inspected. Central heating is still relatively uncommon in New Zealand households. Very few dwellings had open fires (13.3 %), 40% of houses had enclosed burners. This is consistent with the findings of the House Condition Survey.[20]

As might be expected, the surveys showed that the Physical Survey results were consistent with the self report data on heater types and so suggests that Telephone Survey methods could be relied upon to determine the types of heaters in use in New Zealand households.

Householders that report using heat pumps or under floor heating are more likely to characterise their home as energy efficient, while householders that report using fixed or portable electrical appliances are less likely to characterise their home as energy efficient.

The majority of participants in the survey are using electricity to heat their homes with a high proportion using portable heaters. Some householders are using gas heaters for heating – the majority of which are flued (if they are fixed gas heaters). Some householders are using under floor heating and heat pumps. Householders appear to be linking these with increased energy efficiency.

Hot Water

The predominant method of water heating in the households surveyed is electricity. A small proportion of gas water heating and solar water heating was observed. Among the dwellings surveyed in the Physical Survey, 25.9 % of the main hot water cylinders were

insulated. Only 27.5 % in the Telephone Survey with a hot water cylinder reported that their cylinder was wrapped.

Hot water temperatures measured in the Physical Survey were found to average 55.6°C and ranged between 40.0°C and 80.0°C (see Table 6.11). Of the 262 dwellings in the Telephone Survey with at least one hot water cylinder, only a third (32.8 %) of participants reported that the pipes from the cylinder were lagged. The Physical Survey noted that over a third of hot water cylinder pipes were lagged (see Appendix 8 Table 81). Survey participants did not associate the age of their cylinder with the energy efficiency of their dwelling.

Participants were largely using electricity to heat their water and the survey suggested that there were still several opportunities for householders to reduce energy costs given the high proportion of unwrapped cylinders and unlagged pipes. Some water temperatures and shower flow rates were excessively high but in the main the averages reported for the survey were in line or almost in line with what would be advised.

Energy Efficient Light Bulbs

Well over half (61 %) of the Telephone Survey participants reported using energy efficient light bulbs. However, only around a fifth of those reported that energy efficient light bulbs made up 75 % or more of the light bulbs in their dwelling. Almost two thirds (64.4 %) of energy efficient light bulb users report that half or less of their light bulbs are energy efficient. Participants using higher proportions of energy efficient light bulbs (51 % or more) are more likely to report their house as energy efficient than participants with lower proportions of energy efficient light bulbs.

Participants reported encouragingly high levels of usage of energy efficiency light bulbs and associated their use with being energy efficient (most likely a conscious visible indicator of energy efficiency). Without doubt Government and retailer promotions have assisted uptake alongside the fact that bulbs are widely available now in a variety of shapes and types.

Gas and Electricity Costs

One third of households surveyed considered their gas and electricity costs when choosing a house. More than twice as many households considered warmth and comfort to be important (see Table 6.19).

For most households gas and electricity costs account for less than 10% of household income (see Table 6.18).

The average winter gas and electricity costs are 64% higher than the average summer cost. 24% of the annual gas and electricity costs are related to additional winter use ie heating.

Households accurately assessed whether their gas and electricity costs were above average, average or below average. That is they have a good understanding of how their house rates when compared with other houses in terms of gas and electricity expenditure (see Table 6.25).

Householders also connect gas and electricity expenditure with their assessment of how energy efficient their house is. Households with higher gas and electricity costs said their houses were not energy efficient, while those with lower gas and electricity costs tended to say that their houses were energy efficient (see Table 6.24).

These results should be treated with caution when considering total energy costs, because only electricity and gas bills were assessed and in some cases bills were not available to sight but estimated by the householder. Total energy with the inclusion of wood and solar heating was not assessed.

Gas and electricity costs are not considered by most households when purchasing a new house, although they are considered by some. Household gas and electricity costs usually account for a low proportion of total household income. Participants could accurate assess how their house rates compared with others in terms of gas and electricity costs. Participants link high gas and electricity costs with being less energy efficient and low gas and electricity costs with being more energy efficient.

7.2 Demographics and Energy Efficiency

Early work in this project to review existing studies indicated that while very good data is available on dwellings and households demographics there is generally limited or no publicly available information that correlates the energy efficiency characteristics of households with the demographic details of the household occupants at a national level.

The recently published HEEP 10 year report presents some demographics and energy data. In particular the report notes with respect to property age, that post 1978 houses have larger floor areas, are more likely to be in warmer climates, are less likely to use solid fuel, and are occupied by households with higher average incomes. The report also notes that low income households often spend more on energy but they are less likely to achieve a warm house or warm living room. The HEEP 10 year report notes that two particular housing variables have a significant association with the availability of solid fuel appliances – the age of the house and the number of bedrooms in older houses and those with more bedrooms likely to have a solid fuel appliance.[21]

Though small in size, the EECA funded Warm Home Energy Check (WHEC) study in Christchurch did cover a mix of age, genders and income levels. The target audience was middle-to-high-income Christchurch homeowners aged between 30 and 49 that have owned and resided in their older (pre 1977) home for 2 years or less. The post project review identified that older females on lower incomes were most receptive to the idea of a WHEC. The review also noted that those on lower incomes particularly liked the idea of financial incentives, some commenting they were very interested in taking positive action for the environment, but often did not have the financial means to act.

The Ian Page report on insulation trends[34] notes some interesting observations on energy efficiency characteristics and demographics. In particular he concludes that there is no correlation between household income and the incidence of ceiling retrofits (i.e., insulation). Page also notes that with respect to house value, there is a statistically

significant trend for houses with 'satisfactory' insulation to be houses which have slightly more value than average houses.

A brief review of international experiences indicated some interesting findings which in particular link income levels and energy efficiency behaviour. In particular, it was found that higher income households and those on the lowest incomes can react similarly after receiving energy efficiency advice. It appeared that while higher income households could afford not to change, low income households were likely to have few options to do any more than they were already. Higher-income homes typically consume more energy than low income homes even though their homes may be more energy efficient. Low-income homes often have the greatest need for improved energy efficiency but they have least ability to invest in energy efficient measures opting instead for reducing their use (i.e., going without), and in doing so, view or perceive themselves as energy efficient. The literature suggests that low income households in the US tend to live in old homes that are not insulated.

Results from the Telephone and Physical Surveys undertaken in this current work present some interesting findings. In terms of the demographics, three key household/dwelling characteristics were tested in this study – tenure, age of the dwelling and household income. Statistical testing was carried out for both the telephone and physical results to establish if there were statistically significant associations ('relationships') between these characteristics and the following energy efficiency attributes in the home – insulation, perception of energy efficiency, heating, cooling, double glazing and water heating.

From the data collected, the statistically significant associations that were identified are presented in the following summary boxes. In some cases, in particular with the data from the physical survey, sample sizes were too small to test and so they are not listed here.

Self-reported insulation (for ceiling, wall and floor) and insulation coverage (i.e., completeness) shows a relationship with dwelling age, tenure, and income.

- *older houses are less likely to be insulated and are less fully insulated than newer houses*
- *tenanted houses are less likely to be insulated and are less fully insulated than owner-occupied houses.*
- *higher income households are more likely to be insulated than lower income households.*

Observed insulation (i.e. that recorded in the physical survey) (for walls) shows a relationship with dwelling age, tenure and income.

- *older houses are less likely than newer houses to have wall spaces insulated.*
- *tenanted houses are less likely than owner-occupied houses to have insulated wall spaces.*
- *households with incomes of $50,001 and above are more likely than households with lower incomes to have wall spaces insulated.*

Observed insulation (i.e. that recorded in the physical survey) for ceiling space) shows a relationship with tenure.

- *tenanted houses are less likely than owner-occupied houses to have ceiling insulation.*

These findings are largely consistent with expectations. Older houses have less insulation compared to new builds. For those that have been retrofitted, typically the ceiling will have been the most likely target for insulation. Insulation can also have been retrofitted under the floor of houses with suspended timber floors. Walls are only likely to have been insulated as part of a major renovation project.[20] The potential difficulty in influencing landlords with regards to maintenance and improvements expenditure on their rental properties has already been noted.[23] It could be expected therefore that landlords are less likely to make an insulation investment in a rented property although one might expect warmer more comfortable tenants to find the property more attractive in the first place and to stay longer (i.e., a longer more stable tenancy). It could be expected that higher income households are living in better quality builds (i.e., new homes or modernised older homes) and so have insulation[20] (as indicated in this current work also) although the Ian Page study found that there was no correlation between household income and ceiling insulation.

Perception (from the telephone survey) of energy efficiency shows a relationship with dwelling age and, household income. (A statistical relationship between the perception of energy efficiency and tenure was not observed in this dataset).

- *Older dwellings are less likely to be characterised as energy efficient than newer dwellings.*
- *Lower income households are more likely to characterise their dwelling as energy efficient than higher income houses.*

These findings are again consistent with expectations. It is more likely that householders in older houses report them as energy inefficient. With respect to the perception of energy efficiency amongst low income households, the reported relationship is interesting. While the dwellings they live in are less likely to be insulated, their perception is often that though 'frugal' use of energy, they are using energy efficiently when in fact they are simply using less.

Heating sources (reported in the telephone survey) show a statistically significant relationship with dwelling age, tenure and household income.

- *Newer dwellings are more likely to use heat pumps or under floor heating than older dwellings.*
- *Older dwellings are more likely to use electric heaters or enclosed wood burners than newer dwellings.*
- *Rented dwellings are more likely to use electric heaters than owner-occupied dwellings.*
- *Owned dwellings are more likely to use under floor heating, enclosed wood burners or open fires than rented dwellings.*
- *Higher income householders are more likely to heat using fixed gas heaters than lower income households*
- *Middle income householders are more likely to heat using enclosed wood burners than lower or higher income households*

In most cases, the sample sizes for heating sources (reported in the physical survey) were too small to test. Only one heating type showed a statistically significant relationship with tenure.

- *Owner-occupied dwellings are more likely than rented dwellings to have enclosed wood burners.*

Some of these findings are consistent with expectations. In particular that more modern technologies (heat pumps and under floor heating) are more evident in newer dwellings and electric heaters are more prevalent in older dwellings.[20] Also, that electric heaters are more prevalent in rented dwellings and that higher income households heat with fixed gas heaters. Testing also showed a statistical significance between the use of heat pumps in cooling mode with newer dwellings and owner occupiers. Again, this is consistent with expectations.

Double glazing (reported in the telephone survey) shows a statistically significant relationship with tenure. Statistically significant relationships with age of the dwelling or income were not observed in this dataset.

- *Owner occupiers are more likely to have some proportion of their household double glazed.*

This relationship is consistent with expectations. It's likely that new houses will be required to have double glazing (by November 2007) and already, approximately 90 % of new homes in the South Island have double-glazing.[16] A relationship with higher incomes and double glazing might also be expected but it was not observed in this dataset.

Draught-proofing (reported in the physical survey) shows a statistically significant relationship with household age. (Note – the sample size was too small to test associations between double glazing and tenure, dwelling age or income).

- *Newer dwellings are more likely that older dwellings to have some or all of their windows draught proofed.*

This relationship is consistent with expectations. Newer dwellings are more likely to be fitted with better fitted sealed windows and doors.

Water heating sources (reported in the telephone survey) show a statistically significant relationship with tenure and household income.

- *Rented dwellings are more likely to use electricity for water heating than owner-occupied dwellings.*
- *Owned dwellings are more likely to use gas or a wood wetback for water heating.*
- *Lower income households are more likely to use electricity for water heating than higher income households.*
- *Higher income households are more likely to use gas for water heating.*
- *Owned dwellings are more likely to wrap and lag the pipes from hot water cylinders than rented dwellings.*

These relationships are consistent with expectations in particular the use of gas in higher income homes and the use of electricity for water heating in rented and lower income homes. The propensity to wrap and lag pipes from the hot water cylinder could also be viewed as an activity more likely in an owned dwelling with landlords again less likely to invest in the energy efficiency of an investment rental.

7.3 Receptivity to HERS and Willingness to Pay

Early work in this project reviewed existing studies on HERS in New Zealand and noted international findings and experiences. In general it was observed from the surveys that interest in uptake of HERS initiatives tends to be low. Householders indicated that it was of more importance to improve comfort than to get a rating for their home. Some studies have shown that householders do respond to advice and information on how to improve the energy efficiency of their home and there is also an indication that householders can see the merits of a good energy rating.

Introduced HERS have tended to be voluntary and have had limited uptake as a result. Despite this it is clear that there is an increasing trend towards greater awareness of energy issues in general and a positive change in attitude to energy efficiency around the home and increased receptivity to energy efficiency messages. Evidence suggests in the UK for example, that householders do see the merits of a rating and that a rating would influence their decisions.

Internationally where HERS has been mandatory (e.g. Canberra, ACT) there appears to have been greater acceptance.

While not specifically part of the initial brief, the project team have noted in discussions with the EECA project team the issues around the role of estate agent in the future implementation of a HERS in New Zealand. As they are in the 'front line' of the rental and selling process, real estate agents are always going to be a key source of information to homebuyers. Two HERS studies in New Zealand have indicated the views of the real estate sector as outlined in Section 4.4. It is noted therefore that these agents could be valuable outlets for information about HERS and ensuring their support for the voluntary scheme would be valuable. It's likely that as the HERS is implemented, householders that are buying, selling or renting will look to their realtor for information and advice. Agents could face a growing number of queries from a more informed general public. In time, it could be expected that the Agents will have a key role in making the energy efficiency attributes of a property as much a selling feature alongside a modern kitchen and bathroom.

In general the participants in the Telephone Survey undertaken in this work appeared to be very receptive to the idea of a HERS.[p, q] This is consistent with other findings. Participants appeared less willing to pay for the actual rating which may be of concern with respect to encouraging uptake in the early stages of introducing the rating scheme, but an encouragingly high proportion of those asked said that they would be willing to act on the recommendations.

The following boxes summarize the key findings from the Telephone Survey:

[p] Note – the majority of HERS receptivity and willingness to pay questions were asked of owner-occupiers only. Only one question in the Telephone Survey was put to both tenants and owner-occupiers (q.29).
[q] Table 60, Appendix 7.

Property has an energy rating – would you see any advantage in advertising its energy rating if you were selling? [r]

- *YES – 70.8% of homeowners said they would.*

The assumption here is that a rating for describing the energy efficiency attributes of a house at time of sale was favourable to owners.

Property has an energy rating – do different age groups see any advantage in advertising its energy rating if they were selling? [s]

- *YES – the younger age groups were less likely to see value in the rating.*

This finding probably reflects the stage of young people in relation to home ownership. Most will be at the stage of recent first entry into the market. Some evidence suggests that energy efficiency is having a positive effect on property prices but this effect is not yet mainstream.[t and 17]

Property has an energy rating – do different income earners see any advantage in advertising its energy rating if they were selling? [u]

- *YES – lower income and some middle income householders could see the energy rating as giving a selling advantage.*

For these income levels running costs are likely to be of more relevance than for the higher income group. They may see the rating as a means to communicate to similar income levels details about the running costs of the home.

Property has a high energy rating – would you be more likely to buy or rent it? [v]

- *YES – 70.5% of all participants (359 in total) said they would be more likely to.*
- *YES – 69.6% of homeowners said they would be more likely to.*
- *YES – 72.7% of renters said they would be more likely to.*

These results indicate that householders would view the rating information valuable and that it would influence their decision but there is no indication what impact the rating might have on choice compared to other features, for example, location, kitchen/bathroom appearance, number of bedrooms etc and so to what extent it would influence the decision against all other factors.

Property has a high energy rating – would any particular age groups be more or less likely to buy or rent it? [w]

- *YES – householders less than 50 years old are most likely to say that a high energy rating would have an impact on their choice of property.*

The finding here is that the younger half of the age groups questioned were more receptive to a rating.

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[r] Question asked of homeowners only.
[s] Question asked of homeowners only.
[t] A development of up market Kensington Properties at Orewa, north of Auckland have a range of built-in energy-efficient characteristics. Their value is expected to be positively affected by these characteristics.
[u] Question asked of homeowners only.
[v] Question asked of all participants.
[w] Question asked of all participants.

Property has a high energy rating – would any particular income group be more or less likely to buy or rent it?[x]

- *YES – high income households are least likely to say that a high energy rating would have an impact on their choice of property.*

The differentiation between income clusters is muted but the finding that high income groups seem not to be influenced by the rating could imply that given their high income, the potential energy running costs (that an energy rating may imply) of a property are not of significant concern to them and if they were, these householders could afford to address the issue. Other factors may be of greater significance.

Would you be willing to pay for an energy audit to produce an Energy Rating of your home?[y]

- *YES – 56% said they would pay for a rating.*
- *For those who said they would be willing to pay, the amount was relatively small (Almost one fifth indicated they would pay up to $100 and almost one fifth said they would pay up to $200).*
- *NO – 36% said they would not pay.*

Participants in the Christchurch WHEC[4] paid $99 and most found it to be value for money. When the HERS programme is introduced the exact cost of an audit may vary depending on the property but it is likely that it will cost more than $100 to carry out an audit, produce a report and issue a rating certificate.

Is there a link with willingness to pay for an Energy Audit and household income?[z]

- *YES –low income households appear most hesitant to pay.*
- *YES – middle income households also appear hesitant to pay.*

Low income households see an advantage in having the Audit if considering selling but appear from this finding unable/unwilling to pay for the Audit. The result is not unexpected as such households will have less of a disposable income. It may also be that they feel that their property would not achieve a high rating and so not help to sell the property.

Is there a link with willingness to pay for an Energy Audit and householder age?[aa]

- *YES –younger people are more likely to be willing to pay.*

This is consistent with their higher interest in selecting dwellings on the basis of energy performance than any other age groups.

Participants indicated what their key drivers would be to prompt them to improve the energy efficiency on their homes. Their responses indicate financial and environmental considerations were top of the list. Some sort of financial incentive from the government also figured highly. These findings are consistent with the Christchurch study where costs

[x] Question asked of all participants.
[y] Question asked of home owners only.
[z] Question asked of home owners only.
[aa] Question asked of home owners only.

savings were identified as a key driver to implement measures. The Christchurch study indicated that improved warmth was a big driver but it appeared slightly less so in this current study. Participants in this study put less importance on how the rating might affect their property value and even less so on making it more attractive to future buyers (this is consistent with the Dunedin study). This is despite a very high proportion of those asked (in this current study) who indicated that a good rating would influence their choice of property.

Finally, two thirds of owner-occupiers indicated that having had an audit they would be willing to spend some money on energy efficiency measures. Around 14% said they would not act on the recommendations.

Is there a link with willingness to pay for energy efficiency measures and income?

- *UNCLEAR – The association between willingness to pay for energy efficiency measures and household income could not be tested due to the small sample test. However collected data does show that low income households were least likely to report willingness to spend on energy efficiency measure (see Table 6.35).*

These results, specifically in relation to the effect of the rating on property value and attractiveness of the property to future buyers, perhaps indicate that most householders are simply not used to factoring in energy efficiency issues when considering buying a new home or selling their current home. It could be expected that as the proposed HERS takes shape and becomes more of a feature of properties for sale or rent, awareness will be further raised and the appreciation that much in the same way as there are capital and running costs to consider when buying a car, so too are there with a home.

Finally, it is important to treat the responses here re willingness to pay with caution. It's likely that given the question in the survey, householders will be responding to the question asked with a view of the 'price' and not particularly on the basis of its value or benefits. It is also difficult at this stage for a householder to have a good concept of what they would be getting for their money. This will become more obvious as the scheme achieves momentum.

7.4 Conclusions

This project has explored a number of key issues including the energy efficiency characteristics of New Zealand homes and in particular 'older houses'; the types of people that are living in these homes (i.e., demographic details such as their age, income and the age of their property and whether they own or rent it); the receptivity of these householders to the proposed scheme which would give their home an energy rating, i.e., the HERS, and finally how willing these householders might be to pay for the rating. The research conducted has accessed a comprehensive set of existing information and has also produced new data from a small survey exercise. The key conclusions from this work are as follows:

The number and Location of the pre-1977 houses **-** Census data provides information on the location of older houses throughout New Zealand. At present this data provides the best indication on the location of the uninsulated houses. It is estimated that there are

between 220,000 and 310,000 houses with inadequate ceiling insulation and approximately one million houses with inadequate wall and floor insulation. The regions with the highest number and concentration of older houses have been identified and are described in section 5 of this report.

Energy Efficiency Characteristic s- While most houses now have some insulation in the ceiling, very few houses are fully insulated. Households generally know the insulation status of their home and accurately report this when asked in a survey. Householders know least about wall insulation and most about ceiling insulation. Some householders have made significant investments in energy efficiency measures. Some householders appear to be more concerned about comfort than energy bills. Interestingly most households can accurately rate their own houses in terms of energy bills. Most households connect being energy efficient with have a lower than average gas and electricity bill. Heating both for space and water is dominated by electricity. People also make other interesting connections with being energy efficient such as having draft proofing installed, having a high proportion of double glazed windows and using energy efficient light bulbs. These are the more 'visible' signs of efficiency compared to, for example, hot water cylinder wraps. Average water temperatures and shower flow rates are largely consistent with recommendations although some properties have extremes.

Regional Energy Efficiency Data— This project has illustrated the limits of existing data on household energy efficiency. Much of the existing information has been collected for a variety of purposes and so cannot easily provide a detailed national picture. While the new survey conducted in this project provides an indication of the energy efficiency characteristics of New Zealand homes it is a small sample and as such cannot represent the national picture. The annual or biannual collection of residential energy efficiency data on a regional basis would be a valuable exercise to help chart progress and channel resources to where they are most needed. Collaboration with retailers and suppliers of insulation materials and heating equipment could help secure better data and a more informed picture. Regional Surveys of householders would also add to the picture. The aggregation of this regional data could enable the development of a national picture of energy efficiency with the ability to track progress.

Energy Efficiency Data Linked to Household Demographics – A review of existing work confirms that there is a lack of comprehensive data on how the energy efficiency characteristics of a person's home vary with demographic characteristics such as the age of the property, income and the type of tenure. Existing information often relates energy efficiency findings to levels of household income. Survey work conducted in this project has indicated relationships between three demographic characteristics – dwelling age, tenure and income with types of insulation, heating (space and water) and glazing and draught proofing. Where relationships have not been shown to exist, this can be for a variety of reasons not least that the sample size was too small to test. Ceiling insulation is linked to newer houses, ownership and higher incomes. Wall insulation is linked to new houses, ownership and higher incomes. Findings for heating, indicates relationships between new dwellings and heat pumps and under floor heating; old dwellings and electric heaters or wood burners; rented dwellings with electric heaters and owned dwellings with under floor heating, woodburners and open fires. Higher income households show a relationship with fixed gas heaters. Similarly, rented dwellings are linked with electric water heating, owned dwellings with gas or wood wetbacks. Lower income households are linked with electric water heating and higher income households

with gas water heating. Owned houses are more likely to wrap cylinders and lag pipes. Owned houses show a relationship with double glazing and newer houses are more likely to be draught proofed. Findings suggest that older rental properties are likely to be poorly insulated and not draught proofed and have in-efficient space and water heating systems.

Energy Efficiency Understanding - The Surveys undertaken in this work demonstrate that while a general awareness of energy is increasing, householders still seem to be unclear about how they are using energy in the home. Participants in general were aware of energy efficiency issues at a high level and many were able to ascertain whether their property was or wasn't energy efficient. Many appeared to know which measures would make a difference while others were not taking even the most basic steps to improve their energy efficiency. Classic examples illustrating this emerged clearly in the Survey as uninsulated roof spaces and under floor areas, unwrapped hot water cylinders and pipes, high water temperatures and high shower flow rates. The link with warmth and comfort was made by participants as was the ability to reduce their gas and electricity bills and environmental impact.

Householder receptivity to HERS and Willingness to pay – While research accessed as part of this project suggests that uptake is generally low for voluntary home energy rating schemes, encouraging responses from the Telephone Survey indicate that the majority of householders do see the merits in the proposed HERS. This is a good start but the national and international experience indicates that interest in the proposed New Zealand scheme is initially likely to be low. Cost is likely to be a barrier to take up and while participants appear receptive there may be a need for financial encouragement to gain some momentum. The Survey indicates that low and middle incomes see merit in the rating if they were selling their home but are hesitant to pay for it while high income earners appear indifferent. Younger householders (less than 50 years old) are likely to be influenced most by a good energy rating and the need to pay for one. The real estate sector may provide a valuable route for communication of HERS details to householders. While just over half of the participants indicated they would be willing to pay for the rating, they were not prepared to pay very much. The response to the questions about willingness to pay should be treated with caution since at this stage it is difficult for the householder to put value on a 'rating' that does not yet exist.

Appendix 1 Results Phase One – Full Details

1.1 Key Primary Data Sources

This section of the report includes summary details on key primary data sources. Typically these are national studies and Surveys, and they involve primary data collection. They are listed as follows:

1. Statistics New Zealand
2. Quotable Value Limited (QV), New Zealand
3. BRANZ – Building Research Association New Zealand, and
4. CRESA – Centre for Research Evaluation and Social Assessment.

1.1.1 Statistics New Zealand

The Statistics Act 1975, sets out the Government Statistician's role in, and responsibilities for, all official statistics whether produced by Statistics New Zealand or by other government departments.

To meet its responsibilities under this Act, Statistics New Zealand's main roles are to:

1. Provide leadership for New Zealand's official statistics.
2. Be the key contributor to the collection, analysis and dissemination of official statistics relating to New Zealand's economy, environment and society.
3. Build and maintain trust in official statistics.
4. Ensure that official statistics are of high integrity and quality and are equally available to all.

In fulfilling this role Statistics New Zealand undertakes the Census of Population and Dwellings every 5 years. Information from the Census of Population and Dwellings is available in a series of topic-based reports. One of these topic-based reports is titled 'Housing'. This report includes detailed statistics on dwellings and household characteristics at a national and sub national level.

The Statistics New Zealand programmes/strategy's/data sets of interest are:

- Housing Statistics Programme,
- Housing Statistics Strategy,
- Housing Statistics Users Group,
- Census of Population and Dwellings,
- Household Economic Survey, and
- Building Consents.

Housing Statistics Programme

Statistics New Zealand manages the *Housing Statistics Programme* which forms part of a wider *Social Statistics Programme*.[18] The aim of the *Housing Statistics Programme* is to facilitate access to and use of a wide range of housing statistics by Government agencies, academics and the community.

Housing Statistics Strategy

The Statistics New Zealand Housing Statistics Strategy is a long term plan to ensure the successful production, integration and dissemination of relevant and authoritative housing statistics[19]. The Housing Statistics Strategy uses a Housing Adequacy Model to identify gaps in current Housing Statistics. The Housing Adequacy Model includes six interrelated dimensions of housing adequacy: affordability, suitability, habitability, tenure security and freedom from discrimination and crowding.

The most important dimension of housing adequacy with regards to this current project is 'habitability'. Specifically, housing habitability relates to:

- The physical condition of the dwelling (structurally, internally and externally);
- The existence of basic household amenities (such as cooking, washing and heating facilities);
- The condition of the environment surrounding the home.

The essential components of habitability are that the house is healthy to live in, is energy efficient and is resource efficient. The housing statistics programme focuses primarily on the physical condition of the house and the existence of basic amenities. Currently, detailed housing statistics tables relating to Habitability are unavailable.

The Housing Statistics Strategy identifies the following key deliverables of the Housing Statistics Programme:

- The 2001 Census of Population and Dwellings Macro-evaluation Housing Output Report.
- Stakeholder sign-off of the Statistical Standard for Dwelling Type.
- The Administrative Data Project.
- Assessment and Recommendation Report on Housing Data Requirements.
- The Housing Indicators Project.
- A Survey of Housing.
- The Directory of Housing Statistics Update.
- The 2001 Census of Population and Dwellings Housing Tabular Report.
- Housing Analytical Reports on Affordability and Crowding.

Housing Statistics Users Group

Statistics New Zealand has established a Housing Statistics Users Group comprised of housing statistics users mainly from government agencies. The group aims to meet four times per annum.

Statistics New Zealand also publishes a Housing Statistics Newsletter on a quarterly basis to keep users of housing statistics up to date with housing statistics developments and releases.

This users group is a useful forum for EECA to communicate its data needs with regards to obtaining better data on the energy efficiency characteristics of New Zealand houses. EECA staff are actively involved in this Group.

Data sets

The Statistics New Zealand data sets most relevant to this project are:

- Census of Population and Dwellings,
- Household Economic Survey, and
- Building Consents.

Census of Population and Dwellings

The Census of Population and Dwellings is the main source of housing statistics and is completed every five years. It covers the entire population and country and can be analysed down to the unit or mesh-block level.[bb] Some information is available in time series over the last 3 census periods and some series go back to 1916. Long term time series data often requires some manipulation, because the nature of the census questions has changed over time.

This data provides good information about dwelling numbers, age and tenure, and covers the whole country. However, it provides no other information about the condition of the property or its energy efficiency characteristics. The Census would provide an ideal opportunity to establish such information on a regular basis.

Household Economic Survey

The Household Economic Survey is a sample Survey that collects information on the income and expenditure patterns of private households throughout New Zealand. The sample size is 2,800 households, sampled on a statistically representative basis from rural and urban areas throughout New Zealand. The Household Economic Survey was conducted annually between 1973 and 1998, but is now conducted every 3 years. The last two Surveys were published in 2001 and 2004 and the next one is scheduled for 2007. The data is used primarily for social policy and economic analysis.

The data provides statistically representative data on income and expenditure, which includes data on accommodation and energy expenditure. It provides no direct information on the condition of properties, the energy use or energy efficiency characteristics of houses.

Building Consents

Data on building consents is collected each month from all territorial authorities. The data therefore covers the whole country. The data is compiled and published by Statistics New Zealand. Available data includes the number, value and region of both residential and non-residential building consents by building type. It allows us to determine areas with most building activity and least building activity, which will impact on the average age of the building stock in a particular area and therefore the energy efficiency characteristics of the housing stock in the area and nationally.

Conclusions

[bb] Area Units and Mesh-Block's are geographical aggregations. The most disaggregated classification is the Mesh Block (MB) (there are over 41,000 MBs in New Zealand). MBs are then combined to form Area Units, the second most disaggregated classification. There are 1860 area units in New Zealand.

Very good data is available on dwellings and households from the Census. This is completed every 5 years and covers the whole country. It provides good demographic data and the time series data means that it is possible to determine the age of the housing stock. The data provides little detail on house condition, other than house age, and provides no direct information on the energy efficiency characteristics of houses. The regularity of Census data collection presents an opportunity to collect data on energy use and energy efficiency characteristics of New Zealand houses.

Statistically representative data on household expenditure and energy expenditure is available on a time series basis from the household economic Survey.

Data on all building consents issued is available to determine the areas of the country were most new houses are built. This has an effect on the average age of the housing stock and therefore of the energy efficiency characteristics of houses. A general assessment could therefore be made of the relative improvement in the energy efficiency of New Zealand's housing stock.

The Housing Statistics Users Group is a useful forum at which EECA can communicate its data needs with the aim of gaining a better understanding of the energy efficiency characteristics of New Zealand houses. EECA may also choose to encourage Statistics New Zealand to work towards publication of the Habitability component of the dimensions of housing adequacy identified in the Housing Statistics Strategy.

1.1.2 Quotable Value Limited

Quotable Value Limited (QV) is New Zealand's largest valuation and property information company. QV completes rating valuations on every property in New Zealand and therefore has a constantly updated database of properties which includes many fields such as value, property type, size, construction, building age usage etc. They collect no specific information on the energy efficiency characteristics of houses, perhaps because, at present, this has little attributable bearing on the value of the house.

The main purpose of the Quotable Value database is to determine the approximate house value for the purpose of setting local government rates (for both territorial authorities and regional councils).

The following relevant reports on property market statistics are available from their website (https://www.qv.co.nz/faqandsupport/sitemap/):

- Residential property – price movement,
- House/flats – Freehold open market summary,
- Houses – Quarterly price index,
- Houses/flats – Number and average sale price,
- Residential property sales statistics,
- Urban property sales statistics,
- Rural property sales statistics, and
- NZ real estate market summary.

QV can also provide reports in response to customised statistical queries on either a national or local basis. Further details on each of the QV reports listed are presented in the following sections.

Residential property – price movement—This report is released on a monthly basis and has the latest statistics on property price movement available from QV. It gives up-to-date information on how property prices are trending in an area.

The report includes the annual %age change in the QV Price Index (Property Value Growth), and average sale prices for residential property throughout New Zealand, by council and main urban area.

House/flats – Freehold open market summary—This report is a comprehensive quarterly guide to residential property sales for areas across the country. It includes the number of sales, average sale price and the average capital value for three separate residential property categories (houses, flats and sections).

Statistics are reported for each council area and also the sales groups in each council area, allowing users to view sales trends in a local area.

Houses – Quarterly price index—The Quarterly House Price Index measures the movement in house prices for local council areas throughout New Zealand, providing an indicator of capital growth and how prices are trending in an area. The report also allows for a direct comparison between areas of the country.

Quarterly figures are included for local council areas over a two-year period, while figures for main urban areas and New Zealand totals are also included.

Houses/flats – Number and average sale price—This report enables the comparison of the sales of houses and flats in specific council areas, as well as comparing them with other areas of the country. The information is presented in a tabular form.

The quarterly table contains the number and average sale price of houses and ownership flats for each New Zealand council, North and South Islands, Wellington and Auckland areas, and Total New Zealand.

Residential property sales summary—Released quarterly, this report contains sales information on residential houses, flats, and vacant sections for councils and suburbs throughout New Zealand. The QV quarterly house price index is also included, which indicates capital growth by council.

Urban property sales statistics—Released half yearly, this report contains sales information on property types in main urban areas, including residential, commercial, and industrial property. The commercial and industrial property half-yearly price indices are also included back to 1981.

Rural property sales statistics—The report is released half yearly and contains sales information on rural land types, including dairy, grazing, fattening, arable, and horticultural land. The rural price index is included, which contains figures for each of the rural land types back to 1980.

NZ real estate market summary—This publication is released half yearly, and summarises sales activity in a range of property types, including residential houses, sections and flats, and rural property.

Conclusions

Quotable Value Limited has a comprehensive data base of New Zealand houses, which is constantly updated. There is a requirement to update the rating valuation at least every 3 years, although some local councils have chosen to do this on a more frequent basis (for example in Wellington the rating valuations are updated annually). While most of the published information focuses on property values the data base also includes many other fields such as size, construction type, building age, usage etc. The database provides excellent information on the demographics and house age and therefore can provide information about house age and value for different demographic groups. If house age (or perhaps value) could reliably be used as a proxy for energy efficiency characteristics then these characteristics could also be determined for different demographic groups.

The Quotable Value database currently has no specific data on the energy efficiency characteristics of New Zealand house; however, when a Home Energy Rating Scheme is in widespread use it would be expected that this would be a useful field to add to their database.

1.1.3 Building Research Association of New Zealand (BRANZ)

The Building Research Association of New Zealand (BRANZ) collects two key datasets that are applicable to housing. Available datasets are listed as follows:

- House Condition Survey, and
- Household Energy End-use Project (HEEP).

House Condition Survey

Project Description—BRANZ have now completed 3 studies on the condition of New Zealand houses. Surveys were carried out in 2005, 1999 and 1994. The houses are chosen at random from owner occupied houses in the Auckland, Wellington and Christchurch regions. Telephone interviews are completed to collect demographic, economic and maintenance information. Physical inspections of the physical condition of houses are also completed. In the most recent Survey 565 physical inspections were completed.

Key Findings (2005 Survey)—Almost all houses have some ceiling insulation. Only 6 % of houses have no ceiling insulation and 7% of ceiling cavities where inaccessible. Approximately 70% of ceilings have full coverage of ceiling insulation and remainder have incomplete coverage or are inaccessible. 30% of ceilings have inadequate insulation material i.e. only 50 mm thick or less.

More than half of all houses Surveyed did not have wall insulation. Approximately 65% of houses have un-insulated floors. 60% of new houses[cc] have inadequate ceiling insulation, in terms of the current Building Code requirements. Approximately 13% of houses in the Christchurch region have double glazing.

Approximately 35% of houses Surveyed have old (C or D grade) hot water cylinders, which use energy inefficiently. Only 50% of electric hot water cylinders are adequately sized. More than 20% of showers have flow rates of more than 12 litres/minute. More

[cc] New houses are defined as those built after 2000.

than 30% of hot water cylinder thermostats are unreliable and nearly 40% of hot water systems deliver water temperatures well above the 55°C maximum required by the Building Code.

More houses had portable electric heaters than any other type. The most common fixed heaters are wood burners, 40% of houses have these. 20% of houses rely on wood burners as their sole source of heating. The %age of houses with dehumidifiers has doubled in the last 6 years. Houses with un-flued gas heaters have more than twice the rate of dehumidifier use as houses without this form of heating.

Conclusions

The New Zealand House Condition Survey[20] is the most comprehensive Survey of the energy efficiency characteristics of New Zealand houses. The Survey provides very good data on the energy efficiency characteristics of houses including detailed information on insulation, hot water systems and heaters.

The main limitation with respect to this Survey is in the selection of houses Surveyed. The Survey only includes owner occupied houses and houses in the three main regions. The Survey makes no comment on the demographics of the houses surveyed, even though this information is now collected.

The report notes the possibility of some self selection bias, suggesting that owners with houses in poor condition are less likely to offer their houses for inspection. The report also suggests that the Survey results may slightly under-estimate the condition of the housing stock.

The sample size is determined by the requirement to achieve a nationally representative sample; therefore the sample size has increased slightly over time. The houses are randomly selected each time the Survey is completed. It relies on home owners agreeing to be involved in the Survey.

While the Survey sample is limited to owner occupied houses in the three main regions the New Zealand House Condition Surveys provides detailed information on energy efficiency characteristics of New Zealand houses and a very good time series data set, which highlight significant changes between Surveys. The results of this Survey can be used to show both the energy efficiency characteristics of houses, the changes over time, on a national basis. The results could be used to show a best case scenario of the condition of New Zealand homes, with the actual condition expected to be slightly worst when rental properties and houses from other areas are included.

Household Energy End-use Project (HEEP)

Project Description—HEEP[21] is a long term study with the aim of measuring and modelling energy use in New Zealand households. It has monitored all fuels used in New Zealand houses and the services they provide (space and or water heating, cooking etc). Each house is monitored for approximately 11 months. The project commenced in 1995 with a pilot study and data collection was completed in 2005. The project includes data from 400 randomly selected houses over this 10 year period.

The study monitored at least two temperatures in the main living room of each house and one in the main bedroom. House occupant Surveys were completed along with detailed household energy audits. Information on over 20,000 appliances was also collected.

Key Findings—This is a comprehensive research project and the findings are perhaps to numerous to mention. In general the project provides a detailed snapshot of energy use and on the services that energy delivers in a range of New Zealand house types (construction, age, etc), ownership type, locations, and types of families (i.e. varied demographics).
More information is available at: http://www.branz.co.nz/main.php?page=HEEP

Conclusions
The sample is random and includes rental properties as well as owner occupied houses. The coverage is also comprehensive covering both rural and urban areas. Therefore the sample is more representative than that of the New Zealand House Condition Survey. Data collected is comprehensive and covers all fuel types and appliance use in detail.

Data collection has only recently been completed (2005) and therefore detailed analysis based on the full data set has not yet been widely published. Although answers to specific questions are available from BRANZ, there is likely to be costs involved in extracting this information from the final data sets produced.

The HEEP data is comprehensive and is based on a representative sample. Findings of the research have been published in a series of reports, but these have not yet been updated based on the full data set. Answers to specific questions may be available by making specific requests to the researchers. The database will provide a unique resource in that it involves a nationally representative sample, collects demographic data and also collects data on the energy efficiency characteristics of houses and the energy use.

1.1.4 The Centre for Research Evaluation and Social Assessment

The Centre for Research Evaluation and Social Assessment (CRESA) undertakes socially focussed research and evaluation. CRESA's research focuses on encouraging community development and sustainable communities. CRESA's research and evaluation work centres on critical aspects of:

- social development, policy and services
- resource management for sustainable social, economic and environmental outcomes
- housing and the built environment.

CRESA has carried out a number of studies relevant to this current work. That research falls into two broad categories – commissioned research and public good research. The research described here falls into the latter category. Data generated through commissioned research is publicly available were it has been reported and published by the commissioning agency or where the commissioning agency has given permission to access the data. In the case of CRESA's public good research in addition to reported research results CRESA has access to the raw data for future analysis needs.

Public Good Research

Key projects include:

- Panel Surveys for the Building Attachment in Families and Communities Affected by Transience and Residential Mobility project.
- National Landlords Survey – Preliminary Analysis of the Data
- Opotiki House Condition Survey
- National Repairs and Maintenance – Homeowner Survey
- Retrofitting Insulation in the Eastern Bay of Plenty – A retrospective Evaluation
- Disability/Housing Experience Survey (CHRANZ-funded)
- Climate Change Report (FRST-funded and BRANZ-led).

With the exception of the Opotiki House Condition Survey and data presented in the Climate Change Report, the studies undertaken by CRESA do not contain directly measured data on specific energy efficiency features or measures in Surveyed homes. However the majority of the studies incorporate some measure of the overall house condition and/or information on repairs and maintenance activities/expenditure. These studies provide an important context for the current work as previous research both in New Zealand and internationally has shown there is a relationship between poor house condition and poor thermal performance. In addition under investment in repairs and maintenance tends to be more prevalent in homes with some characteristics indicating poor thermal efficiency and therefore an increased risk of being high-energy use households.

Panel Survey for Building Attachment Project[22]

Project Description—A five year FRST-funded project, this research explores the dynamics and drivers of residential mobility and transience and its impacts on: (a) community attachment among the residents of local communities and the major institutional stakeholders in communities – public and private service providers, community organisations, and local employers and business; (b) individual and familial outcomes in relation to: employment, education, health, housing, safety from crime; (c) two critical life stages and processes in the individual life cycle – the cognitive development of children, and transitions of young people to adulthood, and (d) community outcomes in relation to the sustainability of the local economy, the public infrastructure and community attachment.

The research is based in four case study communities – Opotiki, Kawerau, Cannons-Creek/Waitangirua and Amuri. The research included a panel Survey of around 150 households across the four case study areas. Households were interviewed annually for three successive years from 2004/05-2006/07. The panel Survey included a dwelling questionnaire and a household composition questionnaire for each household. Information collected includes house type, tenure, householder perception of overall house condition, details of repairs and maintenance undertaken in the previous 12 months, household size and composition.

Key Findings—This data is not yet reported. Data from the third wave (year three) of the panel Surveys has been inputted but is currently being cleaned and prepared for matching with data from Waves 1 and 2.

On completion of analysis this data will provide a snapshot of householders perceptions of house condition over time for 'stayer' (non-moving) households as well as information on the type and extent of repairs and maintenance undertaken by a range of different household types.

More information on the project including reported data is available at: http://www.whypeoplemove.net.nz

Conclusions

The sample Surveyed across the four case study areas includes households living in rental properties and owner-occupier households; it also covers a mix of rural and urban households.

Data collection was only recently completed (February 2007) and detailed analysis matching data across the three years of data collection has not yet been undertaken.

The dataset collected as part of the panel Surveys provides some useful information on perceptions of house condition and repair and maintenance questions. The panel Surveys did not include systematic data collection on the energy efficiency characteristics of dwellings households were living in but did have questions around householders' overall rating of house condition.

National Landlords Survey – Preliminary Analysis of the Data[23]

Project Description—This report provides preliminary analysis of data gathered in the 2003 Survey of landlords. It describes the Survey method and presents key data derived from the Survey.

Key Findings—The preliminary analysis suggests:

- Fluidity in the rental market, many individuals who acquire rental property often tend to sell again within a relatively short time.
- Investors have an expectation of making significant capital gain.
- Business structures to own and manage assets are not often used.
- Systematic property and tenant management is not often applied.
- There are pronounced preferences for tenants with certain social characteristics.

Conclusions

This study summarises the preliminary findings of a recent Survey of landlords. It identifies a lack of a systematic approach by many landlords to both tenancy management and property maintenance issues. These findings highlight the potential difficulty in influencing landlords with regards to maintenance and improvements expenditure on rental properties. The report contains no information on the energy efficiency characteristics of New Zealand houses but this data suggests that landlords present a particular challenge in relation to ensuring stock thermal performance and insulation.

The Condition of Opotiki's Rural Housing Stock: A Survey of Three Communities[24]

Project Description—This project summarises the key findings of a research study into the physical condition of the rural housing stick in Opotiki District. The research was jointly funded by the Ministry of Maori Development and funding from CRESA's FRST-funded

research programme Sustainable Housing in Disadvantaged Communities and was undertaken as a joint venture between local communities and organisations, the researchers and central government. The final report was prepared for the then Opotiki Development Project

The households sampled for the Survey represented a census of three communities within Opotiki District – constructed from a series of meshblocks the three communities were identified as having relatively typical socio-demographic profiles of the small, rural Maori communities in Opotiki District. The research adopted the BRANZ House Condition Survey instrument to undertake a physical inspection of the sampled houses. In all 117 houses were Surveyed.

Key Findings—When compared to findings from the 1994/95 national house condition Survey the overall condition of Opotiki houses was between 0.5 and 1.0 condition grades worse, depending on age, than the national stock.

In relation to insulation 69% of Surveyed households had ceiling insulation, 58% had floor insulation and 53% had wall insulation.

The most common heater type was portable LPG heaters followed by enclosed wood burners/potbelly stoves. 25% of ovens/hobs were shown to be in serious or poor condition in Opotiki compared to 9% in the national Survey.

Almost 10% of houses have no laundry facilities and no hot water.

Conclusions

A significant proportion of the homes Surveyed for this study had no insulation while the poor ratings for some amenities and for overall house condition also indicate the dwellings Surveyed are likely to be vulnerable to poor thermal performance.

The research provides data on the energy efficiency characteristics of a sample of provincial and rural houses in a low-income area including detailed information on insulation, hot water systems and heaters. Although demographic and household characteristics data were not collected the census sample across the three communities means the Survey likely included dwellings occupied by renters as well as owner-occupiers.

Undertaken in 1998, the research is relatively old. However, the use of a consistent measure – the BRANZ house condition Survey instrument means the report offers some insight into the possible differences between dwellings in urban centres and rural dwellings when compared to the results of the NZ House Condition Survey.

National Repairs and Maintenance – homeowner Survey[25]

Project Description—This Survey represents the phone Survey component which accompanied the BRANZ house condition Survey (as detailed above). CRESA lead on the co-ordination of the phone interviews and analysis of the resulting data. The most recent phone Survey was undertaken at the end of 2004 to provide the sample for the 2005 New Zealand House Condition Survey.

Households were randomly selected from owner-occupied houses in the Auckland, Wellington and Christchurch regions. The Survey collected data on a range of demographic characteristics as well as homeowners' rating of the overall condition of their home and details on repairs and maintenance activities and expenditure in the previous 12 months. In the most recent Survey 611 homeowners were Surveyed.

Key Findings (2004 Survey)─The results of the Homeowner Survey suggest that most New Zealanders are satisfied with the condition of their houses. Of the homeowner respondents, 78.7 % described the current condition of their house as *Excellent* or *Good*. Less than a quarter of homeowners believe their house to be in *Average* or *Poor* condition. A manifestation of this confidence in their homes is the high proportion (47.3 %) of respondents who reported that they had not undertaken repairs, painting or replacement around their house over the twelve months prior to Surveying. But confidence in house condition does not drive the relatively low levels of house maintenance apparent in the Survey. It should not be ignored that 48 % of respondents reported that they deferred maintenance and while the ostensible primary reason for deferral was reported as expense and lack of funds, further analysis suggests that there is no statistically significant relationship between income and likelihood of maintenance deferral.

Conclusions

Overall homeowners have a tendency to think their house is in good condition even when it is not. Therefore there is likely to be a low incentive for homeowners to undertake improvements in efficiency through self-assessment.

Retrofitting Insulation in the Eastern Bay of Plenty – A Retrospective Evaluation[26]

Project Description─This study is a retrospective evaluation of insulation retrofitting project in the Bay of Plenty area. The programme targeted low income households living in dwellings with inadequate insulation. The programme benefited approximately 1,500 households, 4,000 people and 500 under 5 year-old children.

The study aimed to: assess the range of individual and community benefits generated by the programme and to quantify the potential number of dwellings in total within the Eastern Bay Energy Trust area that could benefit from the continuation of the retrofit programme.

Twenty one interviews were conducted including four with retrofitters, three with Opotiki Trade Training staff, one with a former staff member, three members of the Eastern Bay Energy Trust, and ten households who had received a retrofit within the previous two years. The households were selected for interviewing based on location, number of people in the house, presence of five year olds in the house, and the temperature of their hot water cylinders.

Key Findings─The report noted that there was a high degree of expressed satisfaction by households in: increased comfort and improved house condition; increased wellbeing; increased sense of health; and reduced energy costs.

1,500 insulation retrofits had been completed in the Eastern Bay of Plenty area at that time and it was estimated that a further 3,000 households in the area could benefit from a similar insulation retrofit.

Conclusions

This report provides an objective and independent assessment of the outcomes and perceptions of a retrofit programme in Eastern Bay of Plenty. It shows that households recognise a range of benefits deriving from insulation and better thermal performance including reduced energy costs, increased comfort and improved house condition, increased wellbeing and an increased sense of health.

Disability/Housing Experience Survey[27]

Project Description—This Survey was undertaken as part of a wider research project on Accessible Housing for the Future Ageing and Disabled Population in New Zealand, Funded by the Centre for Housing Research Aotearoa New Zealand (CHRANZ). The aim of the research is to assist the housing and disability sectors to effectively optimise housing access for the growing numbers of people who will be managing severe or moderate disability over the next twenty-five years. Participants for the Survey were recruited using snowballing methods and networking through local disability resource centres. In all, 121 individuals with a mobility impairment completed an individual Survey and 31 parents with one or more disabled children completed a parent's Survey.

The Survey included questions on damp/condensation problems, heating type and satisfaction with heating as well as respondents rating of the overall condition of their home,

Key Findings—Surveying was completed in late 2006 and reporting to CHRANZ was timetabled for February 2007 so results of the Survey are not yet available. However preliminary findings indicate only a minority of respondents achieve comfortable winter temperatures all the time and respondents report substantial dissatisfaction with their ability to heat the whole house and the cost of heating. Condensation was a problem reported by almost two-thirds of Survey respondents.

Conclusions

While his Survey is based on a quota sample, the data provides a similar picture as other research – that New Zealand's housing thermal performance is poor. The impact of this on disabled people is particularly pronounced because of their vulnerability to cold.

The Survey did not contain detailed questions on the energy efficiency characteristics of respondents' homes.

Climate Change Report – The Social Dynamics of Climate Change Responsive Housing[28]

Project Description—This 1998 report formed one component of a multi-disciplinary FRST-funded research project led by BRANZ into the extent to which the construction industry has the capacity and/or the inclination to respond to the demands of climate change.

The research involved:

- A self-complete postal Survey with a random sample of homeowners /consumers of new or newly renovated houses in three case study areas – Wellington, Thames-Coromandel and Dunedin.
- Face-to-face interviews with key construction industry stakeholders in the three case study areas, and
- In-depth phone interviews with a small number of homeowners/consumers.

A total of 314 Surveys were completed as part of the postal Survey and 14 phone interviews were completed with consumers. The Survey included: basic demographic data – household size, composition, ethnicity and household income; household characteristics – number of bedrooms, tenure, basic construction, house shape and wind exposure. In addition asked respondents to report on a range of energy efficiency measures in their current home (actual features) and which features were desirable to them (most desired features).

Key Findings—At the time of Surveying, respondents' views indicated that when ranked against other factors such as cost and house size the 'environment' is not seen as a significant priority in decisions around housing.

In terms of insulation over half the respondents believed that the subject house exceeded the Building Code in regard to insulation. A minority of respondents (14%) reported that they used double-glazing, only 8 % of subject houses had heat pumps and/or solar water heating. Over half the houses (57%) were described as using energy efficient lighting and almost two-thirds (62%) reported using energy efficient appliances.

Although a comparison of actual features with most desired features showed that the majority of respondents requirements were met by the subject houses this did not mean that consumers necessarily 'leveraged' that match. In general environmental considerations had not been raised with consumers by designers or builders. Particular problems were noted around features that have not been standardised in the market yet.

Conclusions

Although now somewhat out of date this report raises some interesting issues about the opportunities and barriers for the inclusion of energy efficiency measures in new or renovated homes.

It should be noted that while based on a random sample of the target population – home owners in new or extensively renovated homes – the respondents to this Survey were not typical of the average New Zealander. Survey respondents had higher incomes, were more European and more-likely to be mortgage-free than the population in general. One could expect, therefore, a higher degree of consumer sovereignty in the market. This was not evident and suggests that consumers need considerable support if they are to ask for and get energy efficient features in their homes.

1.2 Key Secondary Data Sources

This section of the report presents summary details on key secondary data sources. Typically, these data sets are national studies based on existing data sets which identify important trends and often identify data gaps and areas for further research.

The sources are listed as follows:

- The Centre for Housing Research Aoteroa New Zealand (CHRANZ)
- Housing New Zealand Corporation
- The Ministry of Social Development
- BRANZ – Building Research Association – New Zealand
- EECA – Energy Efficiency and Conservation Authority, and
- MfE – The Ministry for the Environment.

1.2.1 The Centre for Housing Research Aoteroa New Zealand

The Centre for Housing Research Aoteroa New Zealand (CHRANZ) is the research arm of Housing New Zealand Corporation (HNZC) and was launched in August 2003. CHRANZ's core business includes setting housing research priorities for the total housing market and investing in independent research.

CHRANZ's housing research priorities are:

- The New Zealand Housing System, and
- Linking Housing and Social, Economic and Environmental Outcomes.

CHRANZ makes its housing research investments with regard to these priorities and a research priority framework that is structured around six key components of the housing sector. These include access issues, housing demand and need for vulnerable populations, changing attitudes to tenure, housing investment, alternative providers, and the performance of housing in urban and rural environments.

Further information is available at: http://www.hnzc.co.nz/chr/who.html

CHRANZ has undertaken the following research project of relevance to this current project:

- Review of Statistical Housing Data
- Changes in the Structure of the New Zealand Housing Market
- The Impact on Housing Energy Efficiency of Market Prices, Incentives and Regulatory Requirements, and
- The Future of Housing in New Zealand.

Review of Statistical Housing Data[29]

Project Description—This review of available housing data was completed to facilitate research and analysis of housing related issues. The report provides a table of available primary statistical data and identifies opportunities to improve the availability and use of housing data.

Key Findings—It was not possible to precisely define the data requirements of housing researchers. This was assumed to be cause by a perceived "dearth of existing 'readily-available data' combined with a 'make-do' attitude" (direct quotes from original source) of housing researchers. The review concludes that primary raw data that is useful in the field of housing research is sparse.

Statistics New Zealand's five yearly Census of Population and Dwellings is identified as the most substantive primary data set available. Researchers have identified a need for more regular and timely comprehensive Survey data. The report concludes that the most significant identified gaps in existing data are: a lack of timely time series data; a lack of social statistics and poor awareness of existing data.

Conclusions

While this is a review of existing data, it provided a useful starting point for this review on data of energy efficiency characteristics of New Zealand houses, because if identifies many of the sources of housing related data. The review identifies current data limitations.

This is a one-off review that identifies the limitations of current data, but fails then to define the data needs of housing researchers and the steps necessary to deliver this data.

This study is a useful review of primary housing research, but does not focus specifically on energy efficiency characteristics of New Zealand houses and excludes all secondary research. Although completed in 2003, the study forms a very good starting point for Phase One of this project, because it identifies several useful data sources.

Changes in the Structure of the New Zealand Housing Market[30]

Project Description—This report analyses the housing sector in New Zealand and changes within it over the last twenty years. It looks at housing stock, housing production, supply and exchange, housing finance, market characteristics and trends since 1981, housing access, consumption, needs and demand. The report also considers housing policy and the regulatory environment.

One useful aspect of this report is that it focuses on changes since 1981, which is shortly after insulation became mandatory in all new houses.

Key Findings—There are many findings from this comprehensive report. The findings most relevant to this study are those concerning housing stock. Also of note are the statistics describing the changes in the rates of home ownership.

Key Findings on Housing Stock:

- From 1981 to 2001 the total New Zealand housing stock increased by 36.7%. Dwelling growth has been lead by regions in the north half of the North Island (Bay of Plenty, Northland, Auckland and Waikato) and the north of the South Island (Tasman, Marlborough and Nelson).
- Private person landlords have increased their ownership of rented dwellings over the period 1981 to 2001 from 60.6% to 78.4%. At the same time, rented dwellings owned by the public sector have declined from 39.4% of rented dwellings to 21.7%.
- In terms of dwelling age 6% of the stock dates back from before 1920. 24% from 1920 to the end of the 1950s, 15% from the 1960s, 19% from the 1970s, 13% from the 1980s and 13% from the 1990s.

- The average size of new dwellings has steadily increased from 146 square metres for dwellings built during the 1970s to 194 square meters for those built since the turn of the century.

Key Findings home ownership rates:

- From 1981 to 2001 there was a moderate decline in home ownership from 71.4% to 68.0%,
- From 1981 to 1991 home ownership rates increased by 2.4% to 73.8%, while the period from 1991 to 2001 saw a 5.9% decrease to 68.0%.

Conclusions

Section 7 of this CHRANZ report is entitled "Stock of Housing" and is useful for this current study. While other sections of the report of interest, they are of little value in determining the energy efficiency characteristics of New Zealand houses.

The Impact on Housing Energy Efficiency of Market Prices, Incentives and Regulatory Requirements[31]

Project Description—The aim of this project was to research the effect of prices, incentives and regulation on energy efficiency within households, and to recommend options for regulatory and market based instruments that would further encourage greater levels of energy efficiency in New Zealand houses.

Key Findings—The study noted that New Zealand is generally lagging behind other developed counties in improving household energy efficiency due to our mild climate and historically low residential energy prices. The application of energy focussed regulations has been inconsistent, for example house insulation requirements have changed little in 25 years. The history of incentives to improve energy efficiency in New Zealand has also been stop-start. The report goes on to note that a continuation of current trends is unlikely to lead to investment in substantial energy efficiency measures.

The report notes that overseas experience suggests that a mix of market mechanisms, incentives and regulations supported by information and appropriate institutional responses working together and targeting different parts of the market are what is required to deliver energy efficiency.

About 36% of the current housing stock has been built since the introduction of insulation requirements and therefore 64% of the current stock was constructed before there was any requirement to install insulation in houses.

The report identifies that there are 30 areas in New Zealand that do not meet the National Environmental Standard for air quality, mainly due to residential open fires and burners.

Conclusions

While this study is secondary research it identifies important facts and trends which are very clearly communicated. It is a well informed report with sound supporting data and clear recommendations on both shortcomings of the past and opportunities for the future.

The Future of Housing in New Zealand[32]

Project Description—This report describes a set of scenarios to show how New Zealand's housing sector might look in 2030. The three key questions the report aims to address are:

- How might the New Zealand housing sector look in 2030?
- What are the underlying forces?
- What are the implications i.e., what will this mean for key players in the housing market?

Key Findings—During this project it became apparent that some of the driving forces were firmly established and unlikely to change. These elements included: the advent of new technologies and solutions; more mass-produced/factory housing; capability changes within the construction industry; an increase in the number of households relative to the population; climate change; the need to address the quality of the 70% of 2030's housing stock that already exists; and the regulatory changes in the New Zealand building industry. These elements were assumed to be common to all the scenarios.

A reference scenario was developed based on extrapolations of current trends. The other four scenarios are described briefly below:

- **Sunrise-Sunset:** Considers regional economies focusing on regional decline.
- **Change of Heart:** Considers home ownership aspirations, housing affordability, attitude to debt and the economic life of buildings (durability).
- **Vertical Village:** Considers resource availability and prices including transport and other infrastructure.
- **Gates of Heaven:** Considers rising conservatism, strengthen Christian values and changes in demographic trends.

Conclusions

The pre-determined elements described in this report are interesting and highlight recent changes and established trends. This provides some useful demographic information, perhaps the most significant of which is that we should expect a greater increase in the number of houses than the expected increase in the population. This report includes very little information on the energy efficiency characteristics of either the current or future housing stock.

1.2.2 Housing New Zealand Corporation

Housing New Zealand Corporation (HNZC) is the Government's main advisor on housing, and services related to housing. The key HNZC work that is of most interest to this current study is the report entitled "*Building the Future: The New Zealand Housing Strategy*".

Building the Future: The New Zealand Housing Strategy[1]

Project Description—The New Zealand Housing Strategy sets out priorities for housing and a programme of action to lead the sector over ten years from 2005 to 2015.

Key Findings—The report notes the change underway within New Zealand's population and the corresponding transition therefore of the country's housing needs. The report notes that the homes of the future will be expected to perform better, cost less to maintain and live in, and be more adaptable to the changing needs of their occupants. It is recognised that housing policy can support wider goals – social, cultural and economic and contribute to sustainable development.

The Government's vision for housing is that… "*All New Zealanders have access to affordable, good quality housing appropriate to their needs*." The programmes of Action which are most relevant to the efficient use of energy are:

- Sustainable housing supply, and
- Improving housing quality and sustainability.

The Action Area on sustainable housing supply identifies a requirement to establish mechanisms for monitoring supply including data on the established dwellings market and home improvement activity. The Action Area on housing quality identifies the National Energy Efficiency and Conservation Strategy (NEECS), EECA's EnergyWise Home Grants and Housing New Zealand Corporation's Energy Efficiency Retrofit Programme.

The New Zealand Housing Strategy lists the following supporting initiatives under housing quality – Energy Efficiency and Modernisation:

- Continue to implement the National Energy Efficiency and Conservation Strategy and the Energy Efficiency and Conservation Act 2000, and investigate the implementation of a house energy rating scheme;

- Continue to improve the energy efficiency, energy conservation and use of renewable energy sources in new houses through amendments to the Building Code; and

- Continue state housing modernisation and energy efficiency retrofitting programmes.

One of the most useful characteristics of New Zealand houses identified in the New Zealand Housing Strategy is that "*older cities and those with more stable populations have more old housing*." Cities identified with more than 25% of the current housing that was constructed before 1930 are Dunedin, Wanganui and Wellington, while Nelson Whangarei and Hamilton were identified as the three cities having fewer than average pre 1930 houses.

Conclusions

The New Zealand Housing Strategy identifies priorities and programmes of action for a ten year period. It also provides some general information about housing highlighting significant trends, such as recent changes in home ownership. While from a data perspective is of little use, it does provide important strategic information. Of particular interest are the observations on the historical aspects of housing in New Zealand's cities and the most likely locations of older housing.

1.2.3 The Ministry of Social Development

The Ministry of Social Development (MSD) provides strategic social policy advice to the Government and provides social services to all New Zealanders. The key MSD report of relevance to this study is the Social Report, 2006.

The Social Report 2006[33]

Project Description—The Social Report uses a set of statistical indicators (42 in total) to monitor trends across the following 10 areas to give a picture of wellbeing and quality of life in New Zealand:

- Health
- Knowledge and Skills
- Paid Work
- Economic Standard of Living
- Civil and Political Rights
- Cultural Identity
- Leisure and Recreation
- Physical Environment
- Safety
- Social Connectedness.

The report is has been prepared annually since 2001 and monitors the wellbeing of New Zealanders.

Key Findings—The most relevant indicator for this current project is the physical environment which includes buildings. The following desired outcomes are quoted: "*The natural and built environment in which people live is clean, healthy and beautiful. Everybody is able to access natural areas and public spaces*."

The only indicators monitored with the physical environment are air quality and drinking water quality.

Conclusions

The Social Report is a useful tool to monitor changes in wellbeing and quality of life in New Zealand, so in some aspect an indicator of the way that people are living. However, the indicators on the physical environment are not currently sufficient to monitor the quality of the built environment. Currently they tell us nothing about the energy efficiency characteristics of New Zealand houses.

1.2.4 Building Research Association of New Zealand (BRANZ)

The key BRANZ report of relevance here is the report on insulation trends in New Zealand's houses.

Insulation Trends in New Zealand Houses[34]

Project Description—This report uses data form the New Zealand House Condition Surveys completed in 1994 and 1999 to estimate the voluntary levels of retrofit insulation in pre-1977 house ceilings.

Key Findings—The rate of retrofit of ceiling insulation in pre-1980 houses is estimated to have been approximately 1.3% per year between 1994 and 1999, or 12,000 houses per year.

Conclusions

This report estimates trends in the rate that ceiling insulation is being installed in pre-1977 houses. It is a unique study which shows the rate of voluntary improvement compared to government funded interventions such as EECA's EnergyWise Home Grants and various Housing New Zealand Corporation projects.

While the report is somewhat dated it is of value to compare the scale of improvements as a result of government subsidies with the rate of autonomous improvement by home owners.

1.2.5 Energy Efficiency and Conservation Authority (EECA)

The Energy Efficiency and Conservation Authority (EECA) has produced two key sets of data of relevance to this current project:

- Situation Assessment Report on the National Energy Efficiency and Conservation Strategy, and
- Sustainable Energy Value Project.

Details of these projects are presented in the following sections.

Situation Assessment Report on the National Energy Efficiency and Conservation Strategy[35]

Project Description—This report assesses progress made under the National Energy Efficiency and Conservation Strategy (NEECS) since September 2001, identifies international best practice and opportunities to improve New Zealand's energy efficiency and renewable energy performance.

Key Findings—The report notes that the NEECS achieved necessary changes and laid the foundation for New Zealand to further strengthen its energy efficiency and renewable energy performance.

Generally however, New Zealand's energy efficiency improved at a modest rate consistent with normal rates of replacement of energy using plant and appliances. Within EECA's Buildings and Appliance programmes it is noted that a redesigned and growing residential energy efficiency retrofit programme has improved insulation in about 17,000 of the 100,000 targeted homes.

Conclusions

Within the Buildings and Appliances programme the summary states that: "*Progress in improving the energy efficiency of New Zealand buildings has been very limited, although a research base for future improvements has been established.*"

The report is a broad economy wide assessment of progress toward specific energy efficiency and renewable energy targets over a five year period. Therefore it includes little detailed information on the energy efficiency characteristics of New Zealand houses other than note that significant progress is yet to be made.

Sustainable Energy Value Project[36]

Project Description—The Sustainable Energy Value Project is an evaluation of options for intervention in stationary energy efficiency and renewable energy. The report provides estimates of the costs of a range of possible energy efficiency improvements and of the increased use of renewable energy. It assesses the benefits in terms of saved energy costs and reductions in greenhouse gas emissions.

Key Findings—Energy savings in excess of 13.8PJ per annum are available at a net social benefit by 2030 (this assumes that a 5% discount rate is applicable). This compares with a base case projection of stationary consumer energy demand rising from 350PJ to 400PJ by 2030. Therefore:

- There are opportunities for "no cost" and "low cost" improvements in energy efficiency in all sectors.
- Interventions focussed on encouraging renewables in the electricity sector will have the most significant impact as a means to reduce CO_2 emissions.

Conclusions

The analysis carried out demonstrates that cost effective energy efficiency improvements exist; however, it provides no significant data on the energy efficiency characteristics of New Zealand houses or how to encourage New Zealanders to undertake energy efficiency improvements to their homes.

1.2.6 Ministry for the Environment (MfE)

As part of its work on air quality, the Ministry for the Environment undertook project work focussing on home heating beginning in 2005. The Warm Homes Project has established useful information on heating types in New Zealander's homes and the drivers in terms of the choices people make on how they heat their homes. Further details can be found at http://www.mfe.govt.nz/issues/energy/warm-homes/history.html

Two key reports are noted here:

- Warm Homes Technical Report: Social Drivers: Phase 1: Interim Progress Report, and
- Warm Homes Technical Report: Home Heating Methods and Fuels in New Zealand.

Warm Homes Technical Report: Social Drivers: Phase 1: Interim Progress Report[37]

Of particular interest to this current project are the observations made in the Studies focussed on the social drivers influencing choices of heating. Further details can be found at http://www.mfe.govt.nz/publications/energy/warm-homes-social-drivers-phase1-nov05/html/page5.html#table41

Of particular interest to this current project it is noted that when Surveyed, respondents indicated that the current lack of a Home Energy Rating Scheme was one of the factors that inhibits energy efficiency improvement. The report notes

> *"Unlike a number of other countries, there is no Home Energy Ratings Scheme (HERS) operating in New Zealand. A HERS would provide a tangible measure of the energy performance of the house - information that could inform potential homebuyers or renters. The lack of such a rating scheme acts as a disincentive for home owners to invest in energy efficiency improvements, especially if the owner intends to sell the house in forthcoming years, because the investment often remains invisible and unable to be recouped through a higher value on the house".*

Further, the report notes that the motivation for the installation of double glazing are related not only to do with "*comfort [and] reducing condensation*", but also notably, "*improving the home's value*").[38]

In general, this study makes some interesting observations with respect to householder attitudes towards home heating, energy efficiency and energy related improvements.

Warm Homes Technical Report: Home Heating Methods and Fuels in New Zealand[39]

Further work commissioned by the Ministry focussed on a Survey of home heating methods and fuels used in New Zealand. This report presented the results of a Survey of domestic heating methods and fuels carried out in 29 urban areas of New Zealand. The purpose of the Survey was to collect information to be used in the assessment of measures to reduce PM_{10} (suspended particles) emissions from domestic home heating in these areas. Additional information was collected on house variables including insulation, cost of heating, number of bedrooms, age of dwelling, household tenure and income. The Survey was nationwide and presents national data and data for each of the 29 urban areas. Further details can be found at http://www.mfe.govt.nz/publications/energy/warm-homes-home-heating-methods-fuels-nz-nov05/html/index.html

The report presents the following details likely to be of interest / relevance to this current study:

- *House insulation summary statistics, New Zealand*

Survey results suggest that around 10% of houses in New Zealand may have no insulation or basic energy efficiency measures. Around 71% have ceiling insulation and 50% have wall insulation. Floor insulation was less common at 22% of houses. About 10% of houses were double-glazed and 23% had hot water cylinder wraps fitted. Twenty-six % of households have only one of these energy efficiency options and 1% have all five measures.

- *Degree of house insulation, by heating method, New Zealand*

Survey results here are not as easy to interpret and so come to any significant conclusion on the type of insulation and any link there may be to type of heating in the households Surveyed. Results do show that for all heating types (electricity, gas, wood burner, multi fuel and open fire) most have only one or two types of insulation measures (from the following five - ceiling insulation, wall insulation, underfloor, double glazing and cylinder wrap.

Additional results in the study of some interest present *'Home heating method, by household income, New Zealand'*. The interest here is in establishing if there is a link to method of heating and household income. Again the results are difficult to interpret with no significant finding obvious about how income might influence choice of heating type. Results do indicate that homes with incomes greater than $50,000 are more likely to have gas or open fires. The data does not indicate if the heating types shown are the main types of heating.

The report does not present findings on insulation types against household income or home ownership although it is expected that this could be possible on request.

1.3 Other Data Sources

This section includes other data sources, both primary and secondary, which are targeted at a particular area or region of the country or at a particular demographic group. For each study, this section notes the strengths and limitations of each. Finally, some international

experiences were also researched specifically on householder demographics and energy efficiency characteristics.

The studies have been carried out by the following organisations:

- UMR Research Ltd
- Community Energy Action, and
- Building Research Association of New Zealand (BRANZ).

1.3.1 UMR Research Limited

Consumer Research – Energy Efficient Behaviour (A Quantitative Study)[40]

Project Description—The aim of this research was to provide trendline information on consumer's attitudes to energy efficiency and their behaviour in an energy efficiency context and follows on from a benchmark study conducted in 2003.

Key Findings—The following summary includes the key findings which relate only to energy efficiency in houses:

- Motivations and barriers varied across different energy efficiency behaviours; therefore, different strategies may be necessary to drive changes in behaviour for different actions.
- Some action will only be considered in a power crisis.
- Rising costs have made people more receptive to messages on energy efficiency.
- The cost saving argument can be strengthened when used in conjunction with the message that actions also help the environment and are basic common sense.
- Linking energy efficiency behaviours with health benefits is a powerful driver.
- There is reasonably strong interest in information describing actions that would provide the greatest cost savings.
- 70% of those Surveyed consider they are making a positive effort towards energy efficiency at home (up 5 points from 2003).
- Older New Zealanders were more likely to declare they were making greater effort at home.
- Younger people and those earning more than $70,000 per annum declare that they are making lower levels of effort.
- Most like actions are closing curtains at sunset, systematically turning off lights in unused areas and installing underfloor and ceiling insulation.
- Least likely actions were to install a solar hot water system or a heat pump.

Conclusions

While this report contains no specific information on the energy efficiency characteristics of New Zealand houses, it does provide useful information on what might drive changes in energy related behaviour.

1.3.2 Community Energy Action

An Assessment of the Current Levels of Home Insulation in Christchurch[2]

Project Description—This study aimed to: determine the total number of un-insulated and under-insulated houses in Christchurch and the number of these houses which are lower income households with pre-school children, and those occupied by elderly residents. The study uses other data sources to establish the total housing stock and age distribution for Christchurch and then established the tenure and insulation status of those houses.

The study acknowledges the difficulty in achieving the aim and the data gaps (particularly relating to rental properties). Although the study states that results should be considered indicative in a number of areas, it is based on a wide range of primary and secondary sources and is considered to be as comprehensive as possible (given the limitations in source data).

The study uses census information, data on building consents, information on owner occupies houses from the BRANZ House Condition Survey, data on rental properties from Housing New Zealand Corporation and Christchurch City Council, information from Environment Canterbury's Clean Heat Project and data from a Survey on home heating and insulation carried out by the Ministry for the Environment.

Key Findings—Insulation levels in Christchurch houses are generally better than the national average due to the a range of interventions targeting the existing housing stock, driven initially by Community Energy Action and more recently supplemented by Environment Canterbury's Clean Heat Project.

Most houses in Christchurch have some ceiling insulation. Approximately 4% of houses have no ceiling insulation, although some of these will have inaccessible roof spaces. It is estimated that 40% of houses (55,000) currently have substandard ceiling insulation.

In Christchurch 45% have concrete floors whose insulation properties cannot practically be improved. It is estimated that 33% of houses (45,000) can practically have there floor insulation improved. These are suspended timber floors where the sub floor space is accessible.

While approximately 48% of houses (65,000) have no wall insulation, this is expensive to remedy and therefore retrofit progress is expected to be slow.

In new houses 90% are now fitted with double glazed windows; however the retrofit market is expected to be small.

The analysis indicates a substantial potential for further activity based on ceiling top-ups and insulating suspended timber floors. The rental sector appears to be lagging owner-occupied houses a little. The need for energy efficiency improvements are city wide i.e., not concentrated in any specific areas.

Conclusions

This is a comprehensive study of the insulation characteristics of Christchurch houses, based on currently available data sets. The methodology appears to be robust and based on analysis from a variety of data sources. There was some difficulty resolving

differences in results from different data sources and there is limited data available on the private rental sector. This study provides very good information on the insulation status of houses in Christchurch.

1.3.3 Building Research Association of New Zealand (BRANZ)

Energy Efficiency of Houses in Wanganui Determined from the HERO Programme[41]

Project Description—This report describes the findings from the first large scale application of a home energy efficiency rating scheme in New Zealand. This project took place in the Wanganui area in 1992 and involved a random selection of 700 houses.

Key Findings—The study profiled the energy efficiency of houses in Wanganui. The energy efficiency rating was mainly determined by the efficiency of the hot water system and the level of insulation. Higher energy efficiency ratings were achieved by houses constructed after the introduction of compulsory insulation in new houses.

On average, houses with better energy efficiency ratings were found to use as much energy as those with lower ratings.

Conclusions

The data from this Survey is held by BRANZ and ECNZ. While the data is now out of date, the general findings are of interest. Wanganui is of particular interest, because it is one of New Zealand's older cities with a stable population, which results in an older housing stock than average and therefore, perhaps greater potential to improve energy efficiency.

1.3.4 International Experiences – Demographics and Energy Efficiency

A brief internet search identified some studies indicating how the energy efficiency characteristics of householders varied (if at all) with demographic categories such as income, age and tenancy.

An Australian study[42] on the factors which motivate home energy action amongst householders indicated that age demographics have mixed effects on energy consumption but that studies show older householders are less willing to reduce the temperature at which they heat their home. Income has an interesting effect on behaviour and attitude with higher-income homes consuming more than low income homes even though their homes may be more energy efficient (in terms of measures and appliances). Low-income homes often have the greatest need for improved energy efficiency but the least ability to invest in energy efficient measures. Their approach can be simply to change their lifestyle, i.e., not to use the energy (for example won't turn the heating on) and in doing so, view themselves as energy efficient. Low income households in the US tend to live in old homes that are not insulated.

Studies also show that in general, most householders irrespective of demographics know little about their energy use and how it might be affected by their actions or inactions.

A UK report[43] explored the effects of giving advice to domestic consumers and noted some findings on the basis of demographic characteristics, in particular tenancy and income. The demographic groups which seem likely to save more as a result of behavioural changes in cooking and the use of appliances were tenants in state housing, low income households, householders with a manual profession and households where English was not their first language. High income and professional households seem likely to save less as they follow fewer tips.

After the provision of advice on how best to use heating and hot water most savings could be seen from private tenants (i.e., non-state rental housing), quite low income households and people aged 16 to 34. Higher income houses and those on the lowest incomes changed their behaviour less after advice. This study concluded in this case that for higher income households it was probably because they can afford not too, and low income households because some may already do much to save energy and may have few options remaining.

Savings observed from changes in the use of lighting among various demographic groups were similar, although quite low income households seem likely to save more than high income households.

In terms of the savings made from following so called 'other' energy saving tips (closing curtains or blinds at dusk and opening them at daylight, fitting heavier curtains, and blocking up unused chimneys and gaps in floorboards) the report notes that higher than average savings should be made by those on modest incomes, those whose first language is not English, skilled and non-skilled manual workers, and 16-34 year olds. It's worth noting here that the study showed that 38% of the sample studies recalled these 'other' energy saving tips and most recipients (85%) followed some of this advice (each doing three or four things).

1.4 Research on Home Energy Rating Schemes

This section presents brief details of specific EECA commissioned reports focussing on Home Energy Rating Schemes. These reports provide useful information on how receptive those households questioned were towards a Home Energy Rating Scheme and notes aspects that should be considered in the design of the scheme in order to maximise uptake.

1.4.1 A Home Energy Rating Scheme in New Zealand: Evaluation of the Warm Home Energy Check Pilot[4]

This project was a joint EECA and Environment Canterbury (ECan) initiative on a pilot Home Energy Rating Scheme piloted in Christchurch – a Warm Home Energy Check (WHEC). The objective of the project was to:

- establish a star rating pilot scheme for houses to be used to assess energy efficiency retrofits in houses; and
- to provide incentives for home owners and landlords to invest in energy efficiency in homes.

A total of 73 paid WHEC checks were performed from February to June 2003. In addition, 645 free WHEC checks were performed to ECan's Clean Heat Project participants. Details of the findings of the research conducted after the pilot are presented in the following two subsections. Research was undertaken by UMR Research Ltd. on behalf of EECA.

Although homeowners in the study were not questioned about the rating and their perception about what it could do to the value of their home or its attractiveness in the retail market, the link to property value was made in the study and EECA canvassed the views of 100 real estate agents. The agents indicated that they were generally not opposed to the idea of a Home Energy Rating Scheme being made mandatory in the future for houses at the time of sale, as they would see it as a progressive step from a voluntary scheme. They noted that it was likely that only those owners of properties with a good HERS rating would want to use it to sell their property and that it was important for the public to be educated about how a good rating could help sell their property.

While this pilot project had low levels of participation, and there was a degree of confusion about the scheme locally, several positive messages emerged from it. Initial cost assessments of the WHEC pilot showed that it was a cost effective mechanism for EECA to improve the energy-efficiency in the New Zealand building stock, including new houses. Finally, this 2003 study recommended that the pilot be expanded to a nationwide home energy rating scheme with a number of improvements including the inclusion of space heating assessment in the assessment.

1.4.2 Warm Home Energy Check – A Qualitative Study[5]

Under contract to EECA, UMR Research Ltd undertook the research post the pilot WHEC in Christchurch. A Qualitative and a Quantitative study were under taken.

The aim of this qualitative study was to assess the level of interest in the WHEC scheme and for those who participated in it, their level of satisfaction. The study also looked at

how people responded to the recommendations and what barriers appeared to have prevented them from acting on the recommendations.

The study consulted a small number of homeowners who either participated in the scheme or who did not participate but were aware of it. While the sample size was small, the study was supported by a subsequent quantitative study.

The study demonstrated that most respondents had already implemented recommendations or intended to do so. Cost was identified as the main barrier to implementing recommendations and the prospect of incentives to encourage uptake were supported.

The study looked at how details of the WHEC had been communicated and canvassed views from participants on the most effective methods. The study also noted the key driving factors that made people respond to the initiative – warmth, cost savings and trustworthy advice. Other issues identified included health and environmental impact.

The study demonstrated that good quality, reliable and independent information would be key if a HERS was to be successful. The actual rating received by respondents appeared to have been of limited interest rather the focus was on increased comfort and warmth. Some participants weren't entirely convinced of the benefits of the WHEC, again emphasising the need for good information indicating clearly how particular measures save money and deliver warmth.

The Christchurch home owners generally responded positively to the WHEC experience. This study covered homeowners and included a mix of age, gender and income levels.

Finally, it is worth noting that Christchurch benefits from a number of initiatives on heating and energy efficiency not least the activities of the locally based energy charity Community Energy Action and also the activities of Environment Canterbury.

1.4.3 Warm Home Energy Check – A Quantitative Study[6]

The quantitative study telephoned 200 households in Christchurch with the aim of establishing the following:

- The level of satisfaction with the WHEC including:
  - Accessing the accredited assessor
  - Cost of the service, value for money
  - The assessment process
  - The Physical appraisal outcome
  - The star rating
  - The written report
- Measure the level of intention to undertake the recommendations
- Identify barriers and effective incentives to undertake the recommendations
- Collect demographics, and
- Identify useful media for communication.

The research showed that the WHEC was well received by the participants with most implementing some of what was recommended. The most expensive recommendations were, as could be expected least likely to be installed (double glazing, solar water heating

and wall insulation). Cost was identified as being the key barrier. Many respondents weren't entirely happy about the star rating their home received in the assessment.

Interestingly the respondents most interested in a WHEC were older females on low incomes. Most respondents liked the idea of incentives as a means to encourage them to undertake energy efficiency improvements. Incentives identified included discounts and grants.

In terms of methods of communication relating to the WHEC, respondents indicated TV, mail-drops, articles in the local press and radio were, in their view, the most effective media to encourage uptake of the recommendations. The driving force to undertake any recommendations were the likelihood of greater comfort/warmth, health benefits, energy efficiency and power cost savings.

The study further confirmed the importance of good quality, reliable, independent information and advice. The study did not touch on the relative merits of a HERS and the ability of a higher rating to enhance property value or relative attractiveness on the real estate market.

1.4.4 Final Report: Home Energy Rating Scheme Consultancy[8]

Project Description—This EECA commissioned project presents a comprehensive review of national and international HERS, noting their relatives successes, and sets out the policy options to implement such a scheme in New Zealand. The study recommends the best policy option and presents a cost benefit analysis of its implementation. The ultimate aim of such a scheme, the report notes, is to contribute to improved energy efficiency in the residential housing sector, notably the middle and high income sectors. Low income homes are already being addressed in other ways.

Key Findings—The report notes the advantages and disadvantages of HERS that are voluntary and mandatory and how such schemes are typically implemented. Some HERS are independent, stand-alone programs and others are linked to energy efficiency encouragement programs. Typically, if linked to an energy program, the HERS is used to help determine eligibility for the program, to identify the energy efficiency changes required or to determine the grant or incentive that the householder was eligible for under the program. The range of energy efficiency programs include:

- Energy efficiency mortgage programs
- Home retrofit grants or incentives
- Heating-fuel subside grants and discounts
- Community energy efficiency programs.

The authors note that available information suggests voluntary HERS have a low participation rate (typically under 1% annually). While the majority of home owners do undertake some retrofitting of their home after receiving a home energy rating, uptake is low and the resulting energy efficiency improvement of housing stock is therefore quite small.

For those HERS reviewed which are linked to energy efficiency programmes, the authors noted that information strongly suggests that linking energy efficiency programs to HERS can lead to successful programmes but again, the evidence available on the effectiveness

and participation rates of energy efficiency schemes suggests only small changes in residential energy efficiency but that participation rates are also around 1% annually.

Currently mandatory HERS are linked to new homes, with the exception of the mandatory scheme operating in the Australian Capital (ACT) and the new proposals for Energy Performance Certificates in Europe as part of the EU Directive (covering existing properties and required at the point of sale or letting). While limited evidence exists on the effectiveness of a mandatory HERS, the success of the ACTHERS is encouraging. Evidence does show a link with housing sales, higher ratings lead to higher prices for properties and the scheme has successfully raised awareness of energy efficiency issues amongst householders.

Conclusions

The authors identified the following policy options for consideration for New Zealand:

- Energy Efficiency Incentive Programs,
- Home Energy Audits,
- Voluntary HERS,
- Mandatory HERS, and
- Housing Standards.

For each, the advantages and disadvantages are considered. Ultimately the authors recommend an approach for New Zealand as follows:

1. Starting point –a voluntary HERS
2. Next, an energy efficiency incentive scheme (targeting ceiling insulation) (to accompany the voluntary HERS)
3. Then, a mandatory HERS for home owners (required at the point of sale),
4. Finally, a mandatory HERS for the rental market.

The report then presents a cost-benefit analysis of this policy option. Finally the report notes that further research is required on the current energy efficiency condition of New Zealand homes, especially in the rental and regional sectors, before a HERS (and incentive programme) is designed and implemented. Additional research will also be required to establish the most acceptable level of pricing of the HERS assessments and the exact nature of the incentive programmes.

1.4.5 Promoting Home Energy Rating Scheme in New Zealand[7]

This University of Otago report presented an overview of HERS in the United States and in Australia noting also EECA's initiatives to date to promote the idea of a HERS in New Zealand. The study also canvassed views of Dunedin homeowners and real estate agents on the merits of a HERS using a questionnaire. The response rate was 17 out of 300 questionnaires (5.6%) and 6 out of 10 questionnaires (4%) for homeowners and real estate companies respectively. The study does not gather information on householder income.

Generally the report indicates that those who responded generally did so favourably towards the idea of a HERS and a willingness to improve the energy efficiency of their homes. Generally it was not felt (by homeowners and agents alike) that a high rating was likely to make a property more attractive for sale. Generally there appeared to be a low level of awareness of energy efficiency. The report noted a strong need for awareness

raising amongst the general public and a key role for real estate agents. The report also noted the scope for making an initial HERS voluntary but recognised that for ultimate success and to ensure positive change in the energy efficiency of New Zealander's homes, the scheme would need to be mandatory. The idea of a mandatory scheme, in due course, seemed to be supported by most of those homeowners questioned.

Although a small Survey and limited to Dunedin only, this report presented useful findings on the attitudes not only of homeowners but also of 6 real estate agencies who could have a key role to play in any HERS implemented in New Zealand whether voluntary of mandatory.

Appendix 2 Table of Phase One Information and Data Sources

Source	Title	Date	Frequency	Comment/Relevance
Statistics New Zealand	Census of Population and Dwellings	2006	5 yearly	The main primary source of housing statistics covering the entire population and country.
Statistics New Zealand	Household Economic Survey	2004	Annually to 1998, then 3 yearly	A sample Survey focused on income and expenditure patterns of households.
Statistics New Zealand	Building Consents	ongoing	monthly	Details on the number, value and building type for all building consents issued by territorial authorities in New Zealand.
Quotable Value New Zealand	Residential property - price movement	ongoing	monthly	Statistics on %age changes and average sale prices for residential property by council and main urban area.
Quotable Value New Zealand	House/flat - Freehold open market summary	ongoing	quarterly	Statistics on the number of sales, average sale price and average capital value for houses flats and sections.
Quotable Value New Zealand	Houses - Quarterly price index	ongoing	quarterly	Measures the change in house prices by council areas throughout New Zealand
Quotable Value New Zealand	Houses/flats - Number and average sale price	ongoing	quarterly	Includes number of sales, average sale price and capital value of houses flats and sections.
Quotable Value New Zealand	Residential property sales summary	ongoing	quarterly	Includes number of sales, average sale price and capital value of residential houses flats and sections.
Quotable Value New Zealand	Urban property sales statistics	ongoing	half yearly	Sales information on property in main urban areas, including residential, commercial and industrial.
Quotable Value New Zealand	NZ real estate market summary	ongoing	half yearly	Summarises sales activity in a range of property types.
Building Research Association of New Zealand	New Zealand House Condition Survey	2005	1994, 1999 & 2005	A national Survey on the condition of houses based on physical inspections focuses on the three main population centres.
Building Research Association of New Zealand	Household Energy End-use Project (HEEP)	2007	Project	A long term study to measure and model energy use in New Zealand houses.
Building Research Association of New Zealand	Insulation Trends in New Zealand	2003	Project	This report uses data from the New Zealand House Condition Surveys to estimate the number of uninsulated houses and the rate that these houses are being insulated.

Building Research Association of New Zealand	Energy Efficiency of Houses in Wanganui Determined from the HERO Programme	1992	Project	Describes the findings from the first large scale application of a home energy efficiency rating scheme in New Zealand.
The Centre for Research Evaluation and Social Assessment (CRESA)	Panel Survey for Building Attachment Project	not yet reported	Project	A five year research project which explores the dynamics and drivers of residential mobility and transience and its impacts.
The Centre for Research Evaluation and Social Assessment (CRESA)	National Landlords Survey - Preliminary Analysis of the Data	2004	Project	The report identifies a lack of a systematic approach by many landlords to tenancy management and property maintenance.
The Centre for Research Evaluation and Social Assessment (CRESA)	The Condition of Opotiki's Rural Housing Stock: A Survey of Three Communities	1998	Project	This research provides data on the energy efficiency characteristics of a sample of provincial and rural houses in a low-income area.
The Centre for Research Evaluation and Social Assessment (CRESA)	National Repairs and Maintenance - homeowner Survey	2005	Project	This is the phone Survey component of the New Zealand House Condition Survey
The Centre for Research Evaluation and Social Assessment (CRESA)	Retrofitting Insulation in the Eastern Bay of Plenty - A retrospective Evaluation	2001	Project	This report provides an objective and independent assessment of the outcomes and perceptions of a retrofit programme in Eastern Bay of Plenty.
The Centre for Research Evaluation and Social Assessment (CRESA)	Disability/Housing Experience Survey	2006	Project	This study suggests that New Zealand houses have poor thermal performance and the impact on disabled people is particularly pronounced because of their vulnerability to cold.
The Centre for Research Evaluation and Social Assessment (CRESA)	Climate Change Report - The Social Dynamics of Climate Change Responsive Housing	1998	Project	One part of a research project into the extent to which the construction industry has the capacity and/or inclination to respond to the demands of climate change.
The Centre for Housing Research Aoteroa New Zealand	Review of Statistical Housing Data	2003	Project	The report includes a table of primary statistical data and identifies opportunities to improve the availability and use of housing data.
The Centre for Housing Research Aoteroa New Zealand	Changes in the Structure of the New Zealand Housing Market	2004	Project	This is a comprehensive report on the housing sector in New Zealand. Section 7 titled "Stock of Housing" provides an excellent overview of the age profile of houses.
The Centre for Housing Research Aoteroa New Zealand	The Impacts on Energy Efficiency of Market Prices, Incentives and Regulatory Requirements	2006	Project	This project researched the effect of prices, incentives and regulation on energy efficiency within households.

The Centre for Housing Research Aoteroa New Zealand	The Future of Housing in New Zealand	2006	Project	This report describes a set of scenarios to show how New Zealand's housing sector might look in 2030
Housing New Zealand Corporation	Building the Future: The New Zealand Housing Strategy	2005	10 yearly	The New Zealand Housing Strategy sets out priorities for housing and a programme of action to lead the sector over ten years from 2005 to 2015.
The Ministry of Social Development	The Social Report	2006	Annually since 2001	The Social Report uses statistical indicators to monitor trends over 10 areas to give a picture of wellbeing and quality of life in New Zealand.
The Energy Efficiency and Conservation Authority	Sustainable Energy Value Project	2006	Project	This is an evaluation of options for intervention in stationary energy efficiency and renewable energy.
The Energy Efficiency and Conservation Authority	A Home Energy Rating Scheme in New Zealand: Evaluation of the Warm Home Energy Check Pilot	2003	Project	This report recommended that the pilot be expanded to a nationwide Home Energy Rating Scheme and that space heating should be included in the assessment.
The Energy Efficiency and Conservation Authority	Warm Home Energy Check: A Qualitative Study	2003	Project	This study assessed the level of interest in the WHEC and the level of satisfaction of the households who participated in the scheme.
The Energy Efficiency and Conservation Authority	Warm Home Energy Check: A Quantitative Study	2003	Project	This study was a telephone Survey to assess the level of level of satisfaction of the households who participated in the scheme.
The Energy Efficiency and Conservation Authority	Final Report: Home Energy Rating Scheme Consultancy	2005	Project	A comprehensive review of national and international Home Energy Rating Schemes.
Ministry for the Environment	Warm Homes Technical Report: Social Drivers: Phase 1: Interim Progress Report	2005	Project	This study reports on the social drivers influencing heating choices and includes observations of householder attitudes towards home heating and energy efficiency.
Ministry for the Environment	Warm Homes Technical Report: Home Heating Methods and Fuels in New Zealand	2005	Project	The study includes a summary of insulation statistics and details on insulation levels for different heating types and household incomes.
UMR Research Limited	Consumer Research - Energy Efficient Behaviour (A Quantitative Study)	2003	Project	Trend line information on consumer attitudes to energy efficiency and resulting behaviours.
Community Energy Action	An Assessment of the Current Levels of Home Insulation in Christchurch	2006	Project	A comprehensive study of the insulation characteristics of Christchurch homes.
University of Otago	Promoting Home Energy Rating Scheme in New Zealand		Project	An overview of Home Energy Rating Schemes in the United States and in Australia noting also EECA's initiatives to promote the idea in New Zealand.

Appendix 3 Definitions used in Area Units

Household Income: Based on initial discussions with EECA high income was defined as household income above $40,000. Analyses were also undertaken of Area Units based on household income above $50,000. The selection the data is sorted based on the %age of houses in the area unit above this income level. If the income level is adjusted slightly the ranking of area units based on income level is not expected to change considerably.

Currently therefore, high income households are those with a household income above $40,000 and low income households are those with a household income below $40,000.

House Age: Old houses are those built before 1980, because insulation requirements in new houses became mandatory in most parts of New Zealand in 1978. New houses are those built since 1980.

Rural Areas: Have been selected based on the Statistics New Zealand report titled "Defining Urban and Rural New Zealand". Rural areas have been selected with a moderate or low urban influence rather than highly rural/remote areas.

Appendix 4.1 Area Unit Characteristics

Area Unit Code	Area Unit Name	Territorial Authority	Region	Tenure (% owner occupied)	House Age (%age of houses built before 1980)	Household Income (%age above $40,000)	Household Income (%age above $50,000)
574600	Wadestown	Wellington City	Wgtn	70%	89%	74%	68%
565602	Endeavour	Porirua City	Wgtn	86%	1%	80%	75%
509500	Stanley Bay	North Shore City	Akld	69%	90%	66%	59%
602100	Waldronville	Dunedin City	Otago	88%	94%	40%	28%
571100	Cannons Creek North	Porirua City	Wgtn	22%	98%	18%	11%
536514	Bethlehem	Tauranga City	BOP	72%	22%	47%	37%
609029	Matukituki	Queenstown Lakes District	Otago	69%	18%	48%	36%
603100	Stuart St-Frederick St	Dunedin City	Otago	19%	92%	24%	17%
517100	Point England	Auckland City	Akld	21%	86%	20%	15%
514103	Auckland Central East	Auckland City	Akld	20%	12%	33%	27%
601301	Waihemo	Wataki District	Otago	74%	89%	34%	27%
542200	Edgecumbe Community	Whakatane District	BOP	69%	83%	31%	33%
536513	Bethlehem East	Tauranga City	BOP	84%	2%	56%	44%
569301	Normandale	Lower Hutt City	Wgtn	84%	79%	70%	60%
573200	Aro Street-Nairn Street	Wellington City	Wgtn	24%	82%	37%	31%

Appendix 4.2 Data Field Summary

These are the data fields which are available in the data base. More detailed information is available on each of these fields. Tables can be developed for each data field or those of most interest to EECA. EECA has a copy of the complete data-base for further analysis as required.

Area Unit Name	TOTAL - Count of Occupied Dwellings	TOTAL Usually Resident Population Count	TOTAL - Years At Usual Residence	TOTAL - Household Composition	TOTAL - Sector of Landlord	TOTAL - Source of Household Income	TOTAL - Tenure of Household	TOTAL - Total Household Income	TOTAL - Weekly Rent Paid	TOTAL - Dwelling Type	TOTAL - Fuel Type Used To Heat Dwelling	TOTAL - Number of Bedrooms
Wadestown	1185	3069	3069	1176	288	2685	1173	1173	336	1185	2316	1185
Endeavour	783	2595	2586	777	57	1560	777	777	87	780	1368	780
Stanley Bay	693	2160	2166	681	159	1422	681	681	189	687	1305	687
Waldronville	195	540	543	195	15	342	195	195	21	198	441	195
Cannons Creek North	891	3159	3162	879	591	1578	882	882	618	888	1359	888
Bethlehem	573	1776	1773	570	108	1191	570	570	132	573	957	573
Matukituki	114	282	279	99	15	210	96	99	27	105	240	105
Stuart St-Frederick St	762	2400	2397	723	534	1836	726	723	549	741	1107	741
Point England	1260	4194	4200	1245	855	2031	1245	1242	870	1254	1761	1254
Auckland Central East	1575	3537	3525	1407	819	2217	1410	1410	864	1485	1569	1485
Waihemo	264	636	636	255	36	507	252	255	57	258	558	261
Edgecumbe Community	591	1674	1665	588	153	1026	588	588	162	591	969	591
Bethlehem East	768	2238	2232	765	66	1575	768	765	99	768	1095	768
Normandale	732	2055	2046	726	78	1494	729	729	99	732	1422	732
Aro Street-Nairn Street	1488	3327	3321	1458	1011	3057	1458	1458	1035	1479	2067	1476

Appendix 5 Telephone Survey

07-073
FEBRUARY 2007

HOUSEHOLD ENERGY EFFICIENCY AND CONSERVATION

QUESTIONNAIRE

START TIME: _____

PROPERTY DETAILS

Q.1 "Do you own or rent the home you are living in?" (CIRCLE ONE)

Own ---------- 1
Rent ---------- 2
Other (please specify) _____ 3

Q.2 "When was the home built?" (DO NOT READ OUT. CIRCLE ONE. ENCOURAGE RESPONDENT TO ESTIMATE IF UNSURE.)

Before 1970 ---------- 1
1970-1980 ---------- 2
1981-1990 ---------- 3
1991-2000 ---------- 4
2001-2007 ---------- 5
Don't know ---------- 6

Q.3 "How many bedrooms are there in your home? Please include rooms or sleepouts furnished as bedrooms and any caravan that this household uses as a bedroom."

[ ] (RECORD NUMBER)

Q.4 "How many bathrooms are there in your home?" (NOTE THESE ARE ROOMS THAT HAVE A BATH/SHOWER – DO NOT INCLUDE SEPARATE TOILETS.)

[ ] (RECORD NUMBER)

Q.5 "Is the property built on a concrete slab?" (CIRCLE ONE)

Yes – 1 No – 2 Don't know – 3

RECORD ANY COMMENTS MADE BY RESPONDENT:

_____

_____

ENERGY

Q.6 "Compared with other households, would you say your household energy consumption is…?"
(READ OUT ALL AND CIRCLE ONE.)

"Very high" ---------- 1
"High"---------- 2
"About average" ---------- 3
"Low" ---------- 4
"Very low" ---------- 5

DO NOT READ OUT: Don't know-------- 6

Q.7 "Did you consider any of the following energy issues when you bought, built or rented the home that you are currently living in? Please say 'yes' or 'no' for each."
(READ OUT AND CIRCLE YES OR NO FOR EACH.)

	Yes	No	Don't know
a. "What the energy bill might be like"	1	2	3
b. "Your comfort or warmth within the home"	1	2	3
c. "Whether it had insulation in the roof space or under the floor"	1	2	3
d. "Whether it had double glazing"	1	2	3
e. "Whether the windows and doors were tight fitting or draught-proofed"	1	2	3
f. "Did you consider any other energy issues?" (SPECIFY) _____ _____ _____	1	2	3

Q.8 "Are any of the following areas in your home insulated? Please say 'yes' or 'no' for each" (READ OUT AND CIRCLE ONE FOR EACH)

	Yes	No	Don't know
a. "The roof space"	1	2	3
b. "External walls"	1	2	3
c. "Under the floor"	1	2	3

Q.9 "Do you live in an energy efficient home?" (CIRCLE ONE)

Yes – 1 No – 2 Don't know – 3

Q.10 "Do you live in a water efficient home?" (CIRCLE ONE)

Yes – 1 No – 2 Don't know – 3

HEATING AND COOLING

Q.11 "Which of the following do you use for water heating? Please answer 'yes' or 'no' for each." (READ OUT AND CIRCLE ONE FOR EACH IN Q.11 GRID)

	Q.11 Use			**Q.12 Main**
	Yes	No	Don't know	
a. "Electricity"	1	2	3	1
b. "Gas"	1	2	3	2
c. "Wood wetback"	1	2	3	3
d. "Instantaneous gas or electricity"	1	2	3	4
e. "Solar"	1	2	3	5
f. "Or something else" (SPECIFY) _____ _____ _____	1	2	3	6

Q.12 "Which of those do you <u>mainly</u> use for water heating?" (CIRCLE ONE IN Q.12 COLUMN ABOVE)

INTERVIEWER CHECK:

IF Q.11a = (1) (YES), GO TO Q.13
IF Q.11a = (2) (NO) or (3) (DON'T KNOW), GO TO Q.19

Q.13 "How many electric hot water cylinders are there in the home?"

☐ (RECORD NUMBER. IF NONE, RECORD 0 AND GO TO Q.19)

"The next questions are about the main electric hot water cylinder in your home."

Q.14 "How old is the cylinder?" (DO NOT READ OUT. ENCOURAGE RESPONDENT TO ESTIMATE IF UNSURE.)

More than 10 years old ---------- 1
5 to 10 years old ---------- 2
1 to less than 5 years old --------- 3
Less than 1 year old ---------- 4
Don't know ---------- 5

Q.15 "Is the cylinder wrapped with insulation on the outside, such as hard foam or a jacket?" (CIRCLE ONE)

Yes – 1 ↓ | No – 2 | Don't know – 3 → GO TO Q.17

Q.16 "Is it wrapped with hard foam, a new well-fitted jacket or an older poorly-fitted jacket?" (CIRCLE ONE)

Hard foam ---------- 1
New well-fitted jacket ---------- 2
Older poorly-fitted jacket ---------- 3
Don't know ---------- 4

Q.17 "Are the pipes from the hot water cylinder wrapped or lagged?" (CIRCLE ONE)

Yes – 1 ↓ | No – 2 | Don't know – 3 → GO TO Q.19

Q.18 "Is the wrapping new and well-fitted or older and poorly-fitted?" (CIRCLE ONE)

New well-fitted ---------- 1
Older poorly-fitted ---------- 2
Don't know ---------- 3

Q.19 "Which of the following types of heater do you use to heat your home? Please answer 'yes' or 'no' to each." (READ OUT AND CIRCLE ONE FOR EACH IN Q.19 GRID)

	Q.19 Use			**Q.20 Main**
	Yes	No	Don't know	

a.	"Electric heaters such as fan, bar, convection and night store heaters"	1	2	3	01
b.	"Fixed electric radiators or oil-filled column heaters"	1	2	3	02
c.	"Fixed gas heaters"	1	2	3	03
d.	"Portable gas heaters such as an LPG heater"	1	2	3	04
e.	"Heat pumps"	1	2	3	05
f.	"Underfloor heating"	1	2	3	06
g.	"Enclosed wood burner"	1	2	3	07
h.	"Open log fire"	1	2	3	08
i.	"Or something else" (SPECIFY) _____	1	2	3	09

Q.20 "And which of those do you mainly use for home heating?" (CIRCLE ONE IN Q.20 COLUMN ABOVE)

Q.21 "Does the heating you use make your home comfortably warm over winter?" (CIRCLE ONE)

Yes – 1 No – 2 Don't know – 3

RECORD ANY COMMENTS MADE BY RESPONDENT:

_____

_____

Q.22 "Do you use any of the following appliances to cool your home in summer? Please answer 'yes' or 'no' for each." (READ OUT AND CIRCLE ONE.)

	Yes	No	Don't know
a. "Fans"	1	2	3
b. "Heat pumps"	1	2	3
c. "Dehumidifier"	1	2	3
d. "Air conditioning"	1	2	3
e. "Or something else" (SPECIFY) _____	1	2	3

DRAUGHT PROOFING

Q.23 "Are any of the doors or windows in your home draughty?" (CIRCLE ONE. IF NEEDED, DO THEY LET COLD AIR COME IN THROUGH GAPS?)

Yes – 1 | No – 2 Don't know – 3 → GO TO Q.25

Q.24 "What proportion of the doors and windows are draughty?" (DO NOT READ OUT. CIRCLE ONE. ENCOURAGE RESPONDENT TO ESTIMATE IF UNSURE.)

25% or less ---------- 1
26% to 50% ---------- 2
51% to 75% ---------- 3
76% to 100% ---------- 4
Don't know ---------- 5

Q.25 "Do you have double glazing?" (CIRCLE ONE)

Yes – 1 | No – 2 Don't know – 3 → GO TO Q.27

Q.26 "What proportion of the windows are double glazed?" (DO NOT READ OUT. CIRCLE ONE. ENCOURAGE RESPONDENT TO ESTIMATE IF UNSURE.)

25% or less ---------- 1
26% to 50% ---------- 2
51% to 75% ---------- 3
76% to 100% ---------- 4
Don't know ---------- 5

LIGHTING

Q.27 "Do you use energy efficiency lightbulbs in your home?" (CIRCLE ONE)

Yes – 1 | No – 2 Don't know – 3 → GO TO HOME ENERGY RATING SCHEME

Q.28 "Of all the lightbulbs in your home, what proportion are energy efficient lightbulbs?" (DO NOT READ OUT. CIRCLE ONE. ENCOURAGE RESPONDENT TO ESTIMATE IF UNSURE.)

25% or less ---------- 1
26% to 50% ---------- 2
51% to 75% ---------- 3
76% to 100% ---------- 4
Don't know ---------- 5

HOME ENERGY RATING SCHEME

"A home energy rating scheme is being proposed for New Zealand. This is a way that your home could be given a rating to indicate how energy efficient it is.

The rating would be applied to a house, in a similar way to the star rating that is displayed on a fridge. A high rating means the house is energy efficient, and so the energy (electricity) bills are likely to be lower, and the home more 'comfortable' to live in.

Along with the rating, homeowners would be given recommendations on how they can improve their home's energy performance, and therefore its rating.

The next few questions are about your views on a Home Energy Rating Scheme."

Q.29 "If a property had a high energy rating, would you be more likely to buy it or rent it?" (CIRCLE ONE)

Yes – 1 No – 2 Don't know – 3

INTERVIEWER CHECK:

IF **Q.1** = (1) (OWNS HOUSE) GO TO Q.30
IF **Q.1** = (2) OR (3) (RENTS OR OTHER), GO TO DEMOGRAPHICS

Q.30 "If you were selling your home, would you see any advantage in advertising its energy rating?"
(CIRCLE ONE)

Yes – 1 No – 2 Don't know – 3

Q.31 "How much would you be willing to pay for an Energy Audit to produce an Energy Rating for your home?" (READ OUT ALL AND CIRCLE ONE.)

"More than $400" ---------- 1
"Up to $400 ---------- 2
"Up to $300" ---------- 3
"Up to $200" ---------- 4
"Up to $100" ---------- 5

"Up to $50" ---------- 6

"Nothing" ---------- 7

DO NOT READ OUT: Don't know ------- 8

RECORD ANY COMMENTS MADE BY RESPONDENT:

_____

_____

Q.32 "If you had an Energy Audit which identified a range of measures to improve energy efficiency, which of the following is most likely to describe your response? I am likely to carry out measures that cost…" (READ OUT ALL AND CIRCLE ONE.)

"Less than $100" ---------- 1

"Between $100 and $299" ---------- 2

"Between $300 and $999" ---------- 3

"Over $1000" ---------- 4

"Or, I am unlikely to act on the recommendations"---- 5

DO NOT READ OUT: Don't know ---------- 6

RECORD ANY COMMENTS MADE BY RESPONDENT:

_____

_____

Q.33 "How likely are the following things to prompt you to improve the energy efficiency of your home? Would you say very likely, likely, unlikely or not at all likely?" (READ OUT AND CIRCLE ONE FOR EACH.)

	Very likely	Likely	Unlikely	Not at all likely	Don't know
a. "Improved comfort or warmth"	1	2	3	4	5
b. "Savings on my power bills"	1	2	3	4	5
c. "Adding to the value of my home"	1	2	3	4	5
d. "Making my property more valuable to future buyers or renters"	1	2	3	4	5
e. "A retailer promotion, for example on	1	2	3	4	5

lightbulbs or heat pumps"					
f. "Financial assistance from the Government"	1	2	3	4	5
g. "Knowing it is better for the environment"	1	2	3	4	5

DEMOGRAPHICS

"The final questions ask for some details that describe yourself and your household."

Q.34 "Please say 'stop' when I read out the age group you fall into." (READ OUT AND CIRCLE ONE.)

"24 years or under" ---------- 1
"25 to 49 years" ---------- 2
"50 to 64 years" ---------- 3
"65 years or over" ---------- 4

DO NOT READ OUT: Refused - 5

Q.35 "Please say 'stop' when I read out your household's <u>total</u> annual income before tax. Is it… ?" (READ OUT ALL AND CIRCLE ONE.)

"10,000 or less" ---------- 1
"10,001 to $20,000" ---------- 2
"20,001 to $30,000" ---------- 3
"30,001 to $40,000" ---------- 4
"40,001 to $50,000" ---------- 5
"50,001 to $70,000" ---------- 6
"70,001 to $100,000" ---------- 7
"Over 100,000" ---------- 8

DO NOT READ OUT:
Refused ---------- 9
Don't know ---------- 10

Q.36 "Including yourself, how many people live in your household?"

[ ] (RECORD NUMBER)

Q.37 "And how many are aged 65 years and over?"

[ ] (RECORD NUMBER)

Q.38 "And how many children aged 5 and under live in the household?"

[ ] (RECORD NUMBER)

READ OUT: "Finally, may I have your name so that the Energy Advisor can call you?"

Respondent's name: _____ (RECORD)

Telephone number: _____ (RECORD)

READ OUT: "Thank you very much for talking with me.
As I said, my name is Xxx and I'm from National Research Bureau."

END TIME: _____

Interview Duration: _____ minutes (RECORD)

CERTIFICATION:
I hereby certify that this is a true and accurate record of an interview conducted by me at the time and with the person specified. TICK WHEN CHECKED:

INTERVIEWER'S NAME: _____Date: _____
(Please PRINT)

Supervisor Sign: _____Audit: _____

07-073
FEBRUARY 2007

HOUSEHOLD ENERGY EFFICIENCY AND CONSERVATION

CONTACT SHEET

"Hello, I am Xxx from National Research Bureau. I'm calling on behalf of EECA – the Energy Efficiency and Conservation Authority. May I speak to the householder please?"

(REINTRODUCE IF NECESSARY)

"As I mentioned, I'm calling on behalf of EECA. EECA is a government agency whose role it is to improve New Zealand's energy choices. EECA is doing a study on the energy efficiency of New Zealand homes. There is no cost to you and no selling is involved."

"May I tell you what is involved please? It's quite straight forward.

Yes

No → CHECK IF YOU CAN CALL BACK SOME OTHER TIME.

↓

RECORD APPOINTMENT DETAILS ON SAMPLING SHEET

EXPLAIN:
"There are two parts to the Survey. The first is a 10-12 minute telephone Survey on energy efficiency. We can do that now if it's convenient.

The second part is a visit by a local Energy Advisor, to look at the energy efficiency of your home from a technical point of view. You will receive an energy efficiency report tailored to your home, giving you tips on how to save energy. The report is free. You will also be entered in a draw for $3,000 worth of energy efficiency improvements. The Advisor will phone you to make an appointment, and you can say whether it is convenient or not. All we're asking now is if it's OK for the Energy Advisor to phone you?"

Yes

No → THANK AND CLOSE

↓

"The telephone Survey takes about 10-12 minutes. Can you spare that time now?"

Yes

No → RECORD APPOINTMENT DETAILS ON SAMPLING SHEET

↓

CONTINUE TO INTERVIEW

Appendix 6 Physical Survey

EECA Project - Physical Survey

Company name	Surveyor name	Date of Survey

[note to SURVEYOR – Before you start - ASK THE HOUSEHOLDER NOW FOR THEIR POWER BILLS – try to get all the bills they have – noting that some might have just electricity, some might have one for gas and one for electricity and some might have one bill that covers gas and electricity.]

PLEASE EXPLAIN TO THE HOUSEHOLDER THAT YOU ONLY HAVE ONE HOUR IN WHICH TO COMPLETE THE SURVEY

1. Property Details

1.0 Property ID Number _____**(this is a unique number – refer to client details supplied)**

1.1 Which of the following best describes this house? *(circle one only)*

- θ_1 Stand-alone (detached) house
- θ_2 Semi-detached house
- θ_3 One of a block of flats
- θ_4 Apartment
- θ_5 Other *(please specify)* _____

1.2 How many stories (*please record*) _____

1.3 How many of the following room types (*please record for each*)

Bedrooms	_____

Bathrooms	_____
Living areas/other rooms	_____

1.4 Are there any signs of mould or condensation in the house?

(please circle one only)

θ_1 Yes

θ_2 No

2. Insulation

Ceiling Insulation

2.1 What is your assessment of access to the ceiling? (*please circle one only*)

θ_1 No access

θ_2 Easy access

θ_3 Difficult access

θ_4 Other *(please specify)* _____

2.2 What is the coverage of ceiling insulation? *(please circle one only)*

θ_1 All ceiling area insulated

θ_2 Partial ceiling insulation

θ_3 No ceiling insulation

θ_4 Unclear/Could not get access to the ceiling

2.3 What type of ceiling insulation has been used? *(please circle all that apply)*

θ_1 Fibreglass

θ_2 Macerated paper ISF

θ_3 Rockwool

θ_4 Wool

θ_5 Polyester

θ_6 Other *(please specify)* _____

θ_7 N/A – no ceiling insulation or no access to ceiling space

2.4 Please estimate the thickness of the ceiling insulation *(circle one only)*

θ_1 50mm

θ_2 75mm

θ_3 100mm

θ_4 150mm

θ_5 200mm

θ_6 N/A – no ceiling insulation or no access to ceiling space

2.5 Any general comments about the quality of the insulation?

_____

Underfloor Insulation

2.6 Is the house built on a concrete slab? *(please circle one only)*

θ_1 Yes (if yes go to Wall insulation questions below)

θ_2 No

θ_3 Part

2.7 What is your assessment of under house access? (*please circle one only*)

θ_1 No access

θ_2 Easy access

θ_3 Difficult access

θ_4 Other *(please specify)* _____

2.8 What does the under house area look like?

θ_1 Area has a perimeter foundation wall (enclosed)

θ_2 Area has a perimeter of weatherboard (enclosed)

θ_3 Area is not enclosed

θ_4 Other *(please specify)* _____

2.9 What type of underfloor insulation is used in the house (please circle all that apply)

θ_1 Foil

θ_2 Bubble-foil

θ_3 Polystyrene

θ_4 Fibreglass

θ_5 Wool

θ_6 Polyester

θ_7 Other.

2.10 What is the coverage of any underfloor insulation? *(please circle one only)*

θ_1 All underfloor area insulated

θ_2 Partial underfloor insulation

θ_3 No underfloor insulation

θ_4 Unclear/Could not get access under the house

2.11 General comments about the quality of the underfloor insulation?

θ_1 excellent, well fitted.

θ_2 good

θ_3 poor, needs repair or replaced

θ_4 Other, please describe_____

Wall Insulation

2.12 Is there insulation in any of the external walls? *(please circle one only)*

θ_1 Yes – all external walls insulated

θ_2 Some external walls insulated

θ_3 No – none of the external walls are insulated

θ_4 Unclear/Could not get access to the wall cavities

3. Space Heating, Cooling, Ventilation and Condensation Control

3.1 Heaters used to heat the home? *(circle all that apply & note No. of appliances) (note – this is heaters **actually used**) (Circle main heater) Note if the appliance has any controls (enter 'T' for timer and 'TS' for thermostat).*

		Number	Type (circle)	Control?
θ_1	Electric heaters (fixed)	____	convection/radiators	_____
θ_2	Electric heaters (portable)	____	convection/radiators	_____
θ_3	Gas heater (fixed [mains or tank])	____	flued / unflued	_____
θ_4	Gas heaters (portable; LPG)	____	-	_____
θ_5	Open fire	____	coal/wood (logs)	_____
θ_6	Enclosed burner	____	oil/pellet/wood (logs)/coal	_____
θ_7	Heat pump (single room)	____	-	_____
θ_8	Underfloor heating	____	gas/electricity	_____
θ_9	Central heating (ducted)	____	heatpump/gas/oil	_____
θ_{10}	Central heating (radiators)	____	heatpump/gas/oil	_____

θ_{11} Other (*please describe type and fuel*) _____

3.2 Appliances used to cool the home in summer (*circle all that apply*)

θ_1 Ceiling Fans

θ_2 Portable Fans

θ_3 Heat pumps in cooling mode

θ_4 Dehumidifier

θ_5 Air conditioner

θ_6 N/A- no appliances used for cooling in summer

θ_7 Other (*please describe*) _____

3.3 Does the home have a 'whole house' ventilation system? (please circle)

θ_1 No

θ_2 Yes

3.4 If yes, is it (circle those that apply)

θ_1 a positive pressure system (attic fan; air supplied from attic, no exhaust)

θ_2 a heat recovery air-to-air heat exchanger (1 diffuser per room, air from outside and extracted)

θ_3 accompanied with an inline duct heater?

3.5 Does the householder use a dehumidifier to control condensation?

θ_1 No

θ_2 Yes, used sometimes.

θ_3 Yes, often in use.

4. Hot Water

4.1 What equipment and fuels are used to heat water in the home? *(circle all that apply)*

θ_1 Instantaneous (*note electricity or gas*) i.e. no HWC _____

θ_2 Storage (*note electricity or gas*)(incl. nightrate)_____

θ_3 Solar *(note type of backup, i.e., gas or electricity)* _____

θ_4 Heat pump

θ_5 Wetback (*note type e.g. gas/wood/coal etc*) with electricity back up_____

θ_6 Wetback (*note type e.g. gas/wood/coal etc*) with gas back up_____

θ_7 Other (*please describe*) _____

4.2 Which is the main fuel used for water heating? (use code from question 4.1)

_____

4.3 How many electric hot water cylinders does the house have? _____

4.4 How many gas hot water cylinders does the house have? _____

Answer next questions for <u>each</u> of the electric and or gas hot water cylinders. If no electric or gas cylinders go to question 4.12

4.5 What type of cylinders does the house have? (enter 'e' for electric or 'g' for.

Cylinder 1	Cylinder 2	Cylinder 3
_____	_____	_____

4.6 Does the cylinder have any wrapping or insulation? (Circle one box only for each cylinder).

	Cylinder 1	Cylinder 2	Cylinder 3
Yes	θ_1	θ_1	θ_1
No	θ_2	θ_2	θ_2

4.7 If yes, what is the cylinder wrapped with? (Circle one box only for each cylinder).

	Cylinder 1	Cylinder 2	Cylinder 3
Hard foam	θ_1	θ_1	θ_1
New well-fitted jacket	θ_2	θ_2	θ_2
Older poorly-fitted jacket	θ_3	θ_3	θ_3
Other	θ_4	θ_4	θ_4

If 'other' *(please describe)*_____

4.8 Are the pipes from the HWC wrapped/lagged? (Circle one box only for each cylinder).

	Cylinder 1	Cylinder 2	Cylinder 3
Yes	θ_1	θ_1	θ_1
No	θ_2	θ_2	θ_2

4.9 If yes, describe the wrapping/lagging? (Circle one box only for each cylinder).

	Cylinder 1	Cylinder 2	Cylinder 3
New well-fitted (covers first 600-1000mm	θ_1	θ_1	θ_1
Older poorly-fitted	θ_2	θ_2	θ_2
Other	θ_3	θ_3	θ_3

If 'other' *(please describe)*_____

4.10 What size is the hot water cylinder? (Circle one box only for each cylinder).

	Cylinder 1	Cylinder 2	Cylinder 3
<100 litres	θ_1	θ_1	θ_1
100-120 litres	θ_2	θ_2	θ_2
121-137 litres	θ_3	θ_3	θ_3
138-170 litres	θ_4	θ_4	θ_4
171-185 litres	θ_5	θ_5	θ_5
185-290 litres	θ_6	θ_6	θ_6
>290 litres	θ_7	θ_7	θ_7
Other (*please specify)*	_____	_____	_____

4.11 Hot water cylinder age/grade. How old is the hot water cylinder? circle the most accurate option per cylinder present. *(Record from HWC labelling or estimate if label not present/visible).*

	Cylinder 1	Cylinder 2	Cylinder 3
A- Grade (1986 onwards [has a blue & white 'A' water mark])	θ_1	θ_1	θ_1
B- Grade (1986 onwards unless it has a blue watermark)	θ_2	θ_2	θ_2
C- Grade (1976 – 1986)	θ_3	θ_3	θ_3
D- Grade (pre-1976)	θ_4	θ_4	θ_4

Please note the age of each cylinder if it is given

Estimated age(s) (yrs) for each cylinder

	Cylinder 1	Cylinder 2	Cylinder 3
Age (years)	_____	_____	_____

4.12 Do any of the hot water taps drip?

θ_1 Yes

θ_2 No

4.13 What is the water tap temperature (°C) (as measured) _____

NOTE - DO NOT ADJUST THE TEMPERATURE [instructions from EECA]

4.14 How many showers does the house have? _____(write the number)

4.15 For each shower, what is the shower flow (warm water at normal showering temperature)?

Shower flow: _____ (litres/min)

Shower flow: _____ (litres/min)

Shower flow: _____ (litres/min)

5. Power bills

5.1 Ask the householder what their average **summer power bill** is (e.g. their **January 2007** bill) (inclusive of fixed charges and GST) *(if possible ask householder whether you can see the most recent bill or record estimate if an estimate made)*

Electricity only $ _____

Gas only $ _____

Gas and electricity $ _____(Total); _gas $_____elec $_____

5.2 Ask the householder what their average **winter power bill** is (e.g. their **July 2006** bill) (inclusive of fixed charges and GST)

Electricity only $ _____

Gas only $ _____

Gas and electricity $ _____(Total); _gas $_____elec $_____

6. Windows & Doors

6.1 How many windows are double glazed? (circle best description)

θ_1 'none'

θ_2 'some'

θ_3 'most'

θ_4 'all'.

6.2 How many windows have draft proofing? (circle best description)

θ_1 'none'

θ_2 'some'

θ_3 'most'

θ_4 'all'.

6.3 What type of joinery are the window frames? *(please circle one only)*

θ_1 All wooden

θ_2 All aluminium

θ_3 Combination of wood and aluminium

θ_4 Other *(please specify)* _____

6.4 How many external doors in total? (*please record number*) _____

6.5 How many external doors have draft proofing? (*please record number*)

_____ or θ_1 None or …θ_2…N/A (explain why - _____)

7. Are there any particular energy issues of interest / concern to the householder?

Comments (note briefly in any otherwise note 'none'.)

8. Recommended solutions / options

Comments (note briefly anything that specifically stands out)

Appendix 7 Telephone Survey Results – Frequency Tables

Table 1: Q1 Own or rent the home living in

		Frequency	%	Valid %	Cumulative %
Valid	Own	260	72.4	72.4	72.4
	Rent	99	27.6	27.6	100.0
	Total	359	100.0	100.0	

Table 2: Q2 When was the home built

		Frequency	%	Valid %	Cumulative %
Valid	Before 1970	158	44.0	47.9	47.9
	1970-1980	37	10.3	11.2	59.1
	1981-1990	30	8.4	9.1	68.2
	1991-2000	46	12.8	13.9	82.1
	2001-2007	59	16.4	17.9	100.0
	Total	330	91.9	100.0	
Missing	Don't know	29	8.1		
Total		359	100.0		

Table 3: Q3 Number of bedrooms in their home

		Frequency	%	Valid %	Cumulative %
Valid	1	21	5.8	5.8	5.8
	2	59	16.4	16.4	22.3
	3	149	41.5	41.5	63.8
	4	94	26.2	26.2	90.0
	5	26	7.2	7.2	97.2
	6	8	2.2	2.2	99.4
	7	1	.3	.3	99.7
	10	1	.3	.3	100.0
	Total	359	100.0	100.0	

Table 4: Q4 Number of bathrooms in their home

		Frequency	%	Valid %	Cumulative %
Valid	1	208	57.9	57.9	57.9
	2	117	32.6	32.6	90.5
	3	24	6.7	6.7	97.2
	4	6	1.7	1.7	98.9
	5	1	.3	.3	99.2
	6	3	.8	.8	100.0

	Total	359	100.0	100.0	

Table 5: Q5 Is property built on a concrete slab

		Frequency	%	Valid %	Cumulative %
Valid	Yes	170	47.4	47.4	47.4
	No	157	43.7	43.7	91.1
	Don't know	32	8.9	8.9	100.0
	Total	359	100.0	100.0	

Table 6: Q6 Compared with other households their energy consumption is

		Frequency	%	Valid %	Cumulative %
Valid	Very high	20	5.6	5.6	5.6
	High	46	12.8	12.8	18.4
	About average	203	56.5	56.5	74.9
	Low	66	18.4	18.4	93.3
	Very low	11	3.1	3.1	96.4
	Don't know	13	3.6	3.6	100.0
	Total	359	100.0	100.0	

Table 7: Q7a Considered what the energy bill might be like

		Frequency	%	Valid %	Cumulative %
Valid	Yes	121	33.7	33.7	33.7
	No	236	65.7	65.7	99.4
	Don't know	2	.6	.6	100.0
	Total	359	100.0	100.0	

Table 8: Q7b Considered comfort or warmth within the home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	284	79.1	79.1	79.1
	No	74	20.6	20.6	99.7
	Don't know	1	.3	.3	100.0
	Total	359	100.0	100.0	

Table 9: Q7c Considered whether had under floor/roof space insulation

		Frequency	%	Valid %	Cumulative %
Valid	Yes	200	55.7	55.7	55.7
	No	154	42.9	42.9	98.6
	Don't know	5	1.4	1.4	100.0
	Total	359	100.0	100.0	

Table 10: Q7d Considered whether it had double glazing

		Frequency	%	Valid %	Cumulative %
Valid	Yes	73	20.3	20.3	20.3
	No	284	79.1	79.1	99.4
	Don't know	2	.6	.6	100.0
	Total	359	100.0	100.0	

Table 11: Q7e Considered whether windows/doors draught-proofed

		Frequency	%	Valid %	Cumulative %
Valid	Yes	168	46.8	46.8	46.8
	No	190	52.9	52.9	99.7
	Don't know	1	.3	.3	100.0
	Total	359	100.0	100.0	

Table 12: Q7f Considered other energy issues (1)

		Frequency	%	Valid %	Cumulative %
Valid	Yes	30	8.4	8.4	8.4
	No	328	91.4	91.4	99.7
	Don't know	1	.3	.3	100.0
	Total	359	100.0	100.0	

Table 13: Q7f Considered other energy issues (2)

		Frequency	%	Valid %	Cumulative %
Valid	Yes	3	.8	100.0	100.0
Missing	System	356	99.2		
Total		359	100.0		

Table 14: Q7g Considered orientation to the sun

		Frequency	%	Valid %	Cumulative %
Valid	Yes	39	10.9	100.0	100.0
Missing	System	320	89.1		
Total		359	100.0		

Table 15: Q7h Considered type of heating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	53	14.8	100.0	100.0
Missing	System	306	85.2		
Total		359	100.0		

Table 16: Q7i Considered type of energy used/available

		Frequency	%	Valid %	Cumulative %
Valid	Yes	42	11.7	100.0	100.0
Missing	System	317	88.3		
Total		359	100.0		

Table 17: Q8a Roof space in their home is insulated

		Frequency	%	Valid %	Cumulative %
Valid	Yes	254	70.8	70.8	70.8
	No	49	13.6	13.6	84.4
	Don't know	56	15.6	15.6	100.0
	Total	359	100.0	100.0	

Table 18: Q8b External walls in their home are insulated

		Frequency	%	Valid %	Cumulative %
Valid	Yes	168	46.8	46.8	46.8
	No	96	26.7	26.7	73.5
	Don't know	95	26.5	26.5	100.0
	Total	359	100.0	100.0	

Table 19: Q8c Under the floor in their home is insulated

		Frequency	%	Valid %	Cumulative %
Valid	Yes	95	26.5	26.5	26.5
	No	195	54.3	54.3	80.8
	Don't know	69	19.2	19.2	100.0
	Total	359	100.0	100.0	

Table 20: Q9 Live in an energy efficient home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	200	55.7	62.3	62.3
	No	121	33.7	37.7	100.0
	Total	321	89.4	100.0	
Missing	Don't know	38	10.6		
Total		359	100.0		

Table 21: Q10 Live in a water efficient home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	242	67.4	76.3	76.3
	No	75	20.9	23.7	100.0
	Total	317	88.3	100.0	
Missing	Don't know	42	11.7		
Total		359	100.0		

Table 22: Q11a Use electricity for water heating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	267	74.4	75.0	75.0
	No	89	24.8	25.0	100.0
	Total	356	99.2	100.0	
Missing	Don't know	3	.8		
Total		359	100.0		

Table 23: Q11b Use gas for water heating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	96	26.7	26.9	26.9
	No	261	72.7	73.1	100.0
	Total	357	99.4	100.0	
Missing	Don't know	2	.6		
Total		359	100.0		

Table 24: Q11c Use a wood wetback for water heating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	29	8.1	8.2	8.2
	No	325	90.5	91.8	100.0
	Total	354	98.6	100.0	
Missing	Don't know	5	1.4		
Total		359	100.0		

Table 25: Q11d Use instantaneous gas or electricity for water heating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	51	14.2	14.2	14.2
	No	302	84.1	84.1	98.3
	Don't know	6	1.7	1.7	100.0
	Total	359	100.0	100.0	

Table 26: Q11e Use solar for water heating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	13	3.6	3.6	3.6
	No	343	95.5	95.5	99.2
	Don't know	3	.8	.8	100.0
	Total	359	100.0	100.0	

Table 27: Q11e Use something else for water heating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	4	1.1	1.1	1.1
	No	353	98.3	98.3	99.4
	Don't know	2	.6	.6	100.0
	Total	359	100.0	100.0	

Table 28: Q12 Mainly use for water heating

		Frequency	%	Valid %	Cumulative %
Valid	Electricity	248	69.1	69.1	69.1
	Gas	70	19.5	19.5	88.6
	Wood wetback	6	1.7	1.7	90.3
	Instantaneous gas or electricity	25	7.0	7.0	97.2
	Solar	4	1.1	1.1	98.3
	Something else	4	1.1	1.1	99.4
	Use solar/electricity 50/50seasonal	2	.6	.6	100.0
	Total	359	100.0	100.0	

Table 29: Q13 Number of electric hot water cylinders in home

		Frequency	%	Valid %	Cumulative %
Valid	0	5	1.4	1.9	1.9
	1	229	63.8	85.8	87.6
	2	31	8.6	11.6	99.3
	3	2	.6	.7	100.0
	Total	267	74.4	100.0	
Missing	System	92	25.6		
Total		359	100.0		

Table 30: Q14 Age of the hot water cylinder

		Frequency	%	Valid %	Cumulative %
Valid	More than 10 years old	109	30.4	47.4	47.4
	5 to 10 years old	61	17.0	26.5	73.9
	1 to less than 5 years old	51	14.2	22.2	96.1
	Less than 1 year old	9	2.5	3.9	100.0
	Total	230	64.1	100.0	
Missing	Don't know	32	8.9		
	System	97	27.0		
	Total	129	35.9		
Total		359	100.0		

Table 31: Q15 Is cylinder wrapped with insulation on the outside

		Frequency	%	Valid %	Cumulative %
Valid	Yes	72	20.1	29.3	29.3
	No	174	48.5	70.7	100.0
	Total	246	68.5	100.0	
Missing	Don't know	16	4.5		
	System	97	27.0		
	Total	113	31.5		
Total		359	100.0		

Table 32: Q16 Wrapped with hard foam/well-fitted/poorly-fitted jacket

		Frequency	%	Valid %	Cumulative %
Valid	Hard foam	13	3.6	18.1	18.1
	New, well-fitted jacket	40	11.1	55.6	73.6
	Older, poorly-fitted jacket	7	1.9	9.7	83.3
	Don't know	12	3.3	16.7	100.0
	Total	72	20.1	100.0	
Missing	System	287	79.9		
Total		359	100.0		

Table 33: Q17 Are pipes from hot water cylinder wrapped or lagged

		Frequency	%	Valid %	Cumulative %
Valid	Yes	86	24.0	40.0	40.0
	No	129	35.9	60.0	100.0
	Total	215	59.9	100.0	
Missing	Don't know	47	13.1		
	System	97	27.0		
	Total	144	40.1		
Total		359	100.0		

Table 34: Q18 Is wrapping new well-fitted or older poorly-fitted

		Frequency	%	Valid %	Cumulative %
Valid	New well-fitted	66	18.4	80.5	80.5
	Older poorly-fitted	16	4.5	19.5	100.0
	Total	82	22.8	100.0	
Missing	Don't know	4	1.1		
	System	273	76.0		
	Total	277	77.2		
Total		359	100.0		

Table 35: Q19a Use electric heaters e.g. fan,bar,etc. to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	167	46.5	46.5	46.5
	No	192	53.5	53.5	100.0
	Total	359	100.0	100.0	

Table 36: Q19b Use fixed elec. radiators/oil filled col. heaters-heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	115	32.0	32.0	32.0
	No	244	68.0	68.0	100.0
	Total	359	100.0	100.0	

Table 37: Q19c Use fixed gas heaters to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	79	22.0	22.0	22.0
	No	280	78.0	78.0	100.0
	Total	359	100.0	100.0	

Table 38: Q19d Use portable gas heaters to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	65	18.1	18.1	18.1
	No	294	81.9	81.9	100.0
	Total	359	100.0	100.0	

Table 39: Q19e Use heat pumps to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	49	13.6	13.7	13.7
	No	309	86.1	86.3	100.0
	Total	358	99.7	100.0	
Missing	Don't know	1	.3		
Total		359	100.0		

Table 40: Q19f Use underfloor heating to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	40	11.1	11.1	11.1
	No	319	88.9	88.9	100.0
	Total	359	100.0	100.0	

Table 41: Q19g Use enclosed wood burner to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	107	29.8	29.8	29.8
	No	252	70.2	70.2	100.0
	Total	359	100.0	100.0	

Table 42: Q19h Use open log fire to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	51	14.2	14.2	14.2
	No	308	85.8	85.8	100.0
	Total	359	100.0	100.0	

Table 43: Q19i Use something else to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	7	1.9	1.9	1.9
	No	352	98.1	98.1	100.0
	Total	359	100.0	100.0	

Table 44: Q19j Use central heating to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	11	3.1	100.0	100.0
Missing	System	348	96.9		
Total		359	100.0		

Table 45: Q19k Use a gas fire to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	7	1.9	100.0	100.0
Missing	System	352	98.1		
Total		359	100.0		

T46 Q19l Use a ventilation system to heat home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	7	1.9	100.0	100.0
Missing	System	352	98.1		
Total		359	100.0		

Table 47 Q20 Mainly use for home heating

		Frequency	%	Valid %	Cumulative %
Valid	Electric heaters such as fan, bar,convection,etc.	67	18.7	18.7	18.7
	Fixed electric radiators or oil-filled column heaters	31	8.6	8.6	27.3
	Fixed gas heaters	53	14.8	14.8	42.1
	Portable gas heaters such as an LPG heater	24	6.7	6.7	48.7
	Heat pumps	27	7.5	7.5	56.3
	Underfloor heating	12	3.3	3.3	59.6
	Enclosed wood burner	87	24.2	24.2	83.8
	Open log fire	17	4.7	4.7	88.6
	Something else	4	1.1	1.1	89.7
	Central heating	9	2.5	2.5	92.2
	Gas fire	2	.6	.6	92.8
	Ventilation system	1	.3	.3	93.0
	Use 2+ forms equally/50/50	10	2.8	2.8	95.8
	None/no form of heating used	15	4.2	4.2	100.0
	Total	359	100.0	100.0	

Table 48: Q21 Does heating make home comfortably warm over winter

		Frequency	%	Valid %	Cumulative %
Valid	Yes	303	84.4	84.4	84.4
	No	33	9.2	9.2	93.6
	Don't know	8	2.2	2.2	95.8
	Not applicable-no heating used	15	4.2	4.2	100.0
	Total	359	100.0	100.0	

Table 49: Q22a Use fans to cool their home in summer

		Frequency	%	Valid %	Cumulative %
Valid	Yes	123	34.3	34.3	34.3
	No	236	65.7	65.7	100.0
	Total	359	100.0	100.0	

Table 50: Q22b Use heat pumps to cool their home in summer

		Frequency	%	Valid %	Cumulative %
Valid	Yes	32	8.9	8.9	8.9
	No	327	91.1	91.1	100.0
	Total	359	100.0	100.0	

Table 51: Q22c Use a dehumidifier to cool their home in summer

		Frequency	%	Valid %	Cumulative %
Valid	Yes	24	6.7	6.7	6.7
	No	335	93.3	93.3	100.0
	Total	359	100.0	100.0	

Table 52: Q22d Use air conditioning to cool their home in summer

		Frequency	%	Valid %	Cumulative %
Valid	Yes	15	4.2	4.2	4.2
	No	344	95.8	95.8	100.0
	Total	359	100.0	100.0	

Table 53: Q22e Use something else to cool their home in summer

		Frequency	%	Valid %	Cumulative %
Valid	Yes	6	1.7	1.7	1.7
	No	353	98.3	98.3	100.0
	Total	359	100.0	100.0	

Table 54: Q23 Any of the doors or windows in their home draughty

		Frequency	%	Valid %	Cumulative %
Valid	Yes	147	40.9	41.3	41.3
	No	209	58.2	58.7	100.0
	Total	356	99.2	100.0	
Missing	Don't know	3	.8		
Total		359	100.0		

Table 55: Q24 Proportion of the doors and windows that are draughty

		Frequency	%	Valid %	Cumulative %
Valid	25% or less	87	24.2	59.2	59.2
	26% to 50%	25	7.0	17.0	76.2
	51% to 75%	13	3.6	8.8	85.0
	76% to 100%	19	5.3	12.9	98.0
	Don't know	3	.8	2.0	100.0
	Total	147	40.9	100.0	
Missing	System	212	59.1		
Total		359	100.0		

Table 56: Q25 Have double glazing

		Frequency	%	Valid %	Cumulative %
Valid	Yes	53	14.8	15.2	15.2
	No	295	82.2	84.8	100.0
	Total	348	96.9	100.0	
Missing	Don't know	11	3.1		
Total		359	100.0		

Table 57: Q26 Proportion of the windows that are double glazed

		Frequency	%	Valid %	Cumulative %
Valid	25% or less	19	5.3	35.8	35.8
	26% to 50%	6	1.7	11.3	47.2
	51% to 75%	6	1.7	11.3	58.5
	76% to 100%	22	6.1	41.5	100.0
	Total	53	14.8	100.0	
Missing	System	306	85.2		
Total		359	100.0		

Table 58: Q27 Use energy efficiency lightbulbs in home

		Frequency	%	Valid %	Cumulative %
Valid	Yes	219	61.0	61.5	61.5
	No	137	38.2	38.5	100.0
	Total	356	99.2	100.0	
Missing	Don't know	3	.8		
Total		359	100.0		

Table 59: Q28 Proportion of energy efficient lightbulbs

		Frequency	%	Valid %	Cumulative %
Valid	25% or less	82	22.8	37.4	37.4
	26% to 50%	59	16.4	26.9	64.4
	51% to 75%	29	8.1	13.2	77.6
	76% to 100%	46	12.8	21.0	98.6
	Don't know	3	.8	1.4	100.0
	Total	219	61.0	100.0	
Missing	System	140	39.0		
Total		359	100.0		

Table 60: Q29 If prop. had high energy rating-more likely to buy/rent it

		Frequency	%	Valid %	Cumulative %
Valid	Yes	253	70.5	70.5	70.5
	No	70	19.5	19.5	90.0
	Don't know	36	10.0	10.0	100.0
	Total	359	100.0	100.0	

Table 61: Q30 If selling home-any advantage advertising energy rating

		Frequency	%	Valid %	Cumulative %
Valid	Yes	184	51.3	70.8	70.8
	No	65	18.1	25.0	95.8
	Don't know	11	3.1	4.2	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 62: Q31 Amount willing to pay for Energy Audit-produce Energy Rating

		Frequency	%	Valid %	Cumulative %
Valid	More than $400	3	.8	1.2	1.2
	Up to $400	11	3.1	4.2	5.4
	Up to $300	12	3.3	4.6	10.0
	Up to $200	47	13.1	18.1	28.1
	Up to $100	48	13.4	18.5	46.5
	Up to $50	25	7.0	9.6	56.2
	Nothing	94	26.2	36.2	92.3
	Don't know	20	5.6	7.7	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 63: Q32 Amount likely to spend on energy efficiency measures

		Frequency	%	Valid %	Cumulative %
Valid	Less than $100	34	9.5	13.1	13.1
	Between $100 and $299	51	14.2	19.6	32.7
	Between $300 and $999	50	13.9	19.2	51.9
	Over $1000	36	10.0	13.8	65.8
	Unlikely to act on the recommendations	36	10.0	13.8	79.6
	Don't know	53	14.8	20.4	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 64: Q33a Improved comfort or warmth

		Frequency	%	Valid %	Cumulative %
Valid	Very likely-to improve energy efficiency of home	85	23.7	32.7	32.7
	Likely-to improve energy efficiency of home	117	32.6	45.0	77.7
	Unlikely-to improve energy efficiency of home	41	11.4	15.8	93.5
	Not at all likely-to improve energy efficiency of home	13	3.6	5.0	98.5
	Don't know-to improve energy efficiency of home	4	1.1	1.5	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 65: Q33b Savings on my power bills

		Frequency	%	Valid %	Cumulative %
Valid	Very likely-to improve energy efficiency of home	122	34.0	46.9	46.9
	Likely-to improve energy efficiency of home	114	31.8	43.8	90.8
	Unlikely-to improve energy efficiency of home	21	5.8	8.1	98.8
	Not at all likely-to improve energy efficiency of home	2	.6	.8	99.6
	Don't know-to improve energy efficiency of home	1	.3	.4	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 66: Q33c Adding to the value of my home

		Frequency	%	Valid %	Cumulative %
Valid	Very likely-to improve energy efficiency of home	73	20.3	28.1	28.1
	Likely-to improve energy efficiency of home	124	34.5	47.7	75.8

	Unlikely-to improve energy efficiency of home	51	14.2	19.6	95.4
	Not at all likely-to improve energy efficiency of home	9	2.5	3.5	98.8
	Don't know-to improve energy efficiency of home	3	.8	1.2	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 67: Q33d Making my property more valuable to future buyers/renters

		Frequency	%	Valid %	Cumulative %
Valid	Very likely-to improve energy efficiency of home	67	18.7	25.8	25.8
	Likely-to improve energy efficiency of home	112	31.2	43.1	68.8
	Unlikely-to improve energy efficiency of home	57	15.9	21.9	90.8
	Not at all likely-to improve energy efficiency of home	15	4.2	5.8	96.5
	Don't know-to improve energy efficiency of home	9	2.5	3.5	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 68: Q33e A retailer promotion e.g. lightbulbs or heat pumps

		Frequency	%	Valid %	Cumulative %
Valid	Very likely-to improve energy efficiency of home	37	10.3	14.2	14.2
	Likely-to improve energy efficiency of home	116	32.3	44.6	58.8
	Unlikely-to improve energy efficiency of home	81	22.6	31.2	90.0
	Not at all likely-to improve energy efficiency of home	16	4.5	6.2	96.2
	Don't know-to improve energy efficiency of	10	2.8	3.8	100.0

	home				
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 69: Q33f Financial assistance from the Government

		Frequency	%	Valid %	Cumulative %
Valid	Very likely-to improve energy efficiency of home	117	32.6	45.0	45.0
	Likely-to improve energy efficiency of home	87	24.2	33.5	78.5
	Unlikely-to improve energy efficiency of home	42	11.7	16.2	94.6
	Not at all likely-to improve energy efficiency of home	5	1.4	1.9	96.5
	Don't know-to improve energy efficiency of home	9	2.5	3.5	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 70: Q33g Knowing it is better for the environment

		Frequency	%	Valid %	Cumulative %
Valid	Very likely-to improve energy efficiency of home	101	28.1	38.8	38.8
	Likely-to improve energy efficiency of home	122	34.0	46.9	85.8
	Unlikely-to improve energy efficiency of home	28	7.8	10.8	96.5
	Not at all likely-to improve energy efficiency of home	3	.8	1.2	97.7
	Don't know-to improve energy efficiency of home	6	1.7	2.3	100.0
	Total	260	72.4	100.0	
Missing	System	99	27.6		
Total		359	100.0		

Table 71: Q34 Age group of respondent

		Frequency	%	Valid %	Cumulative %
Valid	24 years or under	19	5.3	5.3	5.3
	25 to 49 years	158	44.0	44.0	49.3
	50 to 64 years	112	31.2	31.2	80.5
	65 years or over	70	19.5	19.5	100.0
	Total	359	100.0	100.0	

Table 72: Q35 Household's total annual income before tax

		Frequency	%	Valid %	Cumulative %
Valid	$10,000 or less	7	1.9	1.9	1.9
	$10,001 to $20,000	39	10.9	10.9	12.8
	$20,001 to $30,000	42	11.7	11.7	24.5
	$30,001 to $40,000	28	7.8	7.8	32.3
	$40,001 to $50,000	36	10.0	10.0	42.3
	$50,001 to $70,000	48	13.4	13.4	55.7
	$70,001 to $100,000	41	11.4	11.4	67.1
	Over $100,000	72	20.1	20.1	87.2
	Refused	26	7.2	7.2	94.4
	Don't know	20	5.6	5.6	100.0
	Total	359	100.0	100.0	

Table 73: Q36 Number of people living in the household

		Frequency	%	Valid %	Cumulative %
Valid	1	51	14.2	14.2	14.2
	2	149	41.5	41.5	55.7
	3	47	13.1	13.1	68.8
	4	64	17.8	17.8	86.6
	5	32	8.9	8.9	95.5
	6	11	3.1	3.1	98.6
	7	2	.6	.6	99.2
	8	1	.3	.3	99.4
	9	2	.6	.6	100.0
	Total	359	100.0	100.0	

Table 74: Q37 Number of people 65+ years

		Frequency	%	Valid %	Cumulative %
Valid	0	274	76.3	76.3	76.3
	1	54	15.0	15.0	91.4
	2	31	8.6	8.6	100.0
	Total	359	100.0	100.0	

Table 75: Q38 Number of children aged 5 and under

		Frequency	%	Valid %	Cumulative %
Valid	0	307	85.5	85.5	85.5
	1	37	10.3	10.3	95.8
	2	14	3.9	3.9	99.7
	3	1	.3	.3	100.0
	Total	359	100.0	100.0	

Appendix 8 Physical Survey Results – Frequency Tables

Table 1 q1.1 House description

		Frequency	%	Valid %	Cumulative %
Valid	stand-alone (detached) house	119	88.1	88.1	88.1
	semi-detached house	3	2.2	2.2	90.4
	one of a clock of flats	7	5.2	5.2	95.6
	apartment	6	4.4	4.4	100.0
	Total	135	100.0	100.0	

Table 2 q1.2 Number of storeys

		Frequency	%	Valid %	Cumulative %
Valid	1.0	77	57.0	57.0	57.0
	1.5	1	.7	.7	57.8
	2.0	48	35.6	35.6	93.3
	3.0	3	2.2	2.2	95.6
	4.0	3	2.2	2.2	97.8
	10.0	1	.7	.7	98.5
	15.0	1	.7	.7	99.3
	20.0	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 3 q1.3bed Number of bedrooms

		Frequency	%	Valid %	Cumulative %
Valid	1.0	4	3.0	3.0	3.0
	2.0	19	14.1	14.1	17.0
	3.0	50	37.0	37.0	54.1
	4.0	45	33.3	33.3	87.4
	5.0	12	8.9	8.9	96.3
	6.0	4	3.0	3.0	99.3
	7.0	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 4 q1.3bath Number of bathrooms

		Frequency	%	Valid %	Cumulative %
Valid	1.0	68	50.4	50.4	50.4
	2.0	52	38.5	38.5	88.9
	2.5	2	1.5	1.5	90.4
	3.0	8	5.9	5.9	96.3
	4.0	2	1.5	1.5	97.8

	5.0	1	.7	.7	98.5
	6.0	2	1.5	1.5	100.0
	Total	135	100.0	100.0	

Table 5 q1.3living Number of living areas/other rooms

		Frequency	%	Valid %	Cumulative %
Valid	1.0	45	33.3	33.3	33.3
	2.0	54	40.0	40.0	73.3
	3.0	23	17.0	17.0	90.4
	4.0	11	8.1	8.1	98.5
	5.0	2	1.5	1.5	100.0
	Total	135	100.0	100.0	

Table 6 q1.4 Are there any signs of mould or condensation in this house?

		Frequency	%	Valid %	Cumulative %
Valid	yes	41	30.4	30.4	30.4
	no	94	69.6	69.6	100.0
	Total	135	100.0	100.0	

Table 7 q2.1 Assessment of access to the ceiling?

		Frequency	%	Valid %	Cumulative %
Valid	no access	25	18.5	18.5	18.5
	easy access	93	68.9	68.9	87.4
	difficult access	14	10.4	10.4	97.8
	Other	3	2.2	2.2	100.0
	Total	135	100.0	100.0	

Table 8 q2.2 Coverage of ceiling insulation?

		Frequency	%	Valid %	Cumulative %
Valid	all ceiling area insulated	96	71.1	78.7	78.7
	partial ceiling insulation	17	12.6	13.9	92.6
	no ceiling insulation	9	6.7	7.4	100.0
	Total	122	90.4	100.0	
Missing	unclear/could no get access to the ceiling	12	8.9		
	Missing	1	.7		
	Total	13	9.6		
Total		135	100.0		

Table 9 q2.3a Type of ceiling insulation (first type)

		Frequency	%	Valid %	Cumulative %
Valid	Fibreglass	92	68.1	82.1	82.1
	macerated paper	6	4.4	5.4	87.5
	Rockwool	5	3.7	4.5	92.0

	Wool	4	3.0	3.6	95.5
	Polyester	5	3.7	4.5	100.0
	Total	112	83.0	100.0	
Missing	n/a - no ceiling insulation or no access to ceiling	22	16.3		
	Missing	1	.7		
	Total	23	17.0		
Total		135	100.0		

Table 10 q2.3b Type of ceiling insulation (second type)

		Frequency	%	Valid %	Cumulative %
Valid	macerated paper	2	1.5	28.6	28.6
	Rockwool	3	2.2	42.9	71.4
	polyester	1	.7	14.3	85.7
	other	1	.7	14.3	100.0
	Total	7	5.2	100.0	
Missing	n/a - no ceiling insulation or no access to ceiling	22	16.3		
	n/a - only one type of insulation	105	77.8		
	missing	1	.7		
	Total	128	94.8		
Total		135	100.0		

Table 11 q2.4a Thickness of ceiling insulation (first type)

		Frequency	%	Valid %	Cumulative %
Valid	50mm	21	15.6	18.8	18.8
	75mm	31	23.0	27.7	46.4
	100mm	40	29.6	35.7	82.1
	150mm	19	14.1	17.0	99.1
	200mm	1	.7	.9	100.0
	Total	112	83.0	100.0	
Missing	n/a - no ceiling insulation or no access to ceiling	22	16.3		
	missing	1	.7		
	Total	23	17.0		
Total		135	100.0		

Table 12 q2.4b Thickness of ceiling insulation (second type)

		Frequency	%	Valid %	Cumulative %
Valid	50mm	3	2.2	42.9	42.9
	75mm	1	.7	14.3	57.1
	100mm	1	.7	14.3	71.4
	150mm	2	1.5	28.6	100.0
	Total	7	5.2	100.0	
Missing	n/a - no ceiling insulation or no access to ceiling	22	16.3		

	n/a - only one type of insulation	105	77.8		
	missing	1	.7		
	Total	128	94.8		
Total		135	100.0		

Table 13 q2.6 Is the house built on a concrete slab?

		Frequency	%	Valid %	Cumulative %
Valid	yes	49	36.3	36.3	36.3
	no	71	52.6	52.6	88.9
	partly	15	11.1	11.1	100.0
	Total	135	100.0	100.0	

Table 14 q2.7 Assesment of under house access

		Frequency	%	Valid %	Cumulative %
Valid	no access	14	10.4	16.3	16.3
	easy access	58	43.0	67.4	83.7
	difficult access	14	10.4	16.3	100.0
	Total	86	63.7	100.0	
Missing	n/a - house on concrete slab	49	36.3		
Total		135	100.0		

Table 15 q2.8 What does under house area look like?

		Frequency	%	Valid %	Cumulative %
Valid	area has a perimeter foundation wall (enclosed)	49	36.3	62.0	62.0
	area has a perimetre of weatherboard (enclosed)	26	19.3	32.9	94.9
	area is not enclosed	3	2.2	3.8	98.7
	other	1	.7	1.3	100.0
	Total	79	58.5	100.0	
Missing	n/a - house on a concrete slab	49	36.3		
	missing	7	5.2		
	Total	56	41.5		
Total		135	100.0		

Table 16 q2.9a Type of underfloor insulation (first type)

		Frequency	%	Valid %	Cumulative %
Valid	foil	24	17.8	72.7	72.7
	polystyrene	7	5.2	21.2	93.9
	other	2	1.5	6.1	100.0
	Total	33	24.4	100.0	

Missing	n/a - house on a concrete slab	49	36.3		
	n/a - house has no underfloor insulation	52	38.5		
	missing	1	.7		
	Total	102	75.6		
Total		135	100.0		

Table 17 q2.9b Type of underfloor insulation (second type)

		Frequency	%	Valid %	Cumulative %
Valid	polystyrene	1	.7	100.0	100.0
Missing	n/a - house on a concrete slab	49	36.3		
	n/a - house has no underfloor insulation or only one type	84	62.2		
	missing	1	.7		
	Total	134	99.3		
Total		135	100.0		

Table 18 q2.10a Coverage of underfloor insulation

		Frequency	%	Valid %	Cumulative %
Valid	all underfloor areas insulated	18	13.3	22.0	22.0
	partial underfloor insulation	10	7.4	12.2	34.1
	no underfloor insulation	52	38.5	63.4	97.6
	unclear/could not get access under the house	2	1.5	2.4	100.0
	Total	82	60.7	100.0	
Missing	n/a - house on a concrete slab	49	36.3		
	missing	4	3.0		
	Total	53	39.3		
Total		135	100.0		

Table 19 q2.11 General comments about quality of the underfloor insulation

		Frequency	%	Valid %	Cumulative %
Valid	excellent, well fitted	17	12.6	60.7	60.7
	good	8	5.9	28.6	89.3
	poor, needs repair or to be replaced	2	1.5	7.1	96.4
	other	1	.7	3.6	100.0
	Total	28	20.7	100.0	
Missing	n/a - house on a concrete slab	49	36.3		
	n/a house has no underfloor insulation	52	38.5		
	missing	6	4.4		

	Total	107	79.3		
Total		135	100.0		

Table 20 q2.12 External Wall insulation

		Frequency	%	Valid %	Cumulative %
Valid	yes - all external walls insulated	51	37.8	49.0	49.0
	some external walls insulated	16	11.9	15.4	64.4
	no-none of the external walls are insulated	37	27.4	35.6	100.0
	Total	104	77.0	100.0	
Missing	unclear/could not get access to wall cavities	28	20.7		
	missing	3	2.2		
	Total	31	23.0		
Total		135	100.0		

Table 21 q3.1.1no Number of Fixed Electric Heaters

		Frequency	%	Valid %	Cumulative %
Valid	0	113	83.7	83.7	83.7
	1	12	8.9	8.9	92.6
	2	5	3.7	3.7	96.3
	3	3	2.2	2.2	98.5
	5	2	1.5	1.5	100.0
	Total	135	100.0	100.0	

Table 22 q3.1.1type Type of Fixed electric heater

		Frequency	%	Valid %	Cumulative %
Valid	convection	18	13.3	85.7	85.7
	radiators	3	2.2	14.3	100.0
	Total	21	15.6	100.0	
Missing	n/a - no fixed electric heaters	113	83.7		
	missing	1	.7		
	Total	114	84.4		
Total		135	100.0		

Table 23 q3.1.1control Fixed electric heater - control

		Frequency	%	Valid %	Cumulative %
Valid	none	8	5.9	38.1	38.1
	timer	3	2.2	14.3	52.4
	thermostat	10	7.4	47.6	100.0
	Total	21	15.6	100.0	
Missing	n/a - no fixed electric heaters	113	83.7		

	missing	1	.7		
	Total	114	84.4		
Total		135	100.0		

Table 24 q3.1.2no Number of Portable Electric Heaters

		Frequency	%	Valid %	Cumulative %
Valid	0	67	49.6	49.6	49.6
	1	28	20.7	20.7	70.4
	2	18	13.3	13.3	83.7
	3	11	8.1	8.1	91.9
	4	8	5.9	5.9	97.8
	5	3	2.2	2.2	100.0
	Total	135	100.0	100.0	

Table 25 q3.1.2type Type of portable electric heater

		Frequency	%	Valid %	Cumulative %
Valid	convection	19	14.1	33.9	33.9
	radiators	24	17.8	42.9	76.8
	both	13	9.6	23.2	100.0
	Total	56	41.5	100.0	
Missing	n/a - no portable electric heaters	67	49.6		
	missing	12	8.9		
	Total	79	58.5		
Total		135	100.0		

Table 26 q3.1.2control Portable electric heater - control

		Frequency	%	Valid %	Cumulative %
Valid	none	17	12.6	26.6	26.6
	timer	4	3.0	6.3	32.8
	thermostat	37	27.4	57.8	90.6
	both	6	4.4	9.4	100.0
	Total	64	47.4	100.0	
Missing	n/a - no portable electric heaters	67	49.6		
	missing	4	3.0		
	Total	71	52.6		
Total		135	100.0		

Table 27 q3.1.3no Number of Fixed Gas Heaters

		Frequency	%	Valid %	Cumulative %
Valid	0	97	71.9	71.9	71.9
	1	28	20.7	20.7	92.6
	2	6	4.4	4.4	97.0
	3	3	2.2	2.2	99.3
	5	1	.7	.7	100.0

	Total	135	100.0	100.0	

Table 28 q3.1.3type Type of Fixed gas heater

		Frequency	%	Valid %	Cumulative %
Valid	flued	17	12.6	73.9	73.9
	unflued	4	3.0	17.4	91.3
	3	2	1.5	8.7	100.0
	Total	23	17.0	100.0	
Missing	n/a - no fixed gas heaters	97	71.9		
	missing	15	11.1		
	Total	112	83.0		
Total		135	100.0		

Table 29 q3.1.3contol Fixed gas heater - control

		Frequency	%	Valid %	Cumulative %
Valid	none	11	8.1	29.7	29.7
	thermostat	22	16.3	59.5	89.2
	both	4	3.0	10.8	100.0
	Total	37	27.4	100.0	
Missing	n/a - no fixed gas heaters	97	71.9		
	missing	1	.7		
	Total	98	72.6		
Total		135	100.0		

Table 30 q3.1.4no Number of portable gas heaters

		Frequency	%	Valid %	Cumulative %
Valid	0	115	85.2	85.2	85.2
	1	19	14.1	14.1	99.3
	2	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 31 q3.1.4control Portable gas heaters - control

		Frequency	%	Valid %	Cumulative %
Valid	none	17	12.6	85.0	85.0
	thermostat	3	2.2	15.0	100.0
	Total	20	14.8	100.0	
Missing	n/a - no portable gas heaters	115	85.2		
Total		135	100.0		

Table 32 q3.1.5no Number of open fires

		Frequency	%	Valid %	Cumulative %
Valid	0	117	86.7	86.7	86.7
	1	15	11.1	11.1	97.8

	2	3	2.2	2.2	100.0
	Total	135	100.0	100.0	

Table 33 q3.1.5type Type of open fires

		Frequency	%	Valid %	Cumulative %
Valid	wood	10	7.4	71.4	71.4
	both coal and wood	4	3.0	28.6	100.0
	Total	14	10.4	100.0	
Missing	n/a - no open fires	117	86.7		
	missing	4	3.0		
	Total	121	89.6		
Total		135	100.0		

Table 34 q3.1.6no Number of enclosed burners

		Frequency	%	Valid %	Cumulative %
Valid	0	80	59.3	59.7	59.7
	1	52	38.5	38.8	98.5
	2	2	1.5	1.5	100.0
	Total	134	99.3	100.0	
Missing	99	1	.7		
Total		135	100.0		

Table 35 q3.1.6type Type of enclosed burners

		Frequency	%	Valid %	Cumulative %
Valid	oil	1	.7	2.2	2.2
	wood	42	31.1	91.3	93.5
	coal	1	.7	2.2	95.7
	wood & coal	2	1.5	4.3	100.0
	Total	46	34.1	100.0	
Missing	n/a - no enclosed burners	80	59.3		
	missing	9	6.7		
	Total	89	65.9		
Total		135	100.0		

Table 36 q3.1.6control Enclosed burners -control

		Frequency	%	Valid %	Cumulative %
Valid	none	52	38.5	96.3	96.3
	thermostat	2	1.5	3.7	100.0
	Total	54	40.0	100.0	
Missing	n/a - no enclosed burners	80	59.3		
	missing	1	.7		
	Total	81	60.0		
Total		135	100.0		

Table 37 q3.1.7no Number of heat pumps

		Frequency	%	Valid %	Cumulative %
Valid	0	120	88.9	88.9	88.9
	1	14	10.4	10.4	99.3
	2	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 38 q3.1.7control Heat pumps - control

		Frequency	%	Valid %	Cumulative %
Valid	none	1	.7	8.3	8.3
	timer	1	.7	8.3	16.7
	both	10	7.4	83.3	100.0
	Total	12	8.9	100.0	
Missing	n/a - no heat pumps	121	89.6		
	missing	2	1.5		
	Total	123	91.1		
Total		135	100.0		

Table 39 q3.1.8no Number of underfloor heating

		Frequency	%	Valid %	Cumulative %
Valid	0	120	88.9	88.9	88.9
	1	14	10.4	10.4	99.3
	8	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 40 q3.1.8type Type of underfloor heating

		Frequency	%	Valid %	Cumulative %
Valid	gas	5	3.7	41.7	41.7
	electricity	7	5.2	58.3	100.0
	Total	12	8.9	100.0	
Missing	n/a - no underfloor heating	120	88.9		
	missing	3	2.2		
	Total	123	91.1		
Total		135	100.0		

Table 41 q3.1.8control Underfloor heating - control

		Frequency	%	Valid %	Cumulative %
Valid	timer	1	.7	7.7	7.7
	thermostat	4	3.0	30.8	38.5
	both	8	5.9	61.5	100.0
	Total	13	9.6	100.0	
Missing	n/a - no underfloor heating	120	88.9		
	missing	2	1.5		
	Total	122	90.4		

Total		135	100.0		

Table 42 q3.1.9no Number of ducted central heating systems

		Frequency	%	Valid %	Cumulative %
Valid	0	126	93.3	93.3	93.3
	1	8	5.9	5.9	99.3
	2	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 43 q3.1.9type Type of ducted central heating systems

		Frequency	%	Valid %	Cumulative %
Valid	heat pump	3	2.2	37.5	37.5
	gas	5	3.7	62.5	100.0
	Total	8	5.9	100.0	
Missing	n/a - no ducted central heating system	126	93.3		
	missing	1	.7		
	Total	127	94.1		
Total		135	100.0		

Table 44 q3.1.9control Ducted central heating systems - control

		Frequency	%	Valid %	Cumulative %
Valid	none	1	.7	12.5	12.5
	thermostat	2	1.5	25.0	37.5
	both	5	3.7	62.5	100.0
	Total	8	5.9	100.0	
Missing	n/a - no ducted central heating system	126	93.3		
	missing	1	.7		
	Total	127	94.1		
Total		135	100.0		

Table 45 q3.1.10no Number of radiator central heating systems

		Frequency	%	Valid %	Cumulative %
Valid	0	134	99.3	99.3	99.3
	4	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 46 q3.1.10type Type of radiator central heating system

		Frequency	%	Valid %	Cumulative %
Valid	oil	1	.7	100.0	100.0
Missing	n/a - no radiator central heating system	134	99.3		
Total		135	100.0		

Table 47 q3.1.10contol Radiator central heating system control

		Frequency	%	Valid %	Cumulative %
Valid	thermostat	1	.7	100.0	100.0
Missing	n/a - no radiator central heating system	134	99.3		
Total		135	100.0		

Table 48 q3.1.11no Number of other heaters

		Frequency	%	Valid %	Cumulative %
Valid	0	127	94.1	94.1	94.1
	1	8	5.9	5.9	100.0
	Total	135	100.0	100.0	

Table 49 q3.1main Main heating type

		Frequency	%	Valid %	Cumulative %
Valid	electric heaters - fixed	3	2.2	4.0	4.0
	electric heaters - portable	17	12.6	22.7	26.7
	gas heaters -fixed	14	10.4	18.7	45.3
	portable gas heaters	2	1.5	2.7	48.0
	open fire	3	2.2	4.0	52.0
	enclosed burner	23	17.0	30.7	82.7
	heat pump (single room)	5	3.7	6.7	89.3
	underfloor heating	5	3.7	6.7	96.0
	central heating (ducted)	1	.7	1.3	97.3
	no heating types uses	2	1.5	2.7	100.0
	Total	75	55.6	100.0	
Missing	missing	60	44.4		
Total		135	100.0		

Table 50 q3.2.1 Cooling appliance used in summer: ceiling fans

		Frequency	%	Valid %	Cumulative %
Valid	yes	15	11.1	11.1	11.1
	no	120	88.9	88.9	100.0
	Total	135	100.0	100.0	

Table 51 q3.2.2 Cooling appliance used in summer: portable fans

		Frequency	%	Valid %	Cumulative %
Valid	yes	23	17.0	17.0	17.0
	no	112	83.0	83.0	100.0
	Total	135	100.0	100.0	

Table 52 q3.2.3 Cooling appliance used in summer: heat pumps in cooling mode

		Frequency	%	Valid %	Cumulative %
Valid	yes	12	8.9	8.9	8.9
	no	123	91.1	91.1	100.0
	Total	135	100.0	100.0	

Table 53 q3.2.4 Cooling appliance used in summer: dehumidifier

		Frequency	%	Valid %	Cumulative %
Valid	yes	8	5.9	5.9	5.9
	no	127	94.1	94.1	100.0
	Total	135	100.0	100.0	

Table 54 q3.2.5 Cooling appliance used in summer: air con

		Frequency	%	Valid %	Cumulative %
Valid	yes	2	1.5	1.5	1.5
	no	133	98.5	98.5	100.0
	Total	135	100.0	100.0	

Table 55 q3.2.6 Cooling appliance used in summer: n/a no appliances used for cooling in summer

		Frequency	%	Valid %	Cumulative %
Valid	yes	85	63.0	63.0	63.0
	no	50	37.0	37.0	100.0
	Total	135	100.0	100.0	

Table 56 q3.3 Does home have a 'whole house' ventilation system?

		Frequency	%	Valid %	Cumulative %
Valid	no	118	87.4	87.4	87.4
	yes	17	12.6	12.6	100.0
	Total	135	100.0	100.0	

Table 57 q3.4a If whole house what type of system?

		Frequency	%	Valid %	Cumulative %
Valid	a positive pressure system	6	4.4	46.2	46.2
	a heat recovery air-to-air heat exchanger	7	5.2	53.8	100.0
	Total	13	9.6	100.0	
Missing	n/a - no ventilation system	118	87.4		
	missing	4	3.0		
	Total	122	90.4		
Total		135	100.0		

Table 58 q3.4b If whole house what type of system?

		Frequency	%	Valid %	Cumulative %
Valid	accompanied with an inline duct heater	1	.7	100.0	100.0
Missing	n/a - no ventilation system or only one answer to 3.4	130	96.3		
	missing	4	3.0		
	Total	134	99.3		
Total		135	100.0		

Table 59 q3.5 Does householder use a dehumidifer to control condensation?

		Frequency	%	Valid %	Cumulative %
Valid	no	103	76.3	77.4	77.4
	yes, used sometimes	19	14.1	14.3	91.7
	yes, often in use	11	8.1	8.3	100.0
	Total	133	98.5	100.0	
Missing	missing	2	1.5		
Total		135	100.0		

Table 60 q4.1.1 Used to heat hot water: instantaneous

		Frequency	%	Valid %	Cumulative %
Valid	yes	19	14.1	14.1	14.1
	no	116	85.9	85.9	100.0
	Total	135	100.0	100.0	

Table 61 q4.1.1type Type of instantaneous system

		Frequency	%	Valid %	Cumulative %
Valid	electricity	1	.7	7.1	7.1
	gas	13	9.6	92.9	100.0
	Total	14	10.4	100.0	
Missing	n/a - doesn't have this type of system	116	85.9		
	missing	5	3.7		
	Total	121	89.6		
Total		135	100.0		

Table 62 q4.1.2 Used to heat hot water: storage

		Frequency	%	Valid %	Cumulative %
Valid	yes	102	75.6	75.6	75.6
	no	33	24.4	24.4	100.0
	Total	135	100.0	100.0	

Table 63 q4.1.2type Type of storage system

	Frequency	%	Valid %	Cumulative %

Valid	electricity	76	56.3	75.2	75.2
	gas	25	18.5	24.8	100.0
	Total	101	74.8	100.0	
Missing	n/a - doesn't have this type of system	33	24.4		
	missing	1	.7		
	Total	34	25.2		
Total		135	100.0		

Table 64 q4.1.3 Used to heat hot water: solar

		Frequency	%	Valid %	Cumulative %
Valid	yes	5	3.7	3.7	3.7
	no	130	96.3	96.3	100.0
	Total	135	100.0	100.0	

Table 65 q4.1.3type Type of solar system backup

		Frequency	%	Valid %	Cumulative %
Valid	electricity	3	2.2	100.0	100.0
Missing	n/a - doesn't have this type of system	130	96.3		
	missing	2	1.5		
	Total	132	97.8		
Total		135	100.0		

Table 66 q4.1.4 Used to heat hot water: heat pump

		Frequency	%	Valid %	Cumulative %
Valid	yes	2	1.5	1.5	1.5
	no	133	98.5	98.5	100.0
	Total	135	100.0	100.0	

Table 67 q4.1.5 Used to heat hot water: wetback with electric back-up

		Frequency	%	Valid %	Cumulative %
Valid	yes	10	7.4	7.4	7.4
	No	125	92.6	92.6	100.0
	Total	135	100.0	100.0	

Table 68 q4.1.5type Type of wetback

		Frequency	%	Valid %	Cumulative %
Valid	wood	8	5.9	100.0	100.0
Missing	n/a - doesn't have this kind of system	125	92.6		
	missing	2	1.5		
	Total	127	94.1		
Total		135	100.0		

Table 69 q4.1.6 Used to heat hot water: wetback with gas back up

		Frequency	%	Valid %	Cumulative %
Valid	no	135	100.0	100.0	100.0

Table 70 q4.1.6type Type of wetback

		Frequency	%
Missing	n/a - doesn't have this type of system	135	100.0

Table 71 q4.1.7 Used to heat hot water: other

		Frequency	%	Valid %	Cumulative %
Valid	yes	2	1.5	1.5	1.5
	no	133	98.5	98.5	100.0
	Total	135	100.0	100.0	

Table 72 q4.2 Main fuel used for water heating

		Frequency	%	Valid %	Cumulative %
Valid	instantaneous	28	20.7	20.9	20.9
	storage	95	70.4	70.9	91.8
	solar	5	3.7	3.7	95.5
	wetback with electicity back up	4	3.0	3.0	98.5
	other	2	1.5	1.5	100.0
	Total	134	99.3	100.0	
Missing	missing	1	.7		
Total		135	100.0		

Table 73 q4.3 Number of electric hot water cylinders

		Frequency	%	Valid %	Cumulative %
Valid	0	47	34.8	34.8	34.8
	1	76	56.3	56.3	91.1
	2	12	8.9	8.9	100.0
	Total	135	100.0	100.0	

Table 74 q4.4 Number of gas hot water cylinders

		Frequency	%	Valid %	Cumulative %
Valid	0	106	78.5	78.5	78.5
	1	27	20.0	20.0	98.5
	2	2	1.5	1.5	100.0
	Total	135	100.0	100.0	

Table 75 q4.5c1 Cylinder 1: Type

		Frequency	%	Valid %	Cumulative %
Valid	electric	86	63.7	75.4	75.4
	gas	27	20.0	23.7	99.1
	gas/oil	1	.7	.9	100.0
	Total	114	84.4	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
Total		135	100.0		

Table 76 q4.5c2 Cylinder 2: Type

		Frequency	%	Valid %	Cumulative %
Valid	electric	11	8.1	68.8	68.8
	gas	4	3.0	25.0	93.8
	solar	1	.7	6.3	100.0
	Total	16	11.9	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	n/a - house has only 1 HWC	97	71.9		
	Missing	1	.7		
	Total	119	88.1		
Total		135	100.0		

Table 77 q4.6c1 Cylinder 1: insulation

		Frequency	%	Valid %	Cumulative %
Valid	yes	35	25.9	31.0	31.0
	no	78	57.8	69.0	100.0
	Total	113	83.7	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	missing	1	.7		
	Total	22	16.3		
Total		135	100.0		

Table 78 q4.6c2 Cylinder 2:insulation

		Frequency	%	Valid %	Cumulative %
Valid	yes	8	5.9	66.7	66.7
	no	4	3.0	33.3	100.0
	Total	12	8.9	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	n/a - house has only 1 HWC	97	71.9		
	missing	5	3.7		
	Total	123	91.1		
Total		135	100.0		

Table 79 q4.7c1 Cylinder 1: Type of wrapping

		Frequency	%	Valid %	Cumulative %
Valid	hard foam	17	12.6	63.0	63.0
	new well-fitted jacket	8	5.9	29.6	92.6
	older poorly-fitted jacket	1	.7	3.7	96.3
	other	1	.7	3.7	100.0
	Total	27	20.0	100.0	
Missing	n/a - house has no electric or gas HWC	21	15.6		
	n/a - no cyclinder wrap	78	57.8		
	missing	9	6.7		
	Total	108	80.0		
Total		135	100.0		

Table 80 q4.7c2 Cylinder 2: Type of wrapping

		Frequency	%	Valid %	Cumulative %
Valid	hard foam	4	3.0	66.7	66.7
	new well-fitted jacket	1	.7	16.7	83.3
	older poorly-fitted jacket	1	.7	16.7	100.0
	Total	6	4.4	100.0	
Missing	n/a - house has no electric or gas HWC	21	15.6		
	n/a - no cyclinder wrap or house has only 1 HWC	106	78.5		
	missing	2	1.5		
	Total	129	95.6		
Total		135	100.0		

Table 81 q4.8c1 Cylinder 1: Pipes wrapped lagged?

		Frequency	%	Valid %	Cumulative %
Valid	yes	39	28.9	35.1	35.1
	no	72	53.3	64.9	100.0
	Total	111	82.2	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	missing	3	2.2		
	Total	24	17.8		
Total		135	100.0		

Table 82 q4.8c2 Cylinder 2: Pipes wrapped lagged?

		Frequency	%	Valid %	Cumulative %
Valid	yes	5	3.7	50.0	50.0
	no	5	3.7	50.0	100.0
	Total	10	7.4	100.0	

Missing	n/a - house has no gas or electric HWC	21	15.6		
	n/a - house has only 1 HWC	98	72.6		
	missing	6	4.4		
	Total	125	92.6		
Total		135	100.0		

Table 83 q4.9c1 Cylinder 1: type of wrapping/lagging

		Frequency	%	Valid %	Cumulative %
Valid	new well-fitted (covers first 600-1000mm)	26	19.3	70.3	70.3
	older poorly fitted	11	8.1	29.7	100.0
	Total	37	27.4	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	n/a - no lagging on this cyclinder	67	49.6		
	missing	10	7.4		
	Total	98	72.6		
Total		135	100.0		

Table 84 q4.9c2 Cylinder 2: type of wrapping/lagging

		Frequency	%	Valid %	Cumulative %
Valid	new well-fitted (covers first 600-1000mm)	6	4.4	85.7	85.7
	older poorly fitted	1	.7	14.3	100.0
	Total	7	5.2	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	n/a - no lagging on this cyclinder or House has only 1 HWC	100	74.1		
	missing	6	4.4		
	System	1	.7		
	Total	128	94.8		
Total		135	100.0		

Table 85 q4.10c1 Cylinder 1: size of HWC

		Frequency	%	Valid %	Cumulative %
Valid	<100 litres	6	4.4	5.4	5.4
	100-120 litres	8	5.9	7.2	12.6
	121-137 litres	13	9.6	11.7	24.3
	138-170 litres	17	12.6	15.3	39.6
	171-185 litres	49	36.3	44.1	83.8
	185-290 litres	15	11.1	13.5	97.3
	>290 litres	3	2.2	2.7	100.0
	Total	111	82.2	100.0	

Missing	n/a - house has no gas or electric HWC	21	15.6		
	missing	3	2.2		
	Total	24	17.8		
Total		135	100.0		

Table 86 q4.10c2 Cylinder 2: size of HWC

		Frequency	%	Valid %	Cumulative %
Valid	<100 litres	3	2.2	21.4	21.4
	100-120 litres	1	.7	7.1	28.6
	121-137 litres	1	.7	7.1	35.7
	138-170 litres	1	.7	7.1	42.9
	171-185 litres	3	2.2	21.4	64.3
	185-290 litres	3	2.2	21.4	85.7
	>290 litres	2	1.5	14.3	100.0
	Total	14	10.4	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	n/a - house has only 1 HWC	97	71.9		
	missing	3	2.2		
	Total	121	89.6		
Total		135	100.0		

Table 87 q4.11c1 Cylinder 1: Grade

		Frequency	%	Valid %	Cumulative %
Valid	A-Grade (1986 onwards)	33	24.4	32.0	32.0
	B-Grade (1986 onwards)	41	30.4	39.8	71.8
	C-Grade (1976-1986)	12	8.9	11.7	83.5
	D-Grade (pre 1976)	17	12.6	16.5	100.0
	Total	103	76.3	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	missing	11	8.1		
	Total	32	23.7		
Total		135	100.0		

Table 88 q4.11c2 Cylinder 2: Grade

		Frequency	%	Valid %	Cumulative %
Valid	A-Grade (1986 onwards)	3	2.2	25.0	25.0
	B-Grade (1986 onwards)	7	5.2	58.3	83.3
	C-Grade (1976-1986)	2	1.5	16.7	100.0
	Total	12	8.9	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	n/a - house has only 1 HWC	97	71.9		
	missing	5	3.7		

	Total	123	91.1		
Total		135	100.0		

Table 89 q4.11c1age Cylinder 1: Age

		Frequency	%	Valid %	Cumulative %
Valid	196	1	.7	1.0	1.0
	1933	1	.7	1.0	2.0
	1955	1	.7	1.0	2.9
	1957	1	.7	1.0	3.9
	1958	2	1.5	2.0	5.9
	1960	1	.7	1.0	6.9
	1967	1	.7	1.0	7.8
	1970	3	2.2	2.9	10.8
	1972	1	.7	1.0	11.8
	1973	3	2.2	2.9	14.7
	1974	1	.7	1.0	15.7
	1975	1	.7	1.0	16.7
	1977	5	3.7	4.9	21.6
	1980	3	2.2	2.9	24.5
	1981	2	1.5	2.0	26.5
	1982	1	.7	1.0	27.5
	1984	2	1.5	2.0	29.4
	1985	1	.7	1.0	30.4
	1986	4	3.0	3.9	34.3
	1987	3	2.2	2.9	37.3
	1989	1	.7	1.0	38.2
	1990	4	3.0	3.9	42.2
	1991	2	1.5	2.0	44.1
	1992	3	2.2	2.9	47.1
	1993	4	3.0	3.9	51.0
	1994	3	2.2	2.9	53.9
	1995	4	3.0	3.9	57.8
	1996	4	3.0	3.9	61.8
	1997	4	3.0	3.9	65.7
	1998	5	3.7	4.9	70.6
	1999	5	3.7	4.9	75.5
	2000	4	3.0	3.9	79.4
	2001	3	2.2	2.9	82.4
	2002	3	2.2	2.9	85.3
	2003	4	3.0	3.9	89.2
	2004	3	2.2	2.9	92.2
	2005	6	4.4	5.9	98.0
	2006	2	1.5	2.0	100.0
	Total	102	75.6	100.0	
Missing	n/a - house has no gas or electric HWC	21	15.6		
	missing	12	8.9		
	Total	33	24.4		
Total		135	100.0		

Table 90 q4.11c2age Cylinder 2: Age

		Frequency	%	Valid %	Cumulative %
Valid	1	1	.7	8.3	8.3
	79	1	.7	8.3	16.7
	1975	1	.7	8.3	25.0
	1986	2	1.5	16.7	41.7
	1989	1	.7	8.3	50.0
	1995	1	.7	8.3	58.3
	1996	1	.7	8.3	66.7
	1997	2	1.5	16.7	83.3
	1998	1	.7	8.3	91.7
	2004	1	.7	8.3	100.0
	Total	12	8.9	100.0	
Missing	n/a - house has no gas or electric HWC	20	14.8		
	n/a - house has only 1 HWC	97	71.9		
	missing	6	4.4		
	Total	123	91.1		
Total		135	100.0		

Table 91 q4.12 Do any of the hot water taps drip?

		Frequency	%	Valid %	Cumulative %
Valid	yes	10	7.4	7.4	7.4
	no	125	92.6	92.6	100.0
	Total	135	100.0	100.0	

Table 92 q4.13 Water temperature at hot water tap

		Frequency	%	Valid %	Cumulative %
Valid	40	1	.7	.8	.8
	45	7	5.2	5.4	6.2
	47	3	2.2	2.3	8.5
	48	6	4.4	4.6	13.1
	49	1	.7	.8	13.8
	50	21	15.6	16.2	30.0
	51	1	.7	.8	30.8
	52	7	5.2	5.4	36.2
	53	10	7.4	7.7	43.8
	54	3	2.2	2.3	46.2
	55	21	15.6	16.2	62.3
	56	5	3.7	3.8	66.2
	57	1	.7	.8	66.9
	58	3	2.2	2.3	69.2
	59	4	3.0	3.1	72.3
	60	9	6.7	6.9	79.2
	61	1	.7	.8	80.0
	62	2	1.5	1.5	81.5

	63	5	3.7	3.8	85.4
	65	7	5.2	5.4	90.8
	66	1	.7	.8	91.5
	67	1	.7	.8	92.3
	68	1	.7	.8	93.1
	70	6	4.4	4.6	97.7
	72	1	.7	.8	98.5
	74	1	.7	.8	99.2
	80	1	.7	.8	100.0
	Total	130	96.3	100.0	
Missing	missing	5	3.7		
Total		135	100.0		

Table 93 q4.14 Number of showers house has

		Frequency	%	Valid %	Cumulative %
Valid	0	1	.7	.7	.7
	1	74	54.8	54.8	55.6
	2	50	37.0	37.0	92.6
	3	5	3.7	3.7	96.3
	4	3	2.2	2.2	98.5
	6	2	1.5	1.5	100.0
	Total	135	100.0	100.0	

Table 94 q4.15.1 Shower 1: shower flow (litres/min)

		Frequency	%	Valid %	Cumulative %
Valid	3.00	4	3.0	3.0	3.0
	4.00	1	.7	.7	3.7
	4.50	1	.7	.7	4.5
	5.00	4	3.0	3.0	7.5
	6.00	28	20.7	20.9	28.4
	7.00	4	3.0	3.0	31.3
	8.00	2	1.5	1.5	32.8
	9.00	14	10.4	10.4	43.3
	9.50	1	.7	.7	44.0
	10.00	5	3.7	3.7	47.8
	10.50	1	.7	.7	48.5
	11.00	2	1.5	1.5	50.0
	12.00	22	16.3	16.4	66.4
	13.00	1	.7	.7	67.2
	15.00	16	11.9	11.9	79.1
	16.00	2	1.5	1.5	80.6
	18.00	9	6.7	6.7	87.3
	20.00	3	2.2	2.2	89.6
	21.00	7	5.2	5.2	94.8
	24.00	4	3.0	3.0	97.8
	25.00	1	.7	.7	98.5
	27.00	1	.7	.7	99.3
	28.00	1	.7	.7	100.0

	Total	134	99.3	100.0	
Missing	n/a - no showers	1	.7		
Total		135	100.0		

Table 95 q4.15.2 Shower 2: shower flow (litres/min)

		Frequency	%	Valid %	Cumulative %
Valid	5.00	2	1.5	3.4	3.4
	6.00	5	3.7	8.5	11.9
	7.00	1	.7	1.7	13.6
	8.00	1	.7	1.7	15.3
	9.00	3	2.2	5.1	20.3
	9.50	1	.7	1.7	22.0
	10.00	4	3.0	6.8	28.8
	12.00	13	9.6	22.0	50.8
	13.00	1	.7	1.7	52.5
	15.00	7	5.2	11.9	64.4
	16.00	2	1.5	3.4	67.8
	17.00	1	.7	1.7	69.5
	18.00	8	5.9	13.6	83.1
	20.00	5	3.7	8.5	91.5
	21.00	1	.7	1.7	93.2
	22.00	1	.7	1.7	94.9
	24.00	3	2.2	5.1	100.0
	Total	59	43.7	100.0	
Missing	n/a - no showers or no more than 1 shower	75	55.6		
	missing	1	.7		
	Total	76	56.3		
Total		135	100.0		

Table 96 q4.15.3 Shower 3: shower flow (litres/min)

		Frequency	%	Valid %	Cumulative %
Valid	6.00	1	.7	10.0	10.0
	12.00	3	2.2	30.0	40.0
	16.00	3	2.2	30.0	70.0
	20.00	1	.7	10.0	80.0
	24.00	2	1.5	20.0	100.0
	Total	10	7.4	100.0	
Missing	n/a - no showers or no more than 2 showers	125	92.6		
Total		135	100.0		

Table 97 q5.1elect Summer power bill: electricity only

		Frequency	%	Valid %	Cumulative %
Valid	16.15	1	.7	2.3	2.3
	20.00	2	1.5	4.7	7.0
	25.00	1	.7	2.3	9.3

	28.89	1	.7	2.3	11.6
	30.00	2	1.5	4.7	16.3
	30.20	1	.7	2.3	18.6
	40.00	1	.7	2.3	20.9
	41.48	1	.7	2.3	23.3
	42.39	1	.7	2.3	25.6
	45.00	1	.7	2.3	27.9
	47.06	1	.7	2.3	30.2
	50.00	4	3.0	9.3	39.5
	53.30	1	.7	2.3	41.9
	54.00	1	.7	2.3	44.2
	54.53	1	.7	2.3	46.5
	55.00	2	1.5	4.7	51.2
	57.00	1	.7	2.3	53.5
	60.00	3	2.2	7.0	60.5
	68.00	1	.7	2.3	62.8
	70.00	1	.7	2.3	65.1
	70.11	1	.7	2.3	67.4
	80.00	2	1.5	4.7	72.1
	85.00	1	.7	2.3	74.4
	93.00	1	.7	2.3	76.7
	93.38	1	.7	2.3	79.1
	93.93	1	.7	2.3	81.4
	95.00	1	.7	2.3	83.7
	97.00	1	.7	2.3	86.0
	100.00	3	2.2	7.0	93.0
	130.00	1	.7	2.3	95.3
	170.00	1	.7	2.3	97.7
	282.77	1	.7	2.3	100.0
	Total	43	31.9	100.0	
Missing	n/a doesn't have this type of billing or this type of energy	79	58.5		
	missing	13	9.6		
	Total	92	68.1		
Total		135	100.0		

Table 98 q5.1gas Summer power bill: gas only

		Frequency	%	Valid %	Cumulative %
Valid	30.00	2	1.5	1.7	1.7
	36.85	1	.7	.8	2.5
	37.00	1	.7	.8	3.4
	40.00	2	1.5	1.7	5.1
	40.46	1	.7	.8	5.9
	42.79	1	.7	.8	6.8
	45.00	1	.7	.8	7.6
	48.00	1	.7	.8	8.5
	49.57	1	.7	.8	9.3
	50.00	1	.7	.8	10.2
	60.00	4	3.0	3.4	13.6

65.00	1	.7	.8	14.4
67.00	1	.7	.8	15.3
70.00	2	1.5	1.7	16.9
71.00	1	.7	.8	17.8
73.00	1	.7	.8	18.6
75.00	1	.7	.8	19.5
78.50	1	.7	.8	20.3
78.73	1	.7	.8	21.2
80.00	8	5.9	6.8	28.0
82.64	1	.7	.8	28.8
85.00	4	3.0	3.4	32.2
89.95	1	.7	.8	33.1
90.00	4	3.0	3.4	36.4
93.00	1	.7	.8	37.3
93.96	1	.7	.8	38.1
94.92	1	.7	.8	39.0
95.00	1	.7	.8	39.8
100.00	4	3.0	3.4	43.2
105.00	1	.7	.8	44.1
108.71	1	.7	.8	44.9
110.00	7	5.2	5.9	50.8
111.00	1	.7	.8	51.7
111.68	1	.7	.8	52.5
112.80	1	.7	.8	53.4
113.90	1	.7	.8	54.2
115.87	1	.7	.8	55.1
118.00	1	.7	.8	55.9
120.00	3	2.2	2.5	58.5
121.00	1	.7	.8	59.3
123.86	1	.7	.8	60.2
125.00	2	1.5	1.7	61.9
126.00	1	.7	.8	62.7
126.88	1	.7	.8	63.6
130.00	2	1.5	1.7	65.3
132.00	1	.7	.8	66.1
134.30	1	.7	.8	66.9
135.21	1	.7	.8	67.8
137.00	1	.7	.8	68.6
138.30	1	.7	.8	69.5
140.00	4	3.0	3.4	72.9
147.80	1	.7	.8	73.7
150.00	3	2.2	2.5	76.3
160.00	3	2.2	2.5	78.8
164.00	1	.7	.8	79.7
165.00	1	.7	.8	80.5
170.00	2	1.5	1.7	82.2
171.62	1	.7	.8	83.1
177.15	1	.7	.8	83.9
180.00	2	1.5	1.7	85.6
184.00	1	.7	.8	86.4
190.00	1	.7	.8	87.3

	191.00	1	.7	.8	88.1
	200.00	1	.7	.8	89.0
	207.00	1	.7	.8	89.8
	212.00	1	.7	.8	90.7
	220.00	3	2.2	2.5	93.2
	224.97	1	.7	.8	94.1
	225.00	1	.7	.8	94.9
	242.78	1	.7	.8	95.8
	250.00	1	.7	.8	96.6
	270.00	1	.7	.8	97.5
	296.78	1	.7	.8	98.3
	339.00	1	.7	.8	99.2
	400.00	1	.7	.8	100.0
	Total	118	87.4	100.0	
Missing	n/a doesn't have this type of billing or this type of energy	5	3.7		
	missing	12	8.9		
	Total	17	12.6		
Total		135	100.0		

Table 99 q5.1.combin Summer power bill: combination

		Frequency	%	Valid %	Cumulative %
Valid	146.82	1	.7	33.3	33.3
	180.00	1	.7	33.3	66.7
	200.00	1	.7	33.3	100.0
	Total	3	2.2	100.0	
Missing	n/a doesn't have this type of billing or this type of energy	120	88.9		
	missing	12	8.9		
	Total	132	97.8		
Total		135	100.0		

Table 100 q5.2elect Winter power bill: electricity only

		Frequency	%	Valid %	Cumulative %
Valid	25.00	1	.7	2.0	2.0
	30.00	1	.7	2.0	4.0
	37.27	1	.7	2.0	6.0
	42.39	1	.7	2.0	8.0
	43.20	1	.7	2.0	10.0
	49.31	1	.7	2.0	12.0
	50.00	1	.7	2.0	14.0
	58.05	1	.7	2.0	16.0
	61.97	1	.7	2.0	18.0
	70.00	2	1.5	4.0	22.0
	72.77	1	.7	2.0	24.0
	75.00	1	.7	2.0	26.0
	81.33	1	.7	2.0	28.0

	83.19	1	.7	2.0	30.0
	89.50	1	.7	2.0	32.0
	90.00	2	1.5	4.0	36.0
	93.95	1	.7	2.0	38.0
	96.00	1	.7	2.0	40.0
	100.00	1	.7	2.0	42.0
	101.00	1	.7	2.0	44.0
	105.00	1	.7	2.0	46.0
	110.00	2	1.5	4.0	50.0
	110.18	1	.7	2.0	52.0
	120.00	2	1.5	4.0	56.0
	125.74	1	.7	2.0	58.0
	130.00	1	.7	2.0	60.0
	138.00	1	.7	2.0	62.0
	140.00	1	.7	2.0	64.0
	150.00	1	.7	2.0	66.0
	168.22	1	.7	2.0	68.0
	170.00	2	1.5	4.0	72.0
	174.00	1	.7	2.0	74.0
	200.00	3	2.2	6.0	80.0
	221.00	1	.7	2.0	82.0
	222.22	1	.7	2.0	84.0
	230.00	1	.7	2.0	86.0
	240.00	2	1.5	4.0	90.0
	250.00	1	.7	2.0	92.0
	265.00	1	.7	2.0	94.0
	270.00	1	.7	2.0	96.0
	438.40	1	.7	2.0	98.0
	1097.00	1	.7	2.0	100.0
	Total	50	37.0	100.0	
Missing	n/a doesn't have this type of billing or this type of energy	69	51.1		
	missing	16	11.9		
	Total	85	63.0		
Total		135	100.0		

Table 101 q5.2gas Winter power bill: gas only

		Frequency	%	Valid %	Cumulative %
Valid	35.59	1	.7	.9	.9
	36.20	1	.7	.9	1.8
	50.00	1	.7	.9	2.7
	50.18	1	.7	.9	3.5
	60.00	4	3.0	3.5	7.1
	65.00	2	1.5	1.8	8.8
	70.00	1	.7	.9	9.7
	71.28	1	.7	.9	10.6
	75.00	1	.7	.9	11.5
	80.00	1	.7	.9	12.4
	85.00	1	.7	.9	13.3

90.00	4	3.0	3.5	16.8
95.00	3	2.2	2.7	19.5
99.68	1	.7	.9	20.4
100.00	4	3.0	3.5	23.9
104.83	1	.7	.9	24.8
106.19	1	.7	.9	25.7
110.00	1	.7	.9	26.5
119.00	1	.7	.9	27.4
120.00	6	4.4	5.3	32.7
120.14	1	.7	.9	33.6
123.00	1	.7	.9	34.5
125.00	2	1.5	1.8	36.3
130.00	1	.7	.9	37.2
137.31	1	.7	.9	38.1
145.00	1	.7	.9	38.9
147.40	1	.7	.9	39.8
149.00	1	.7	.9	40.7
150.00	5	3.7	4.4	45.1
152.55	1	.7	.9	46.0
160.00	5	3.7	4.4	50.4
160.38	1	.7	.9	51.3
163.66	1	.7	.9	52.2
166.80	1	.7	.9	53.1
167.00	1	.7	.9	54.0
170.00	3	2.2	2.7	56.6
170.94	1	.7	.9	57.5
178.00	1	.7	.9	58.4
180.00	4	3.0	3.5	61.9
189.62	1	.7	.9	62.8
190.00	2	1.5	1.8	64.6
195.09	1	.7	.9	65.5
196.00	1	.7	.9	66.4
200.00	5	3.7	4.4	70.8
210.00	2	1.5	1.8	72.6
211.00	1	.7	.9	73.5
215.00	1	.7	.9	74.3
225.00	2	1.5	1.8	76.1
240.00	1	.7	.9	77.0
242.40	1	.7	.9	77.9
247.00	1	.7	.9	78.8
250.00	2	1.5	1.8	80.5
254.00	1	.7	.9	81.4
260.00	2	1.5	1.8	83.2
260.87	1	.7	.9	84.1
265.00	1	.7	.9	85.0
269.80	1	.7	.9	85.8
280.00	2	1.5	1.8	87.6
285.00	1	.7	.9	88.5
290.93	1	.7	.9	89.4
300.00	3	2.2	2.7	92.0
301.48	1	.7	.9	92.9

	320.00	1	.7	.9	93.8
	333.00	1	.7	.9	94.7
	350.00	1	.7	.9	95.6
	450.00	1	.7	.9	96.5
	503.71	1	.7	.9	97.3
	556.00	1	.7	.9	98.2
	600.00	1	.7	.9	99.1
	800.00	1	.7	.9	100.0
	Total	113	83.7	100.0	
Missing	n/a doesn't have this type of billing or this type of energy	6	4.4		
	missing	16	11.9		
	Total	22	16.3		
Total		135	100.0		

Table 102 q5.2combi Winter power bill: combination

		Frequency	%	Valid %	Cumulative %
Valid	115.00	1	.7	50.0	50.0
	171.76	1	.7	50.0	100.0
	Total	2	1.5	100.0	
Missing	n/a doesn't have this type of billing or this type of energy	118	87.4		
	missing	15	11.1		
	Total	133	98.5		
Total		135	100.0		

Table 103 q6.1 How many windows are double glazed?

		Frequency	%	Valid %	Cumulative %
Valid	none	115	85.2	85.8	85.8
	some	12	8.9	9.0	94.8
	all	7	5.2	5.2	100.0
	Total	134	99.3	100.0	
Missing	missing	1	.7		
Total		135	100.0		

Table 104 q6.2 How many windows have draft proofing?

		Frequency	%	Valid %	Cumulative %
Valid	none	56	41.5	41.5	41.5
	some	12	8.9	8.9	50.4
	most	5	3.7	3.7	54.1
	all	62	45.9	45.9	100.0
	Total	135	100.0	100.0	

Table 105 q6.3 What type of joinery are window frames?

		Frequency	%	Valid %	Cumulative %
Valid	All wooden	46	34.1	34.1	34.1
	All aluminium	75	55.6	55.6	89.6
	Combination of wood and aluminium	13	9.6	9.6	99.3
	other	1	.7	.7	100.0
	Total	135	100.0	100.0	

Table 106 q6.4 How many external doors?

		Frequency	%	Valid %	Cumulative %
Valid	1	5	3.7	3.8	3.8
	2	41	30.4	30.8	34.6
	3	18	13.3	13.5	48.1
	4	25	18.5	18.8	66.9
	5	13	9.6	9.8	76.7
	6	12	8.9	9.0	85.7
	7	10	7.4	7.5	93.2
	8	4	3.0	3.0	96.2
	9	2	1.5	1.5	97.7
	10	1	.7	.8	98.5
	11	1	.7	.8	99.2
	12	1	.7	.8	100.0
	Total	133	98.5	100.0	
Missing	missing	2	1.5		
Total		135	100.0		

Table 107 q6.5 How many external doors have draft proofing?

		Frequency	%	Valid %	Cumulative %
Valid	0	33	24.4	28.7	28.7
	1	15	11.1	13.0	41.7
	2	21	15.6	18.3	60.0
	3	12	8.9	10.4	70.4
	4	5	3.7	4.3	74.8
	5	8	5.9	7.0	81.7
	6	7	5.2	6.1	87.8
	7	9	6.7	7.8	95.7
	8	1	.7	.9	96.5
	9	1	.7	.9	97.4
	10	1	.7	.9	98.3
	11	1	.7	.9	99.1
	12	1	.7	.9	100.0
	Total	115	85.2	100.0	
Missing	n/a for some reason e.g. aluminium doors	14	10.4		
	missing	6	4.4		
	Total	20	14.8		
Total		135	100.0		

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