PR106/2

Market Segmentation of New Zealand's Housing Stock

Final

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About This Report

Title

Market Segmentation of New Zealand's Housing Stock

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Abstract

This report identifies the key market segments with the New Zealand residential housing stock and the associated drivers and opportunities to improve the sustainability of the homes in each segment. There are four key segments based on ownership and age of house; owned pre 1979, owned 1979 onwards, rental pre-1979 and rental 1979 onwards. For existing homes, alteration and additions provide a point of significant opportunity where including sustainability features in the upgrade of the home can be incorporated more easily. Three life stages offer specific drivers and hence opportunities to upgrade a home. These are family with young children, family with teenage children and couples about to retire.

Reference

Amitrano, L., Kirk, N. and Page, I. October 2006. Market Segmentation of New Zealand's Housing Stock.Report PR106/2 for Beacon Pathway Limited.

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1 Executive Summary

This report provides information on the breakdown of the New Zealand's housing stock, to identify opportunities to improve the sustainability of our housing stock, and to allow associated targeted strategies to be developed. It provides many layers of different segments with the size of each market segment identified, and discusses the overlaps and interactions between different segments.

There are approximately 1.6 million homes currently built, with 1.04 million built before insulation was required in our homes. Four key market segments are identified.

The first segment is houses built before 1979 that are owner occupied, the largest segment of approximately 700,000 homes. For these homes, a key improvement is upgrading insulation to improve the energy efficiency and indoor environment via increased comfort and ability to heat and reduced relative humidity. In the majority of these homes upgrading insulation in the ceiling and floor is relatively easy. For those with skillion roofs, homeowners should be encouraged to lift the roof to add insulation when it needs maintenance (e.g. painting) or when it needs replacing. To insulate the walls of these homes, the most opportune time is when redecorating and replacing the internal linings.

The second segment is houses built after 1979 that are owner occupied. This market segment makes up 25% of the existing stock and, whilst perceived as being new, or at least 'newer', in some cases the energy efficiency will not meet Beacon's high standard of sustainability. The likely perception that their newer homes are more sustainable makes this segment difficult to engage with; yet apart from insulation their homes on average offer no additional sustainability features to older homes. Using both the need to maintain a home and the drivers of family life-age will be essential to engage with this market segment, which will be necessary if Beacon is going to reach their goal of making 90% of homes sustainable.

The last two key segments are rental properties built before 1979 (20% of the existing market stock) and those built from 1979 onwards (12%). Once again the perception that newer housing don't need improving will make it difficult to engage with landlords who own homes less than 25 years old. The rental property segment overall is the most challenging because the owners will not necessarily reap the ongoing benefits of the improvements directly. Therefore, for Beacon to engage in increasing the sustainability of this market segment, influencing government will be a key factor. This includes:

- encouraging Department of Building and Housing to include minimum levels of sustainability in the Residential Tenancy Act OR
- setting minimum acceptable levels with the HERS scheme under development
- requiring landlords to display the HERS rating (or a similar sustainability rating if developed) when advertising a property for rent.
- looking at opportunities to partially subsidise sustainability improvements to take into account the benefits that are passed onto the occupiers of the rental properties to kick-start improvement of this segment.

- Encouraging government at all levels to upgrade their own rental properties to set a good example to the ‘single rental’ property landlords.

Information to property owners showing the benefits of improving their properties, including longer tenancy periods and properties being easier to rent, are key for increasing the sustainability of properties in this segment.

Other key areas where Beacon should influence policy are:

- Encouraging higher standards of sustainability for new housing with the current Building Code review with a focus on doing better than the minimum and providing aspirational goals for existing homeowners.
- Working with local government on water efficiency opportunities to reduce barriers to installing rainwater tanks and grey water systems

The three key areas where sustainability can be improved, based on the physical attributes of the house, are:

- Energy efficiency
- Water efficiency
- Internal environmental quality

The analysis has shown that a freehold house does not necessarily equate to a higher disposable income so further breakdown between owning a house with or without a mortgage is not necessary. The opportunities tend to be more determined on life stage more than ownership category. The following life stage categories and opportunities can be integrated into all four market segments:

- *Family with young children*: With young children the desire to ensure the house is kept to a comfortable warm level to prevent sickness is likely to be greater, and there is a higher chance of people being at home during the day, increasing particularly the heating use over winter.
- *Teenage Children*: It has been long assumed and documented in the early days of HEEP (Pollard, 2002) monitoring the relationship between teenagers (particularly female) and higher energy use. This is a key driver for families either with teenage children or, more importantly, children who will soon be teenagers to make their home more sustainable, specifically in terms of energy and water use.
- *Retirement age*: The analysis shows at retirement, although it is more likely a person will have a freehold home, their income is reduced significantly. Therefore an opportunity arises for those pre-retirement to sustainably retrofit their homes, providing a home for retirement that has lower operational costs and can provide the desired comfort and amenity. Given the ageing population, the greater likelihood of having a freehold or near-to-freehold house there is significant opportunity in this segment.

2 Introduction

This report provides information on the breakdown of the New Zealand's housing stock, to identify opportunities to improve the sustainability of our housing stock, and to allow associated targeted strategies to be developed. It provides many layers of different segments with the size of each market segment identified, and discusses the overlaps and interactions between different segments.

Beacon needs to understand these different markets so it can efficiently target markets in an appropriate way with the right messages about what their homes need and how houses can be made more sustainable. The housing market can be segmented in many ways so for this project the following will be used:

- House factors; age of house, insulation levels, size of house etc
- Regional factors; climate, rural, urban etc
- Social factors; income, household size, age of occupants etc
- Market factors; freehold, ownership with mortgage, rental etc.

From this information, it is possible to look at the trends and changes within the housing stock for the future, and then identify the key segments and potential drivers for each of those segments.

This report has been divided into three main sections. Section 1 looks at the physical attributes of our housing stock including a breakdown of the building stock, energy and water efficiency features, regional breakdowns and the impact of climate.

Section 2 looks at the market trends in terms of ownership of housing and social factors such as age and income that allow further segmentation of the housing stock market and potential opportunities for different segments to be identified.

The resulting discussion uses the information provided in the first two sections, and pins it back to Beacon's goal of 90% of homes having a high level of sustainability. It looks at the opportunities within each market segment, the size of the segment, and potential drivers.

3 Section One: Physical attributes of our housing stock

3.1 Understanding the physical attributes of our housing stock

The physical characteristics of houses and different segments within those physical characteristics have an impact on the sustainability features and benefits of a dwelling, whether it be the dwelling type, location or components.

There are two main house types discussed when identifying opportunities for making houses more sustainable, existing housing stock and new (or newer) housing. However, within these broad bands, it is important to look at the interactions in many areas including:

- Sustainability components to the house (e.g. insulation, installed solar hot water systems)
- Types of dwellings (single units, semi-detached or apartments)
- Regional breakdown and climate

The existing building stock is about 1.6 million. Therefore, how many ways can these 1.6 million dwellings be “sliced and diced” into sub groups to quantify gaps to Beacon’s goal, identify target markets for Beacon, and identify the potential drivers to increase the uptake of sustainable solutions within these markets?

The first three key areas discussed are:

- Energy efficiency
- Water efficiency
- Indoor environmental quality

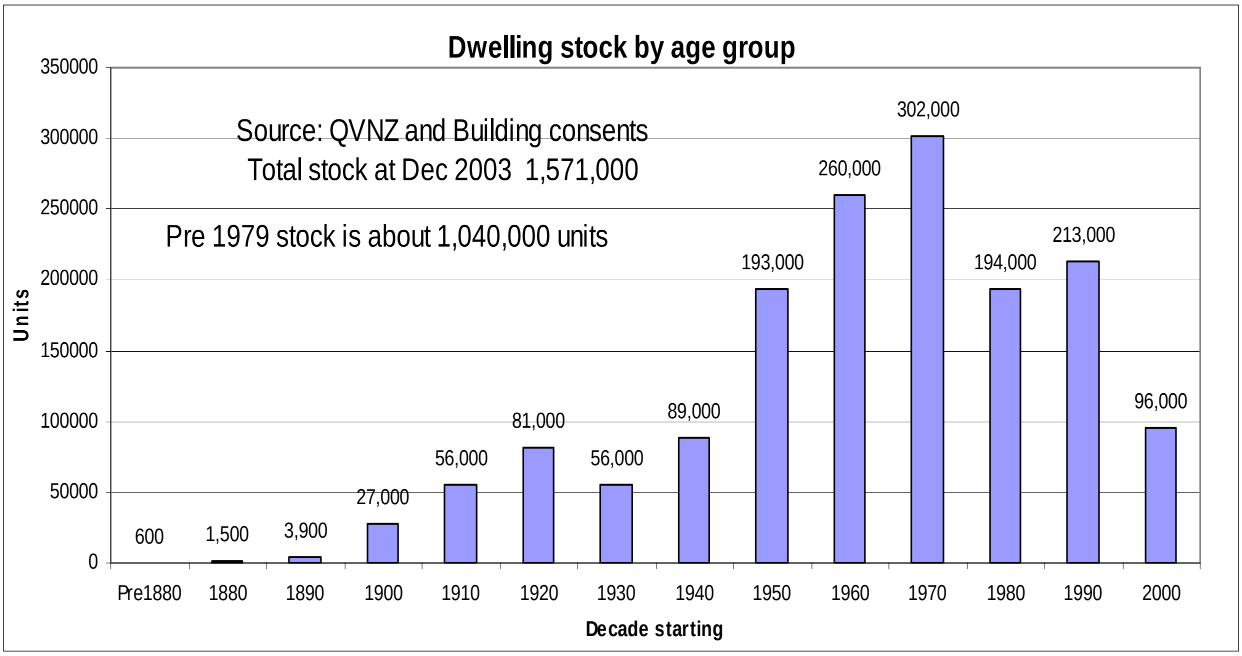


Figure 1: New Zealand's dwelling stock by decade age group (Storey et al, 2004)

3.1.1 Energy efficiency and energy use

This section identifies the energy efficiency-related physical components (e.g. ceiling insulation, solar hot water systems) of New Zealand houses, and uses these components to identify market segments of the existing building stock.

So, where does the energy go in our houses? In general terms it can be divided into three equal parts; space heating, hot water and the rest (other appliances). Space heating is the amount of energy used to heat a home, but this is dependent on the physical energy efficiency attributes of the dwelling (e.g. insulation). For the other appliances, the mains users of energy are lights, range and refrigerator/freezers.

The BRANZ Household Energy End-use Project (HEEP) breakdown of energy use in houses can be seen in Figure 2. Given the 'other appliances' category can be further divided into all appliance types, the two key areas to concentrate on should be water heating and space heating to improve efficiency, making up over 60% of the energy use in a house.

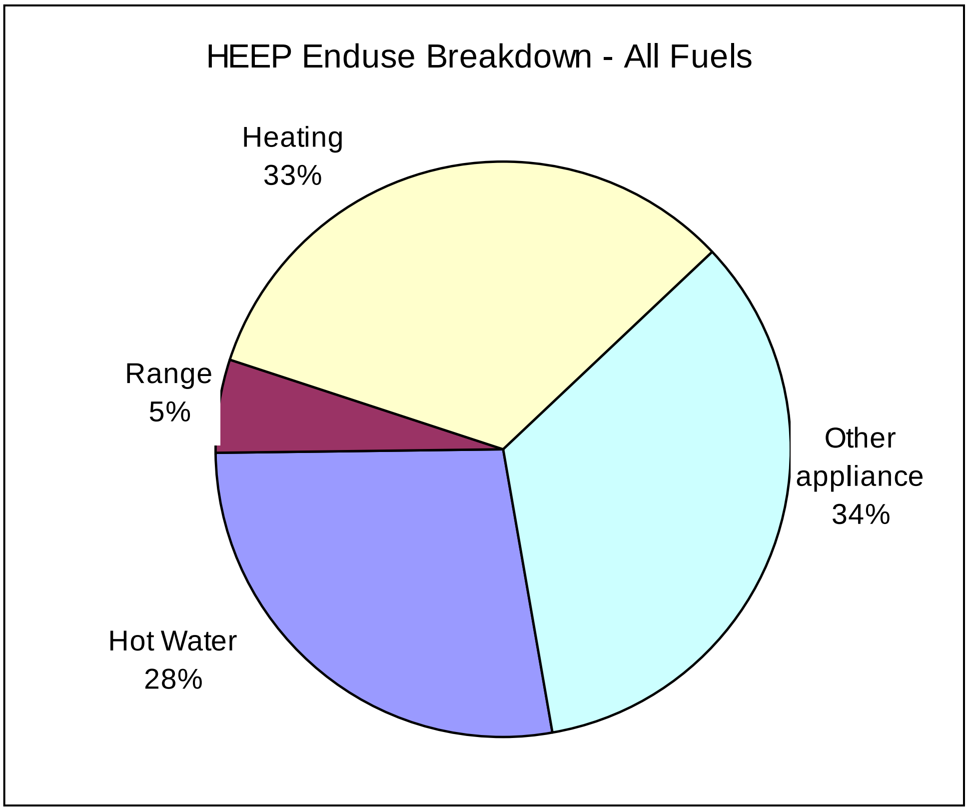


Figure 2: Breakdown of energy use in New Zealand houses.

(HEEP 2006)

3.1.1.1 Existing housing – Pre 1979

The main difference between housing built before 1979 and from 1979 onwards is the requirement for houses built from 1979 to have insulation. In order to reach the Beacon goal of 90% of homes meeting a high level of sustainability, the addition of insulation to pre-1979 homes is essential. This is the largest segment of the building stock, with approximately 1,040,000 dwellings. It is anticipated that some houses in this segment will have retrofitted insulation installed, particularly in the ceiling and to a lesser extent underfloor.

The BRANZ House Condition Survey[i] reports 69% of New Zealand homes have full-cover ceiling insulation which at first implies a significant number of houses have had insulation installed, leaving only 31% uninsulated. However further inspection of the House Condition Survey shows many of these homes had insulation of an insufficient thickness to meet current Building Code requirements, let alone a higher standard of sustainability. Table 1 shows only 21% of the houses inspected had insulation with a thickness of more than 75mm across the entire roof-space. Although it is dependent on the type of insulation, for most bulk insulation (e.g. glass-wool, polyester, macerated paper etc) the typical R-value of 100mm thickness is R 2.2 - 2.4.

Ceiling insulation condition score				
% insulation ceiling cover	Thickness mm	Condition Score	Count (houses)	%
nil		1	35	7
other		2	55	11
100	50	3	118	24
100	75	4	180	36
100	>75	5	106	21
>79	>50	3	494	100

Table 1: Ceiling insulation scores

(2005 BRANZ House Condition Survey)

This shows a huge opportunity in improving the energy efficiency of New Zealand dwellings by retrofitting insulation to a high level, starting in the ceiling where the heat losses are greatest (42%) and then looking at underfloor and wall insulation.

Across all houses, it would be anticipated that older houses would score lower than newer houses in the Survey. Table 1 shows this is true from 1950's to present, however it is interesting that, for all decades, some insulation has been installed (otherwise the score would be zero), and although there is an upward trend from 1950 – 2000, even in the last decade not all houses have had adequate installation installed.

Whilst this indicates how poor our current housing stock is in terms of inclusion of energy efficiency measures, it does provide an area of huge opportunity to improve the sustainability of our homes by adding and increasing insulation in the ceiling, underfloor and walls. The breakdown of the construction types and estimated percentage of insulated and uninsulated homes, by components, for homes built prior to 1979 is shown in Table 2. The construction types and insulation estimates have been derived from the House Condition Survey, 2005.

House component	Type	# of homes	% of market segment
Roof	Cavity - uninsulated Cavity - insulated to current code Skillion – uninsulated	631,810 167,950 240,240	61% 16% 23%
Walls	Cavity – timber frame with cladding No Cavity – solid timber or concrete block	975,520 64,480	94% 6%
Floor	Suspended – uninsulated Suspended – insulated Slab on ground Suspended – too close to ground	711,491 56,029 272,480 10,400*	68% 5% 26% 1%

* This number has been estimated as the 2005 HCS did not provide specific information to determine the number of homes that are too low to the ground to install insulation in the sub-floor space.

Table 2: Insulation and construction type of dwellings – Pre 1979

(derived form BRANZ House Condition Survey 2005)

In many homes (for the ceiling and underfloor) this can be carried out quite easily as there is easy access to install insulation. It is also reasonably inexpensive, can be done as a DIY job, or by companies (e.g. Opotiki Trading or Energy Smart) or non-profit organisations (e.g. Christchurch Community Energy Action) that have been set up initially in response to EECA's Energy Wise Homes Grants scheme, but also provide the services to the general public. Education and awareness through public information and campaigns (e.g. Contact Electricity campaign), good independent information on the right products for the right jobs, encouraging building above minimum Code requirements, putting a value on a comfortable home through rating schemes, packaged solutions at both outlets for DIYers and from companies that carry out installations, are all options to increase the perceived value of insulation in the home.

3.1.1.2 Existing housing – 1979 to present

One would assume that all new houses had insulation to Code level, and that low overall standards of insulation could be attributed to older houses retrofitted with insulation without a code compliance requirement. However, Figure 3 shows that even in houses built from 1990 onwards, a reasonable percentage of houses (26%) surveyed did not meet the Code level that had been required since 1979.

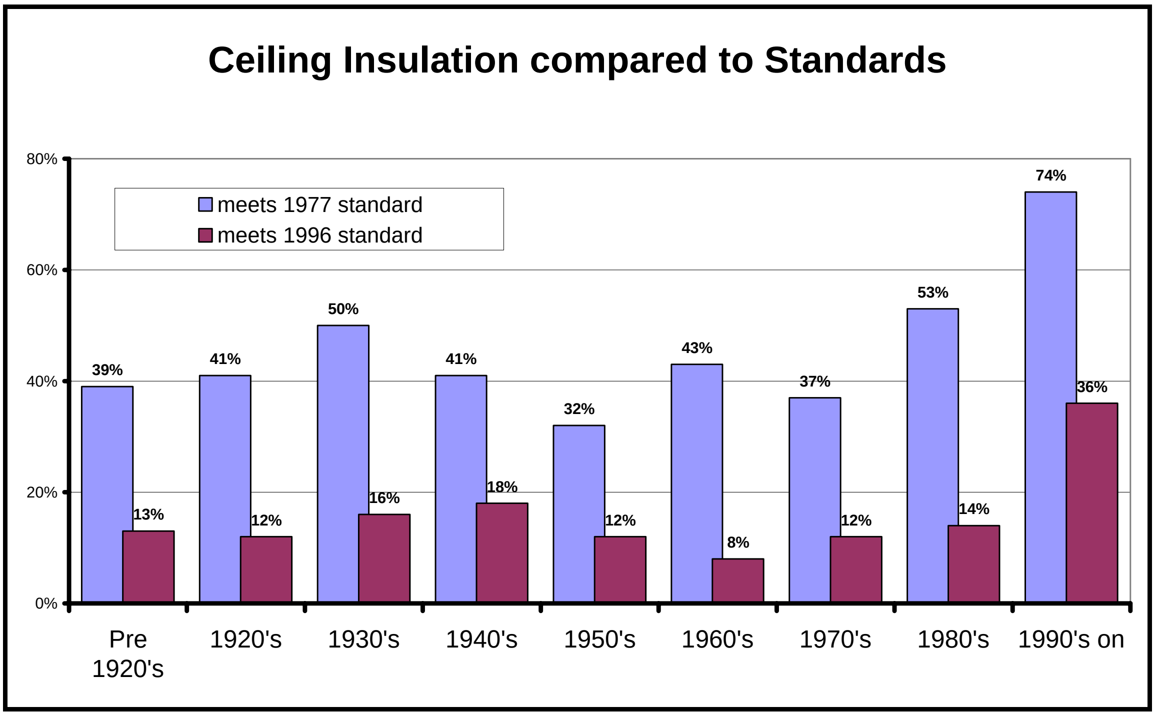


Figure 3: Ceiling insulation standards in surveyed houses

(NZHCS, 2005)

This may be due to damage, settling, degradation of insulation materials, incomplete cover[ii] or a combination of these factors. This is not a priority area for Beacon because there are more houses with much lower levels of insulation, however it is recommended that, through the Beacon Market Transformation research stream, methods are developed to engage owners of these homes. The message should be for homeowners to at least check if their current insulation levels are to an 'acceptable standard'. Table 3 gives a breakdown of the number of homes, the insulation levels and the component types in New Zealand.

House component	Type	# of homes	% of market segment
Roof	Cavity – below code insulation Cavity - insulated to current code Skillion – below code Skillion – insulated to current code	136,840 313,360 45,850 99,950	23% 53% 8% 17%
Walls	Cavity – timber frame with cladding insulated to code* No Cavity – solid timber or concrete block	524,480 71,520	88% 12%
Floor	Suspended – uninsulated Suspended – insulated to code Slab on ground Suspended – too close to ground	17,740 150,421 427,840 5900	3% 25% 72% 1%

*It is known some houses (typically simple lower cost houses built during the late '80's) will have foil in the wall cavity as insulation. Currently there are no estimates on the number of houses built using the foil as insulation in this way, but it is no longer seen as good practice or as meeting the Building Code because the R-value achieved was not as good as originally expected (actual R-value was around R0.8 and in some cases there were problems with moisture inside the cavity.

Table 3: Insulation and construction type of dwellings –1979 to 2005

(derived from BRANZ House Condition Survey 2005)

3.1.1.3 Leaky houses to 2012

A sub-set of the insulated (1979 to present) homes are those that are defined as "leaky buildings". With the rise in popularity of monolithic claddings, and "Mediterranean style" dwellings with flat roofs and small or no eaves, as well as poor or deficient detailing in constructions, and use of untreated timber, New Zealand has seen many cases of what has been deemed 'leaky building syndrome'[iii, iv]. 'Leaky building syndrome' is where buildings have water penetrating the building envelope and unable to escape easily, resulting in problems ranging from mould and peeling paint to rotting structures[v]. As a result of awareness of this problem, the New Zealand Government set up the Weathertight Homes Resolution Service (WHRS) as part of the Department of Internal Affairs in November 2002[vi]. In July 2005 it was moved to the Department of Building and Housing[vii]. The WHRS only deals with cases in houses that are under ten years old.

As at the 17th of November 2005, 3,765 claims had been received by the Weathertight Homes Resolution Service (WHRS), and around 20% of these had not been continued due to ineligibility or at the claimant's request[viii]. As of the 29th of March 2006, 3,356 active claims had been resolved, 522 were undertaking a WHRS resolution process, and 1,505 claimants were awaiting claimant decisions[ix]. Current estimates put the number of dwellings affected by 'leaky building syndrome' at 15,000[x], between 2-3% of the housing built since 1979 to present, with most built in the 1990's.

The problem with weathertightness issues in houses is that it often takes several years for symptoms to show and problems to be identified. Although new regulations were included in 2004 Building Code[xi] in an effort to prevent more cases happening in new homes, there are likely to be more homes built before this stage but affected by 'leaky building syndrome' than are currently known.

3.1.1.4 Double glazing

Double glazing is included in the latest Housing Insulation Standard (NZS4218:2004) for the colder parts of New Zealand (Zone 3 – South Island and Central Plateau region in the North Island), but at present this version of the insulation standard is not called up in the Building Code. NZS 4218:2204 also recommends double glazing for any house with a window-to-wall ratio greater than 30%. This is because of the very poor R-value of single glazing (approximately R0.2) in comparison to the R-value of the wall (R1.5).

The number of houses in New Zealand that have double glazing or are partially double glazed is unknown at present. However, given it has only been in the last five to seven years that double glazing has been given emphasis in new housing and the building industry, it is estimated to be in less than 5% of new homes. Initially this started in the South Island (Christchurch and Queenstown), and, as Table 4 shows, through most parts of New Zealand there is currently some uptake of double glazing in new housing, with the exception being the far north and parts of Auckland.

With double glazing in new housing increasing, the awareness of it as an option for homes, and of the benefits it provides in preventing condensation, reducing noise and reducing heat loss has also increased. This new level of awareness has, in some areas, created the ability for small 'cottage' businesses to set up retrofit double glazing companies where the existing window frames are either rerouted or adapted to fit double glazing. At this stage most are located in the South Island covering Christchurch, Ashburton, Dunedin and Queenstown (e.g. Thermoglaze).

There are a range of options for retrofitting double glazing including:

- Magnetic framed acrylic windows to add to the inside of aluminium frames (e.g. Energy Doctor)
- Plastic film – taped and heat-shrunk to the inside of windows (aluminium and wooden)
- Frames with acrylic glazing screwed to the outside of existing window frames.

At this stage none of these retrofit options have made any significant in-roads into the existing housing market. However, with the increase in double glazing for new housing, it is likely there will be an increasing demand for good retrofit options.

From BRANZ Materials Survey for 6 months to June 2006.

	% of new houses with double glazing
Queenstown/ Lakes	100
Christchurch	80
Dunedin	90
Tasman	15
Whangarei	5
Rodney	5
Auckland	5
Manukau	0
Franklin	0
Hamilton	10
Tauranga	20
Thames-Coro	20
Palm North	10
Wellington	45

Table 4: Percentage of new homes with double glazing per region based on a six month period to June 2006
(BRANZ Material Survey 2006)

3.1.1.5 Hot water

Typically 35 - 40% of a household's energy use will be to heat water and maintain it to a set temperature in order to have a constant supply of hot water. This is dependent on the type of hot water system and fuel, and the amount of hot water used as dictated by the behaviour of the occupants.

Fuel Type	Percentage of systems (HEEP)	Estimated number of homes
Electricity cylinder	71%	1,125,000*
Electricity + solar	1%	22,000*
Electricity + wetback	14%	230,000
Electricity + solar + wetback	1%	13,000*
Solid Fuel	< 1%	7,000
Gas cylinder (nat. gas or LPG)	8%	123,000
Instant gas	5%	73,000
Other	< 1%	7000

* Adjusted to align with information from EECA's hot water discussion document (EECA, 2006)

Table 5: Break down of hot water cylinder types from the HEEP study
(HEEP, Year 8)

The table above shows that, overall, New Zealand homes are heavily dependent on electricity to heat hot water. The HEEP information shows of the 440 hot water systems monitored, 313 were electric hot water cylinders (Isaacs et al, 2004), with just under half (46%) of the cylinder being the same age as the house (suggesting that they are the original cylinders).

The dominance of electricity is likely to be due to the age of the building stock, the limited distribution of piped natural gas around the country, and the use of bottled gas being relatively new to New Zealand. The high number of wetbacks indicates New Zealanders reliance on, and easy access to, wood to use as solid fuel. The small market penetration of solar hot water is supported by the HEEP data with only 2% (6 solar hot water systems) being sampled.

The pressure (mains or low) of the hot water system typically has an impact on the amount of hot water delivered, with mains pressure systems having a greater average flow rate than low pressure. For the HEEP houses, the majority of the electric hot water systems were mains pressure (79%). The HEEP data also showed that newer houses are much more likely to have mains pressure (whether the hot water system is gas or electric) with over 70% of the houses monitored that were built after 2000 (which was only a sample of 11 houses) having mains pressure systems.

Given the improvements possible for hot water systems by either replacement with a newer better-insulated cylinder, upgrading to solar water heating systems or using heat pump technology, a significant amount of energy saving is achievable, with 98% of the current market in a position where they would benefit from an improved system. In terms of fuel type, the ‘wetback’ system should not be dismissed given approximately 15% of the existing market (mainly in rural areas) uses a wetback, often where free firewood provides a cheap fuel source. Provided clean-burning wetbacks are available, the combination of solar (for summer) and wetback (for winter) would mean no reliance on either electricity or gas networks, however, based on the HEEP data, less than 1% of houses has this option currently.

A cheaper and simpler solution is to wrap cylinders and the first 2 metres of the hot water pipe from the cylinder. The HEEP Year 9 report suggests the installation of cylinder wraps and pipe insulation on all the C or D grade cylinders (all electric cylinders built before 1988) would require:

- Installing wraps and piping on approximately 240,000 135 litre cylinders; and
- A further 160,000 180 litre cylinders

This would achieve a national energy saving of 122GWh per year, with a retail electricity savings of about $10 million per year.

Solar Hot Water

EECA's discussion document on increasing the uptake of solar water heating (EECA, 2006) estimates the total number of solar hot water systems in New Zealand homes as 35,000, a mere 2.2% of the total number of houses. However, the number of installations has increased significantly recently, with 10% of the total solar hot water cylinders installed in the last year (July 05 – June 06). Most solar hot water manufacturers will claim their systems can achieve up to 65-75% savings compared to a standard electric cylinder. However, little research or testing has been carried out in New Zealand to back up these claims, and it now recognised within the industry that performance data specific to New Zealand is required. A project has recently started, co-funded by Building Research and EECA, and undertaken by BRANZ, to measure the performance of a range of solar hot water systems in the four main regions. The study will also measure a small number of hot water heat pumps.

Heat Pumps

Hot water heat pumps (e.g. Quantum and Rheem) offer another solution to efficiently heat water for households. At this stage they are seen as newcomers to the New Zealand market and have not had a huge amount of traction to date. The first hot water heat pumps were promoted in New Zealand only 10 years ago through some of the power companies at that time (e.g. Tasman Energy), but with the restructuring of the electricity industry they were not available for many years. It has only been in the last two years that about four different brands have come onto the New Zealand market.

Like the solar hot water systems, they have not been fully tested (both in terms of physical tests under New Zealand conditions, durability and performance).

High pressure versus Low Pressure

The HEEP project estimates 79% of domestic hot water systems use low pressure cylinders. Although anecdotal, it seems when an old system fails it is usually replaced with a 'mains' pressure system, ensuring "good" delivery of hot water to showers etc. However there is a downside to using mains pressure systems; they deliver more water and hence more hot water is used, therefore more energy is needed to heat the water. The HEEP houses recorded an average of 7.2 litres per minute (L/min) for houses using low pressure hot water, and 10.6 L/min for mains pressure – an increase of 47%.

Although some low pressure systems can deliver a large amount of water (the highest shower flow rate for the HEEP database is 20 L/min), this clearly identifies an opportunity and need for education and awareness for the future. With every hot water cylinder upgrade from low pressure to mains pressure, there should be a low flow shower head!

Space heating

With approximately a third of energy in houses used for space heating, it is essential to understand what energy and what space heating systems are used in our houses to help determine whether current heating systems meet the needs of homeowners and occupants while delivering heat efficiently and effectively.

Results from the HEEP study (Year 9 report) provide a snapshot of how New Zealanders heat their homes.

> *"Just over half of the HEEP houses had a solid fuel burner (52%), while fewer than one in nine had an open fire (11%). Four out of every nine houses (44%) had an LPG heater. "*

The monitoring of the homes was completed during the years 1998 – 2005, and of the 400 homes, only 6 had heat pumps for space heating. If wood burners are excluded, by far the majority of the remaining homes had portable heating systems (approx 70%).

As a comment, it is interesting to note that over the last 10 years, new housing plans have changed in terms of now having full heating systems incorporated at planning stage rather than an add-on or after-thought.

This may be due to a number of influences but they are likely to include:

- The recognition and desire for a new house to be comfortable.
- Influence from overseas (Europe and America) where central heating is the norm.
- The increased marketing of heating systems (and joint heating systems such and heating ventilation systems)

With the large number of houses monitored, HEEP data could be used to analyse the relationship between heating type and temperature.

Table 6 provides this information and shows the average temperature in the room when the heater is being used in the evening period, for each heater type. Given the poor efficiency of open fires (5-15%) it is not surprising they do not provide warm temperatures and just make 16ºC. The next group, which can be defined as the portable heating systems, provide the mid range temperatures from 16.9ºC to 17.8ºC ,while the fixed heating systems on average provide the warmest temperatures of 18ºC or more. This shows that in order to ensure a comfortable house or room at a healthy temperature, the choice and size of the heater is important. From the HEEP study it is clear that wood burners, heat pumps and fixed gas heaters (flued to ensure no moisture and combustion issues) are more likely to provide an acceptable temperature than the smaller and more portable heaters. This may, in practice, count against any potential energy savings, as changes in behaviour and the desire for a more comfortable home could lead to increased energy usage for space heating.

Main fuel and heater type	Temperature (°C) ± 1 SD	Sample Count
Open fire (wood or coal)	16.0 ± 0.5	12
Portable Electric	16.9 ± 0.3	83
Portable LPG	17.1 ± 0.2	54
Fixed electric	17.8 ± 0.3	19
Gas	18.0 ± 0.5	26
Heat pump (electric)	18.0 ± 0.4	4
Central gas	18.3 ± 0.7	7
Enclosed solid fuel (wood)	18.9 ± 0.2	138

Table 6: Heater types with average temperatures

(HEEP Year 8)

The removal of older open fires, coal ranges and wood burners is being either enforced or encouraged in some regions where particulate levels in the air are high due to solid fuel burner emissions (e.g. Christchurch). This will reduce the number of wood burners in these regions and is likely to affect the national heating system percentages because of the number of houses that have opted to replace a wood burner (or open fire) with heat pumps. In Christchurch, 65% of the homes which have removed their older wood burner or open fire have chosen to replace it with a heat pump.

(http://www.ecan.govt.nz/cleanheat/cleanheatgraphs/totalprogrammes.aspx) Nationwide, 13% of homes that use electricity in their main living areas use heat pumps (Ministry for the Environment 2005) equalling around 120,000 dwellings.

3.1.2 Water efficiency

The efficient use of water, or effectively managing the amount of water used, is not something that many New Zealanders currently think about as it has been so successfully supplied to dwellings through our urban infrastructure. It is only those in rural areas that are not connected to the local water supply or specific areas (e.g. Kapiti Coast and Auckland) where water shortages have led to greater restrictions than watering the garden every second day, who have had to face this issue.

According to the Ministry of Health, each person on average uses around 300 litres of water per day (Table 7). Of that, a mere 5 litres is needed to be biologically and chemically safe for drinking, cooking and preparing food, and a further 100 litres biologically safe for showering. The remaining amount of 195 litres - almost two thirds of the water - does not require any treatment. However this is quite different from the figures used by Waitakere City Council of

180 litres per day, which could be the result of regional differences across New Zealand, or of potentially including different end-uses.

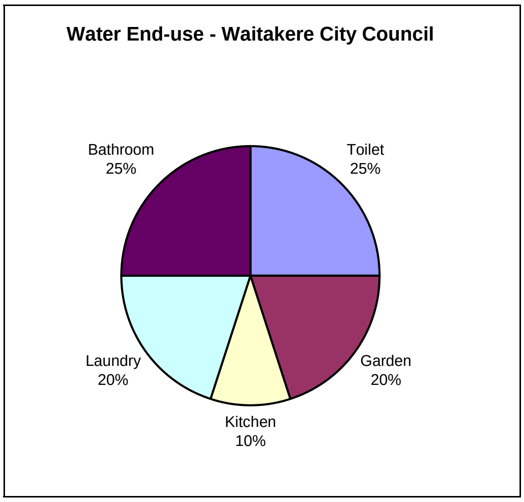
Nevertheless a significant amount of untreated water could be collected and used in our houses, vastly reducing the demand for water, and the load on water-related infrastructure.

Source	Requirements	litres/capita/day
Drinking	Biologically & chemically safe	2
Cooking	Biologically & chemically safe	2
Food preparation	Biologically & chemically safe	1
Showering	Biologically safe	100
Toilet/clothes washer	Not discoloured & stain causing	145
General use	No requirements	50
TOTAL		300

Table 7: Fresh water requirements

(Ministry of Health 2004)

To better understand where the savings can be made, it is important to see what end-uses consume the most water. The following pie graphs from Waitakere City Council and North Shore City Council show that between 25-30% of water used in a dwelling is for toilet flushing, around 25% is used for showering and baths, between 20-30% is used in the kitchen and laundry, and the final 15-30% is used outdoors. Therefore, the total of the toilet, laundry and outdoor use is around 60 - 70% of the total water use in the house.



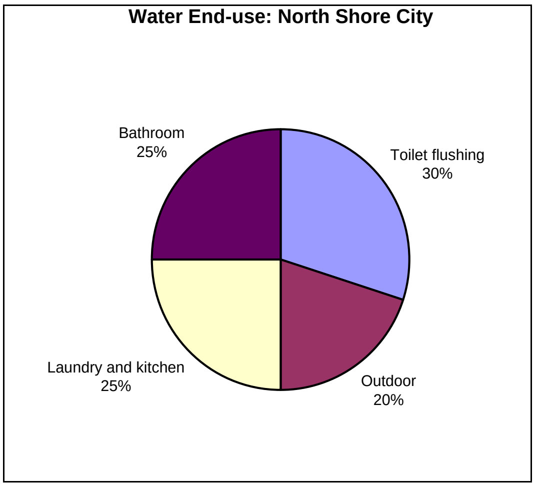


Figure 4: Water end-use in Waitakere and North Shore Cities

(Waitakere, North Shore City Councils)

At present about 380,000 people in New Zealand consume roof-collected rainwater (Abbott 2005), representing 10% of homes or around 160,000 dwellings. At this stage there is no information on whether there is a higher percentage of rainwater tanks used in rural areas but this is expected due to the larger number of houses not able to be connected to a local water supply. However, over time, it is anticipated regional differences will become apparent with some areas suffering from lower rainfall or supply problems, and as strong policy is put in place to either regulate or encourage households to save water. There is no specific market segment to address water efficiency, however those areas with water supply issues are likely to be more receptive. The three key areas at present are: Auckland, Christchurch and the Kapiti Coast. If 50% of our housing stock added rainwater tanks plumbed to flush the toilet, a conservative 44,000,000 litres of water would not be required of the local water supplies each day.

Another way of reducing consumption of water by households is by introducing water meters. Auckland City Council and Tasman District Council experienced reductions in consumption of at least 15% upon implementing water metering[xii]. Over the course of nine years the Rotorua District Council saw a decrease in annual consumption of 35%, and 50% in times of peak usage[xiii]. This would mean that approximately 15% more households could live on the same amount of water in non-metered regions, allowing for an expansion on time available for thought-out upgrades to the supply network that currently lose up to 20% of public water[xiv]. Using regulation (the stick rather than the carrot) and having a user pays system for water also means people begin to realise it is a precious resource, and it is likely to encourage people to incorporate more water-saving technologies into their homes when they are building and retrofitting dwellings.

Table 8 gives the water consumption rates of water (litres per capita per day) for a number of different regions throughout New Zealand showing the large range of water use dependent on area.

	Consumption	
Area	l/c/d	Source
Hutt City	381	Wellington Council – Annual Report 2005 (see References)
Porirua City	327	Wellington Council – Annual Report 2005
Upper Hutt City	408	Wellington Council – Annual Report 2005
Wellington City	451	Wellington Council – Annual Report 2005
Paekakariki*	603	Kapiti Coast Council (see References)
Paraparaumu/Raumati*	621	Kapiti Coast Council
Waikanae*	808	Kapiti Coast Council
Otaki*	1070	Kapiti Coast Council
Kapiti average	1300	Dominion Post 3/12/2005 (see References)
Auckland	185	Auckland Water Management Plan 2004 (Dziegielewski 2000)
Wellington	240	Auckland Water Management Plan 2004
Invercargill	245	Auckland Water Management Plan 2004
Hamilton	260	Auckland Water Management Plan 2004
Palmerston North	265	Auckland Water Management Plan 2004
Christchurch	280	Auckland Water Management Plan 2004
*Peak consumption summer 2001		

Table 8: Reported regional water consumption rates

3.1.3 Indoor environmental quality (IEQ)

The quality of the internal environment covers a wide range of areas including; comfort and internal temperature, air quality, ventilation rates, humidity levels and volatile organic compounds (VOC).

3.1.3.1 Indoor temperatures

Figure 5 below shows the wide range of temperatures observed in the HEEP houses when they were being heated, with approximately 30% of homes averaging below the minimum heating level of 16°C, as recommended by the World Health Organisation. Colder homes that are not well heated are likely to have dampness and moisture problems which have a strong relationship with respiratory illness. The HEEP project also concluded that homes with insulation are likely to be warmer so the homes below 16°C in

Figure 5 are most likely to be built before 1979.

This has significant implications for both health and energy efficiency. To raise the temperature requires more heat, which in some cases may require a better heating system to achieve an acceptable temperature, but this will take more energy. Whether it be from a more efficient heating system, better design or higher levels of insulation, it is highly likely that any savings due to increased efficiency of heating our houses, in particular for the houses built before 1979, will not be fully recognised as the savings will be taken back in comfort and improved indoor environmental quality in the dwelling.

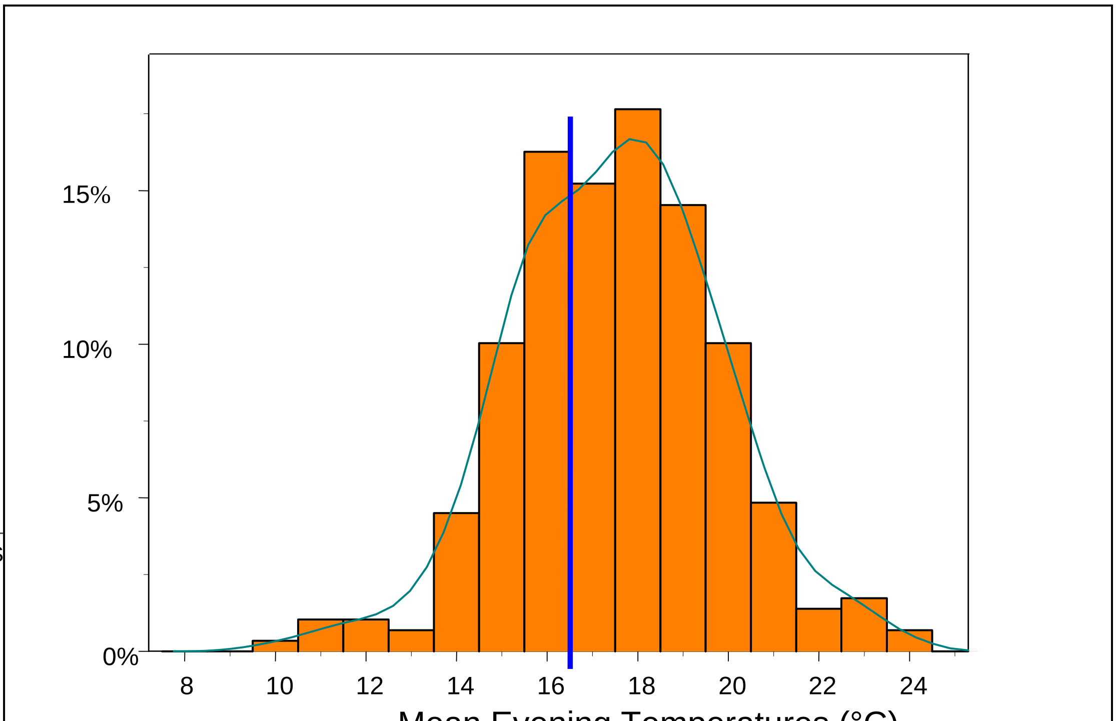


Figure 5: Mean evening temperatures during the heating season, May–Aug

(HEEP Year 8)

3.1.3.2 Airtightness –too tight or too leaky?

The airtightness of a house can be estimated from a simple description of the building (Table 9) that enables a house to be classified as either airtight, average, leaky or draughty.

<table>
<tr><th>Type description</th><th>Base level infiltration ac/h</th><th>Building description</th><th>Number of houses</th></tr>
<tr><td>Airtight</td><td>0.3 ac/hr</td><td>Post 1960 houses with a simple rectangular single storey floor plan of less than 120m² and airtight joinery (windows with airtight seals).</td><td rowspan="3">1,090,000</td></tr>
<tr><td>Average</td><td>0.5 ac/hr</td><td>Post 1960 houses of larger simple designs with airtight joinery. Building may be two stories.</td></tr>
<tr><td>Leaky</td><td>0.7 ac/hr</td><td>Post 1960 houses of more complex shapes and unsealed windows.</td></tr>
<tr><td>Draughty</td><td>0.9 ac/hr</td><td>All pre 1960's houses with strip flooring and unsealed timber windows.</td><td>510,000</td></tr>
</table>

Table 9: Airtightness categories with house descriptions

(BRANZ ALF3, 1999)

These groupings are rather broadly based, but have been categorised as a result of a number of blower door tests of New Zealand houses where the air leakage rate was measured (Bassett 1996)

as shown in

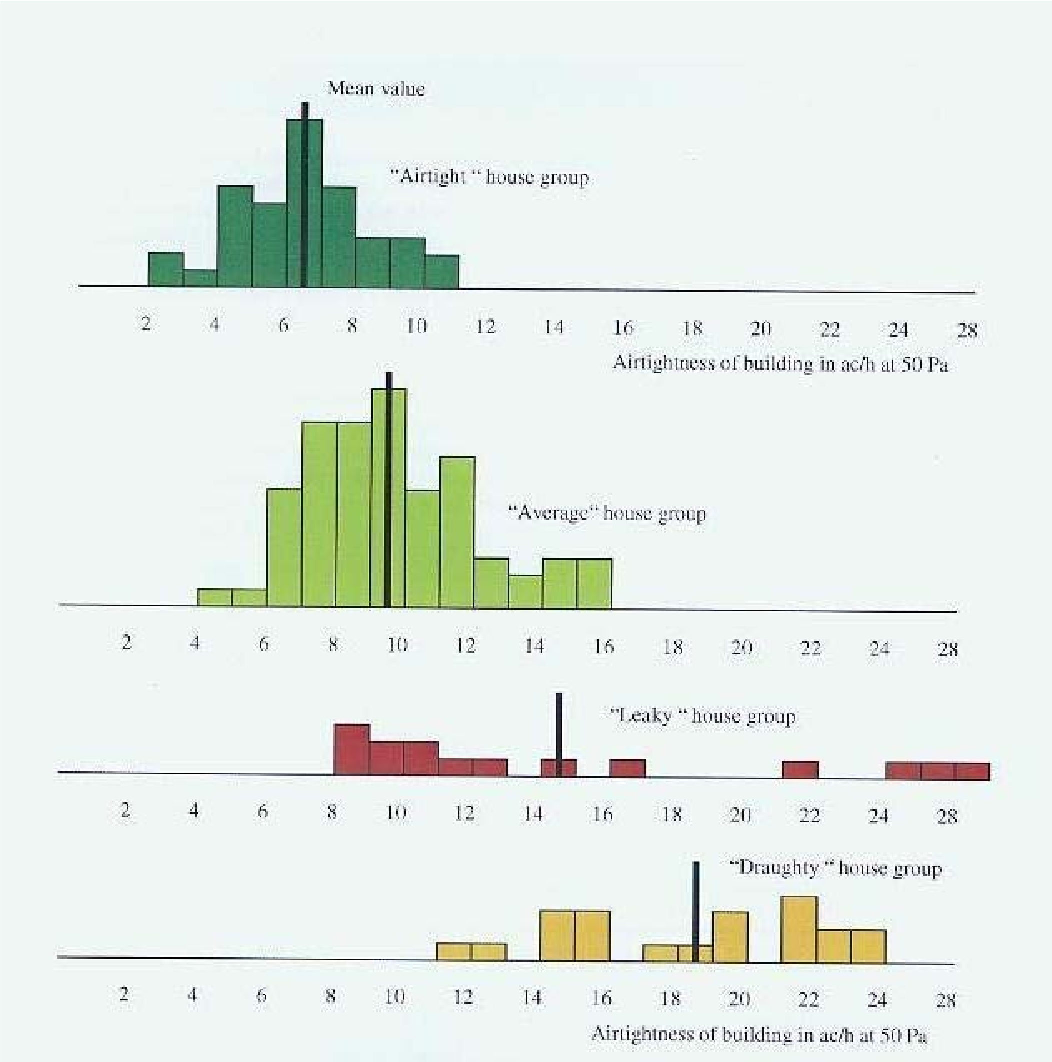


Figure 6. As can be seen from the histograms, the 'leaky' house category has the widest margin of error with the air leakage rates at a pressure of 50 Pa range form 8 -30 air changes per hour. So, although it may be that a specific house built before 1960 fits into the average or leaky category rather than the draughty category, the groupings provide a good rule of thumb.

If a house has too much natural ventilation, it will be difficult to retain heat as cool, fresh air from outside is coming in too quickly to heat, and so the energy used to heat the home is wasted. On the 'flip side' a house that is too airtight will not get fresh air circulating, leading to poor air quality and high moisture problems due to the lack of ventilation. From the table above, the estimated numbers of draughty houses in New Zealand is substantial at about a third of the current building stock. This segment of the housing market is also a subset of the pre 1979 uninsulated houses making it possible to put together the energy and indoor air quality sustainability messages for this collective housing group.

It is important to note that a house that has a high level of ventilation may also have moisture problems. However, in this case, adding more ventilation will not solve the moisture problem because it is likely that the high level of moisture is due to either the heating system (see section 3.1.3.3), no mechanical ventilation in high moisture areas such as the bathroom and kitchen, too many indoor plants, moisture from the sub floor (rising damp) or a leaking pipe or tap.

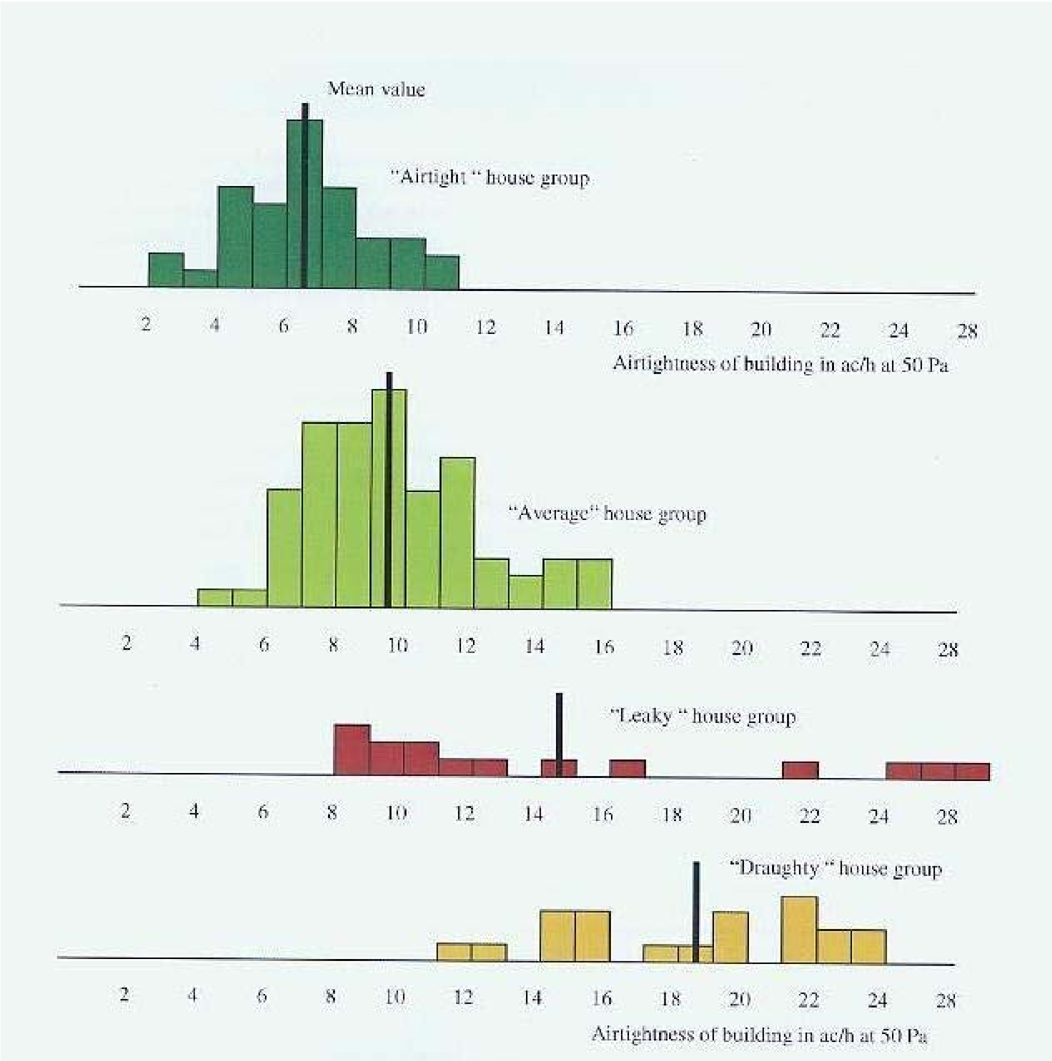


Figure 6: Graphs providing air leakage rates of New Zealand houses

(Bassett, 1986)

3.1.3.3 Unflued gas heaters

Four out of nine houses in the HEEP project had an LPG heater (44%), which is significantly larger than previously realised. The HEEP Year 7 report (Isaacs et al 2003) reported that of the houses that used LPG heaters, 35% also had a dehumidifier whereas for the houses not using LPG potable heaters, 21% had dehumidifiers. This relationship is not entirely surprising given the major bi-products of the combustion of LPG is water vapour and carbon dioxide. An unflued LPG heater set at a low heat output of 1kW, will release 150gm of water into the space each hour, which can create problems with dampness and even mould and mildew. Although LPG heaters can be set on full (three burners) and give a heat output around 4 kW (producing 600gm of water – approx a pint of water) the average output from the HEEP data is 1.7kW (255ml).

This is true not only for LPG portable heaters, but for any unflued gas heater. These types of heaters also burn oxygen from the surrounding air, which is why it is necessary to have to have a window ajar, ensuring adequate fresh air is available in the room. They are also not recommended for small rooms and they must not be used in bedrooms and bathrooms as ventilation cannot be guaranteed.

3.2 Dwelling Types

The dwelling type describes a dwelling in terms of its relationship with other buildings, in particular whether it is a separate house or joined to another dwelling either as semi-detached, medium density (single or two storey group housing) or apartments (units a three or more storey building).

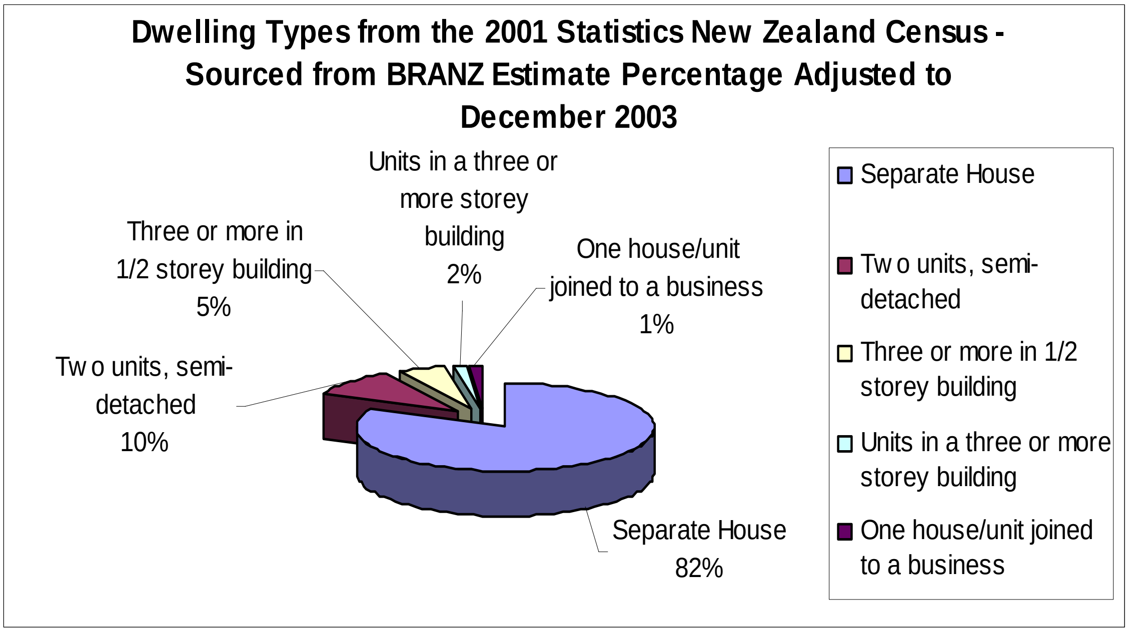


Figure 7; Dwelling types in New Zealand derived from 2001 census data

(BRANZ)

Currently separate or stand-alone houses are by far the largest proportion of dwellings in New Zealand, constituting approximately 82% of all dwellings, as seen in Figure 7 which equates to about 1,300,000 dwellings. This is not surprising, because for many decades the ultimate Kiwi dream was to own your own house on a '¼ acre block', and due to the large percentage of stand-alone houses, it is likely this form of housing will remain dominant for many years at a national level, even with changing trends.

However, a fundamental aspect of achieving Beacon's goal of sustainable homes is encouraging homes which are future-proof, so it is important to understand whether the national breakdown is representative of the entire country, and to understand the projected growth in dwelling types.

3.2.1 Region breakdown

The majority of New Zealand's population resides in the Auckland region followed by Canterbury, the Waikato / Bay of Plenty, and the Wellington regions, and with similar percentages for the housing numbers in each region. Over a quarter (28%) of New Zealand's housing stock is in the Auckland region, approximately 15% in Canterbury region, 10% in Wellington and a further 18% in the combined Waikato-Bay of Plenty regions. Therefore, collectively, these four regions make up seventy percent of the total dwelling numbers. In order to include ninety percent of the dwellings, a further five regions need to be included (Manawatu-Wanganui, Otago, Hawkes Bay, Northland and Taranaki) showing that, for Beacon, a national approach to the 90% target is necessary if it is to be achieved.

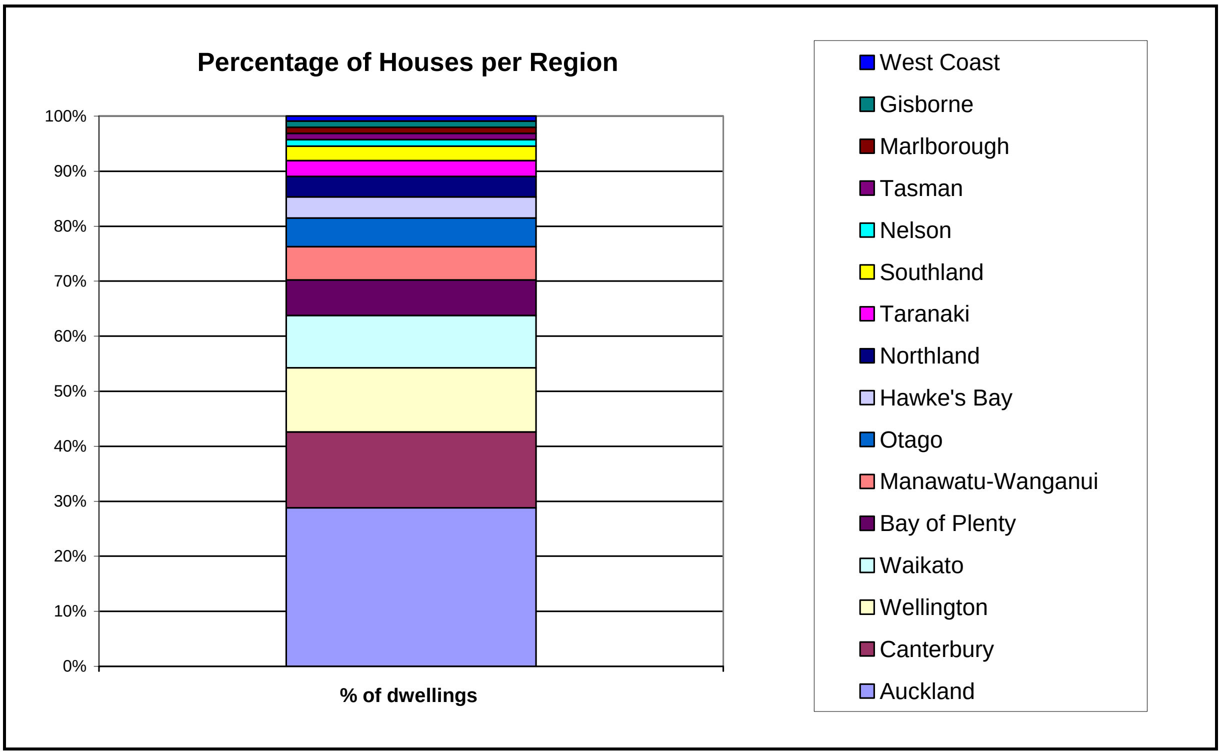


Figure 8: Stack chart showing the percentage of houses by region

(Statistics NZ 2001)

There are also large regional differences in the percentage of single dwelling houses compared to multi-unit dwellings with the region that has the largest ratio of multi-unit dwellings being Wellington (approximately a 50/50 split between the two housing groups) to more rural regions where the dominance (80% or more) of the houses are standalone. Therefore if Beacon is going to choose a specific region (e.g. Auckland which has around 40% of dwellings classified as multi-unit) there will need to be knowledge, options and information on both types of buildings otherwise the real number of dwellings in the market segment being engaged may be reduced significantly.

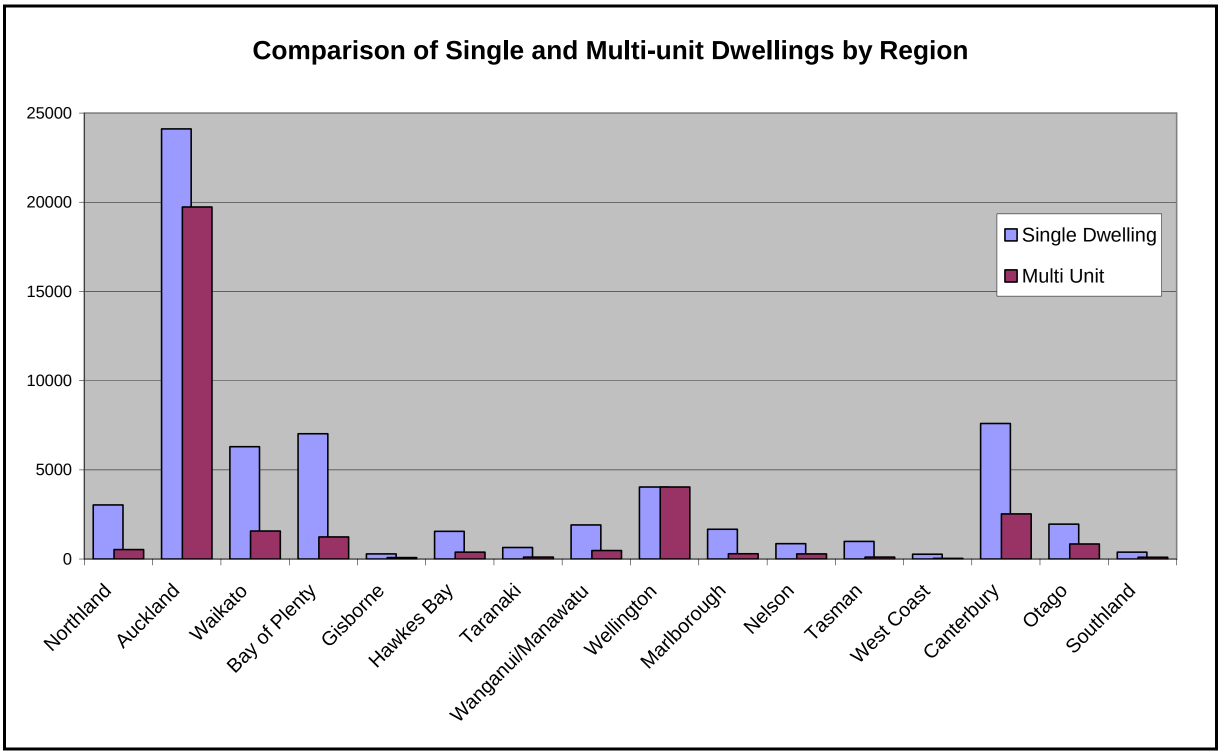


Figure 9: Comparison of single and multi unit dwellings by region

(Statistics NZ 2001)

3.2.2 Changing trends – what are our future needs?

3.2.2.1 Dwelling numbers – regional projected change

To look at the changes in dwelling numbers it is useful to look at population trends across New Zealand by region. Auckland's population is expected to grow the fastest of anywhere in New Zealand through to 2026, and is projected to gain approximately 600,000 residents in the 25 years from 2001 to 2026. Whilst other areas such as Canterbury and Waikato have a strong upward trend, it is small in comparison (both by numbers and rate of increase) compared to Auckland, which shows incredibly strong and continued dominance as a region.

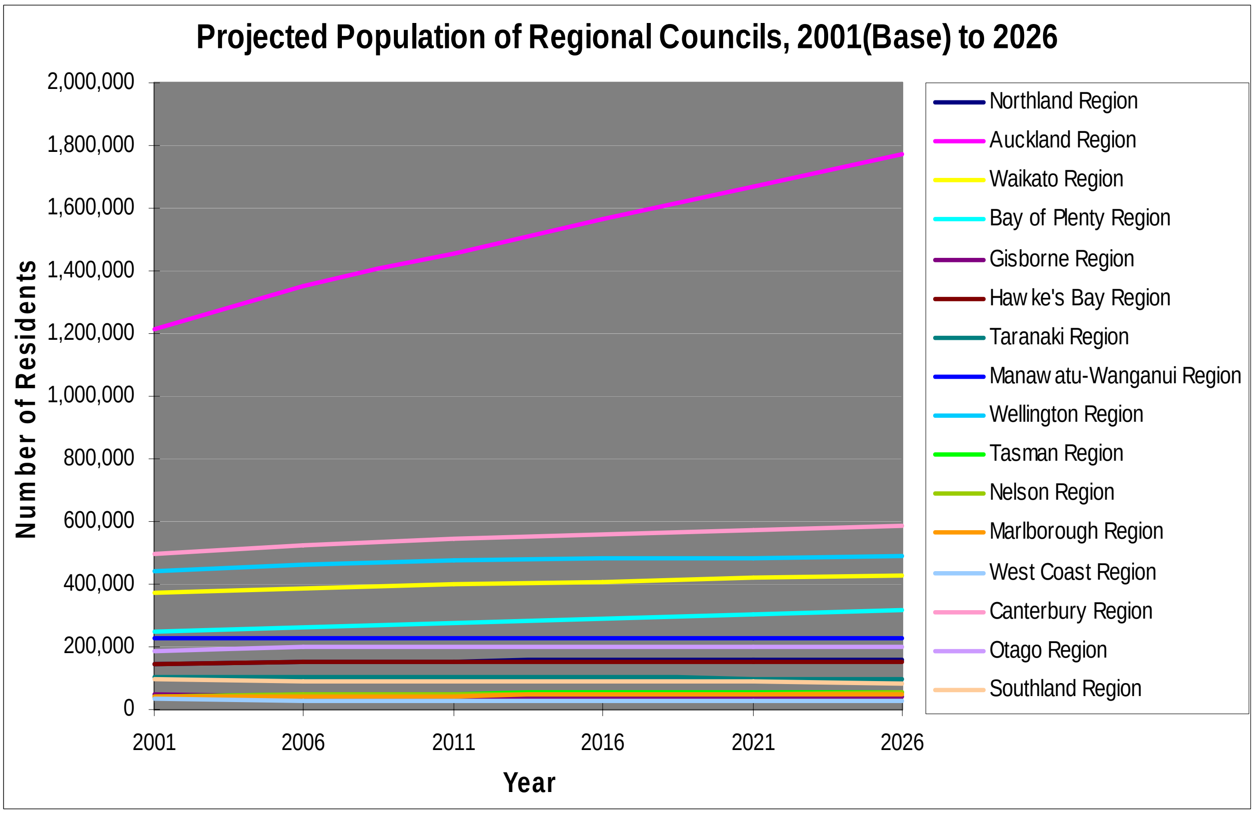


Figure 10: Projected population by region to 2026

(Statistics NZ 2001)

The number of households in Auckland at 2021 is projected to be over twice that of Canterbury and more than Canterbury and Wellington put together. The rest of the regions were projected to have small numbers of households in comparison.

It is projected that there will be more rapid growth in the city and urban areas than rural areas, particularly with people continuing to gravitate around the Auckland region. The number of dwelling in the Auckland region is expected to increase by 46% by 2026 (base 2001) Other regions with a large projected increase include Canterbury, the Waikato, and the Bay of Plenty, which are projected to grow slightly faster than the Wellington region from 2001 to 2021 (Census, 2001).

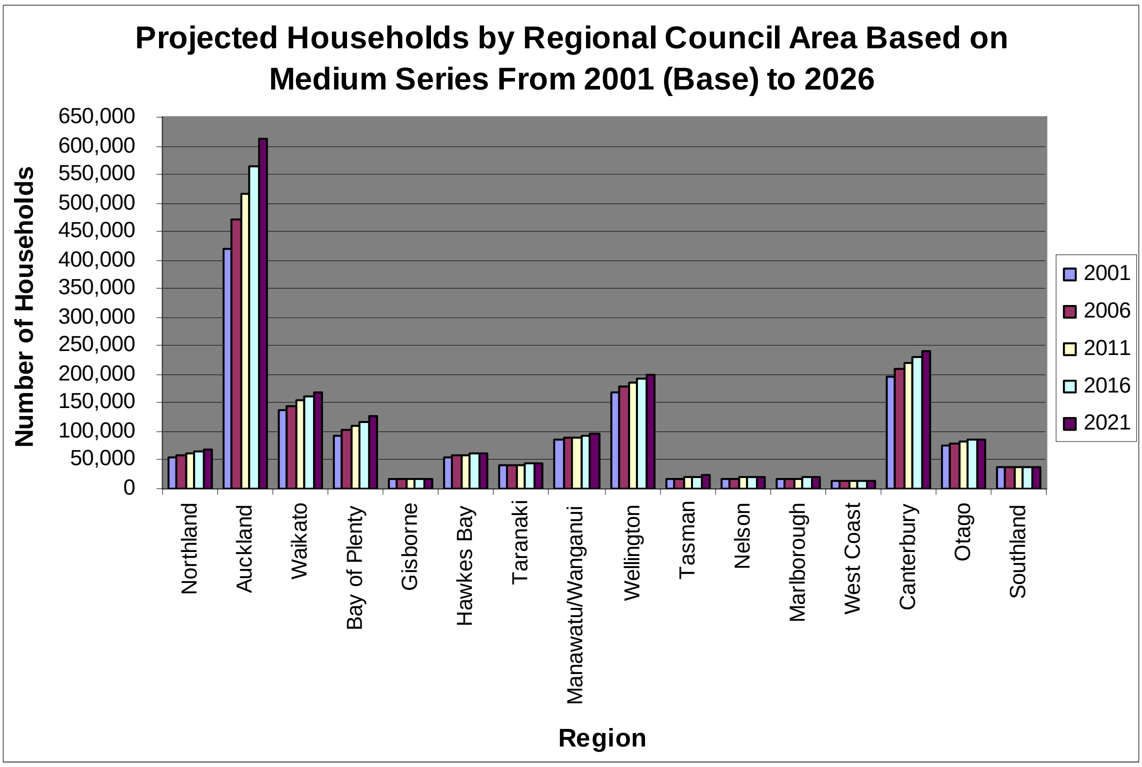


Figure 11: Projected household numbers by region

(Statistics NZ 2001)

If we look at population changes in each region by head of population, Auckland once again shows the greatest increase, but the second fastest growing region is Tasman, closely followed by Bay of Plenty and Canterbury, as seen in Figure 12. A reason for the large growth in population in these secondary areas is possibly due to the larger percentage of New Zealanders reaching retirement age, and choosing to shift away from the cities to the smaller urban regions like Tasman/Nelson and Tauranga.

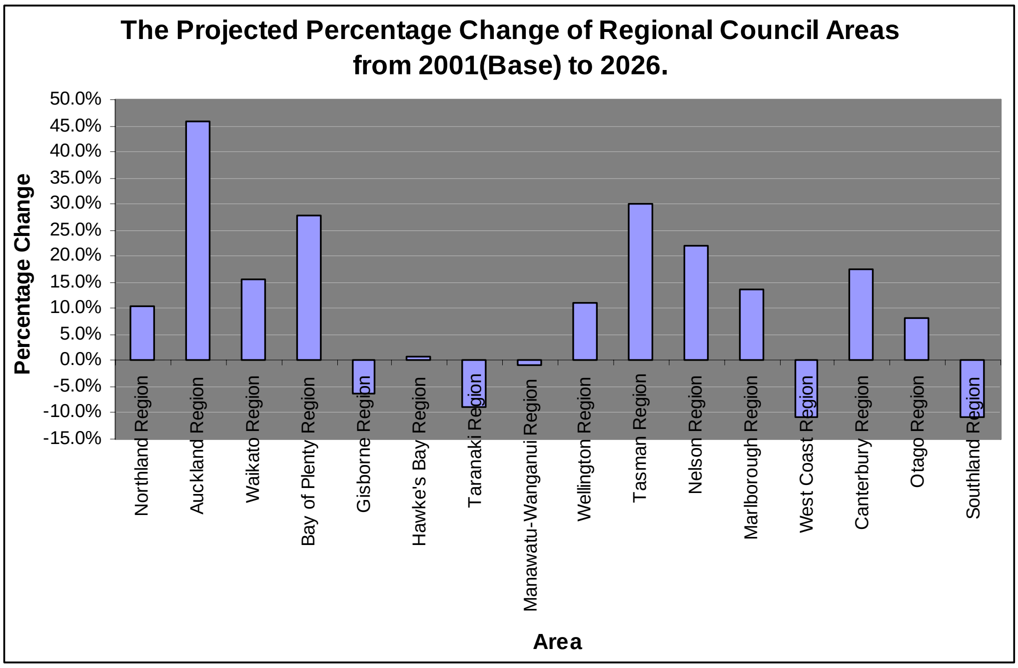


Figure 12: Percentage change in population by region

(Statistics NZ 2001)

This is particularly important for the building industry and industry-based market transformation, as understanding where areas of change and growth are occurring is key to ensuring the skill base in these regions is sufficient to keep up with demand. For Beacon this is also important from a long term perspective, ensuring high quality building occurs, improving the durability and hence sustainability of current and future housing.

3.2.2.2 Dwelling size - average floor area

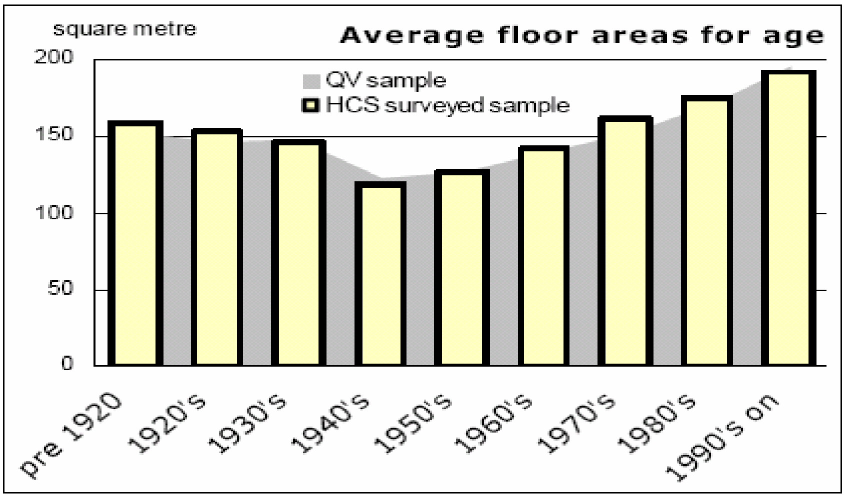


Figure 13: Average floor area by age, derived from Quotable Value New Zealand

(HCS 2005)

The floor area of houses varies over time with additions, but in houses built since the 1940s, there has been an upward trend in average floor sizes in New Zealand's houses by age group. After the 1940s, the house age group with the lowest average floor area, the average floor area of houses in New Zealand continuously increased, and by the 1990s the average floor size for houses surveyed in the 1999 New Zealand House Condition Survey (1999 NZHCS)[xv] had reached approximately 194 square metres. The average floor area across all ages of houses according to Quotable Value New Zealand (QV) was 140 square metres at the 2005 NZHCS[xvi].

3.2.2.3 Changes in dwellings

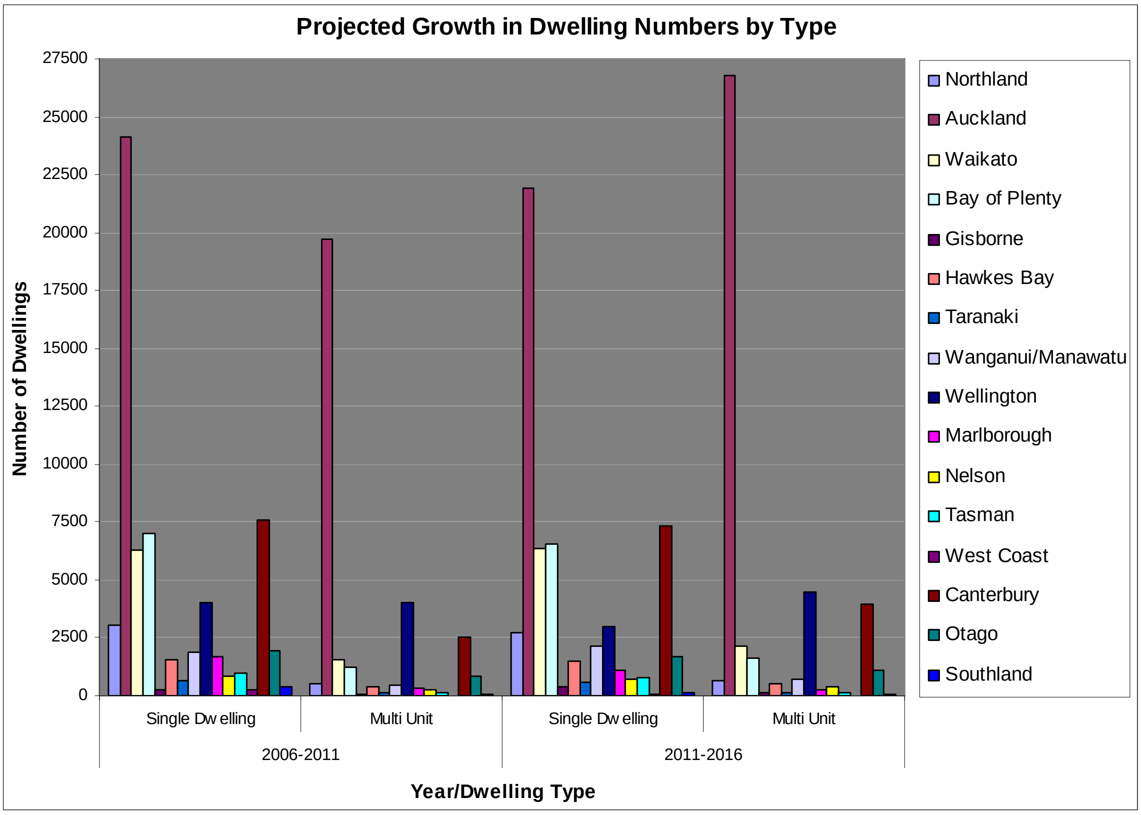


Figure 14: Projected growth in single standalone and multi unit dwellings

(Statistics NZ 2001)

The projections for most of New Zealand but particularly for the larger centres is by the middle of the next decade there will be more multi-unit dwellings than single dwellings. At present the only region where the number of multi unit dwellings equal single dwellings is Wellington so there will be a significant shift in the type of house that is most common, most notable in Auckland.

This offers an opportunity for improving the sustainability of homes as it is likely the size of these homes will be smaller and intensification of buildings will slow the growth of urban sprawl. However ensuring they are of good quality with flexible spaces will be essential to meeting long term needs.

3.2.3 Climate Factors and relationships with sustainability

3.2.3.1 Temperature

The external temperature and the range of temperatures are important when addressing housing and, in particular, residential energy use for space heating and cooling. New Zealand has a temperate climate that does not have huge diurnal swings, but the temperature does vary across the country because of its long, narrow shape. Typically it is a heating climate, which means there is a need to provide energy to keep warm compared to a cooling climate, where energy is used for air-conditioners to keep cool.

Figure 15 provides an illustration of the average daily temperatures across New Zealand. It clearly shows the top part of the North Island is warmer than the rest of the country, and almost the entire South Island and Central Plateau region in the North Island are the coldest areas. This information was used when developing the standard Code requirements for insulation and that is why there are three regional heating zones.

Therefore, to keep the same comfort levels, it would be expected that both the heating season (how many months per year heating is needed) and the amount of heating would increase the further south a house is situated, with the exception of the Central Plateau region of the North Island.

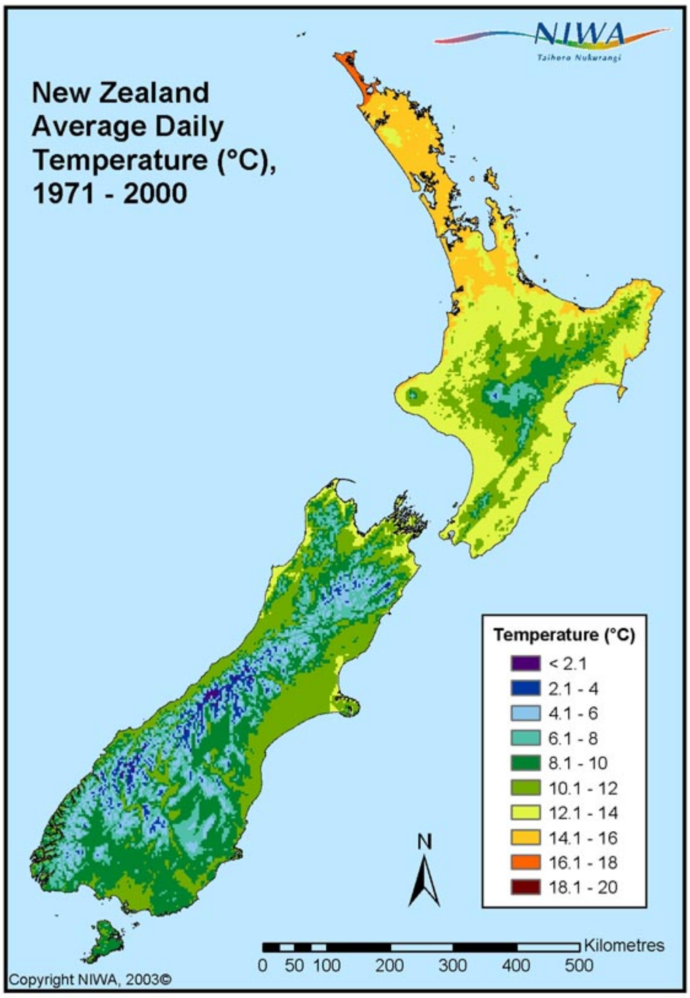


Figure 15: New Zealand average daily temperatures. (NIWA)

3.2.3.2 Rainfall

As mentioned earlier, for most New Zealanders, the need to collect and treasure rainfall to be used for the house water supply is a 'forgotten art' as the majority of New Zealand has reticulated water that is supplied direct to the house. However, with the current climate patterns and the assumption it will continue to be drier in the east (and wetter in the west), and more demand with increasing population (particularly around Auckland), the need to preserve water and use it effectively is inevitable.

Figure 16 shows the mean annual rainfall patterns across New Zealand. The east/west divide particularly over the Southern Alps is very clear with the driest regions of New Zealand being Canterbury and Hawke's Bay. Given the high levels of demand on water by agriculture in both these areas, and particularly for Canterbury, and the added demand from population increases, the need to carefully manage water demand will only increase, encouraging options such as rainwater tanks and grey water systems.

For Auckland, the large and increasing population is more likely to be a driver for better water efficiency, however in all areas there is significant opportunity to effectively use rainwater tanks and grey water systems but it will need policy drivers to increase the uptake.

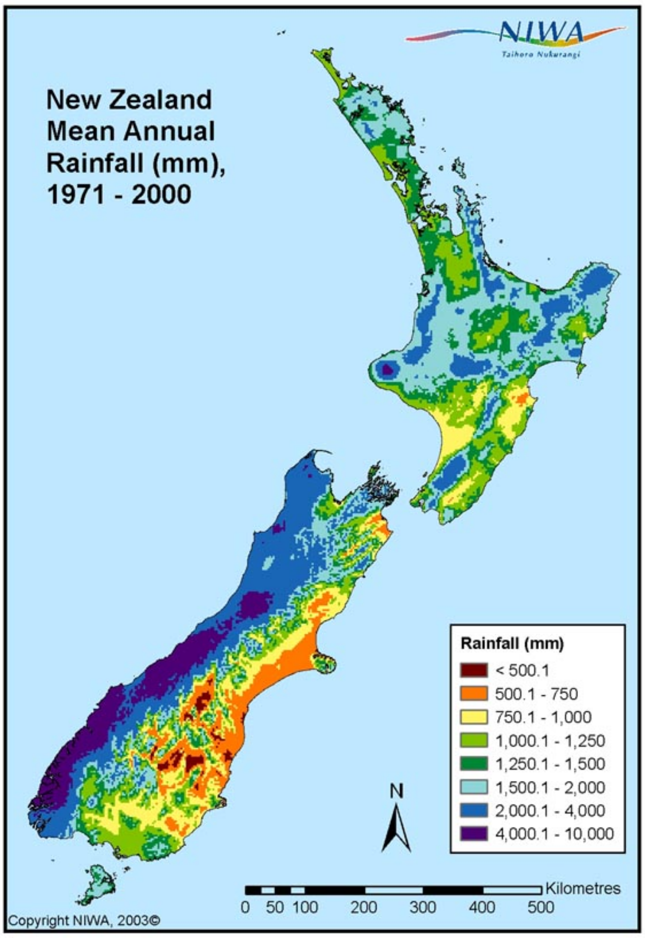


Figure 16: New Zealand mean annual rainfall

(NIWA)

4 Section Two: Market trends and social factors

4.1 Housing ownership and trends

Traditionally New Zealanders always had a strong desire to own their own home as a security for when they get old or retire and it has been seen as a sign of wealth in the New Zealand society. Currently around two thirds of our housing is owner occupied but there has been a downward trend in home ownership since the 1980s, with the housing ownership percentage dropping to the lowest in 30 years.

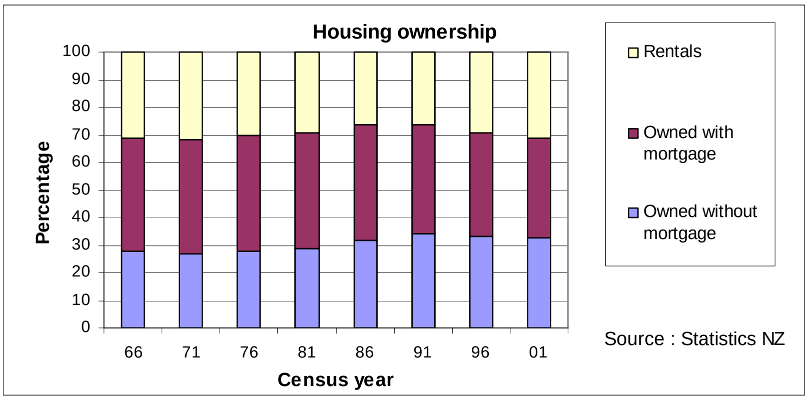


Table 10: Housing ownership in New Zealand from the 1966 census to the 2001 census (Storey et al, 2004[xvii])

The percentage of households owning their homes fell by approximately 6% in the decade from 1991 to 2001 from an average ownership (with or without mortgage) of 74% to 68% by 2001, as seen in Table 10.

Whilst in the short term this is unlikely to have any impact on our building, potentially it shows the drivers in our society of a house equalling security may be weakening, and people are choosing rentals so they don't have their money tied up in a house and the ongoing costs to live a more flexible lifestyle. The other "flipside" possibility is the simply the cost of housing has increased so much over the last two decades (see Table 13) means those on lower incomes cannot save up the required deposit or due to tertiary study already are have a significant debt before considering buying a house.

When we re-evaluate the breakdown of housing ownership by age group, Figure 17, it provides a clear picture showing the older you are, the more likely you are to own your home outright. The younger a person, the more likely they will be renting, with the 35-44 year old age group having the largest proportion of household that are owned with a mortgage at 52% of that age group. This is the age at which most people have young families. Servicing the debt and supporting children means these age groups are likely to have less expendable income than any other working age group, reducing the ability to maintain and retrofit the homes despite potentially being the group that has the most to gain with increasing operational costs as their families grow.

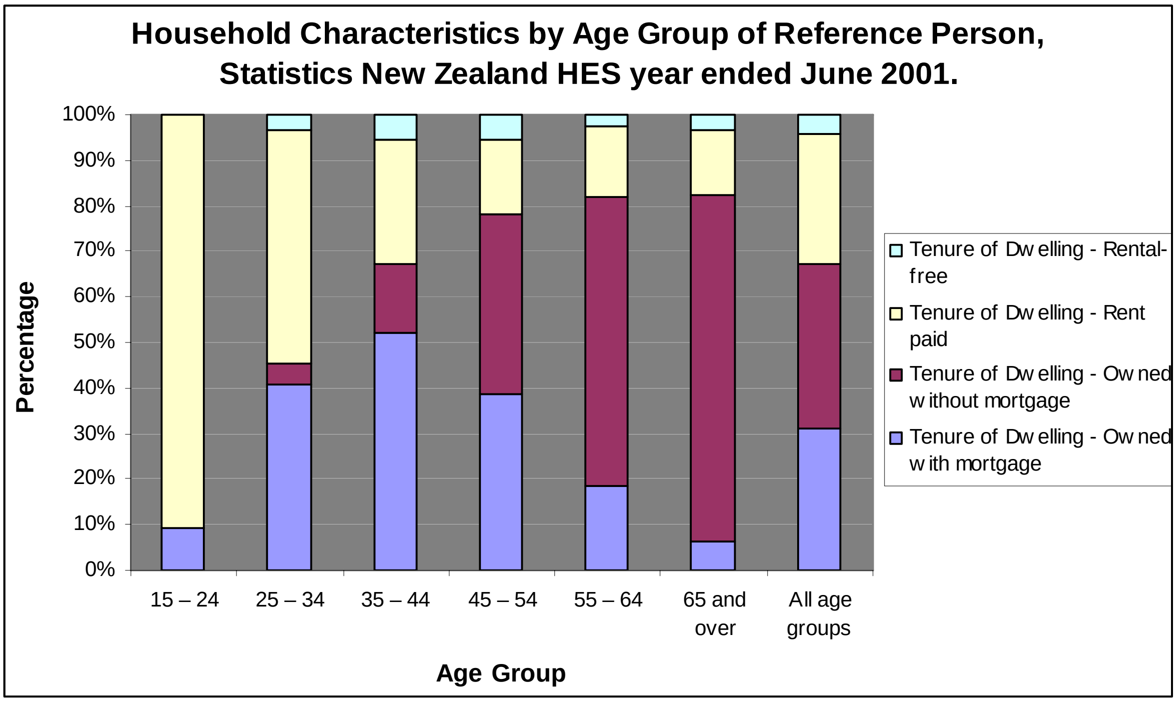


Figure 17: Percentage of New Zealand adults living in each tenure type by age group

(Household Economic Survey, Statistics NZ 2001)

A third way to segment the housing ownership information is by income. Table 11 shows the ownership by income as a percentage from the last census and the 1991 census. It clearly shows the increasing ownership of a house with increasing income and the overall decrease in home ownership is across all income brackets and not just the low income or middle income, strengthening the argument this is will be an ongoing trend for the near future.

Household Income	2001	1991
Nil or loss	46.0%	63.9%
$1-$5000	42.0%	56.3%
$5001-$10000	48.0%	56.3%
$10001-$15000	57.8%	63.5%
$15001-$20000	64.6%	72.3%
$20001-$25000	61.2%	71.7%
$25001-$30000	69.2%	72.0%
$30001-$40000	67.0%	75.7%
$40001-$50000	70.5%	79.2%
$50001-$70000	75.3%	82.7%
$70000+	80.5%	87.2%
Total Average	62.0%	71.0%

Table 11: Percentages of home ownership by income

(2001 Statistics New Zealand Census)

4.1.1 Regional differences

Error! Reference source not found. provides a regional breakdown of the following areas:

- Household ownership (based on Statistics New Zealand 2001 census)
- Average summer and winter temperatures (NIWA)
- Annual rainfall (NIWA)
- New Zealand climate change information on rainfall and temperature (NIWA)

This provides analysis of differences between regions and the potential impact on the drivers and options for Beacon

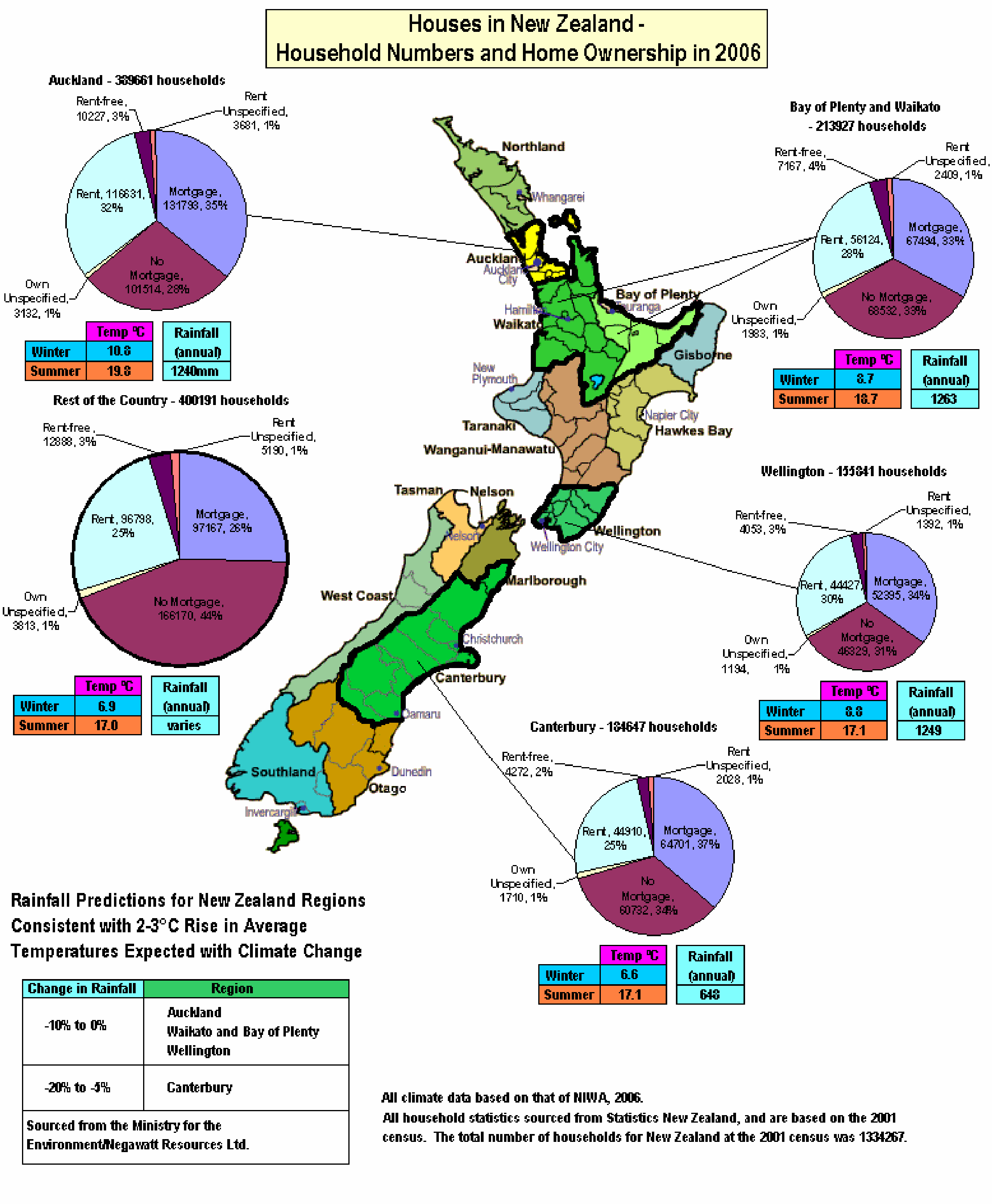
The areas with the largest number of households were selected to regionalise with the remaining areas lumped together as ‘the rest of New Zealand. The four largest areas are: Auckland, Waikato/Bay of Plenty, Wellington, Canterbury.

The regional breakdown of home ownership and house numbers provides a picture that shows significant regional differences, with Auckland and Wellington having a higher percentage of rental properties compared to the other regions. In fact, Statistics New Zealand 2001 Census’ detailed breakdown shows the percentage of rental properties in Auckland City is around 45%. Therefore in order to have an impact on the sustainability of housing in the Auckland region, which by far has the largest numbers, it will be essential to not just concentrate on owned houses but on rental properties as well.

For Canterbury, the second largest region, and the group classified as the rest of New Zealand the number of rental households drops to 25%.

The variation across these regions in average summer temperatures is 2.7°C while the variation in winter temperatures is 4.2°C. Rainfall in the Canterbury region is significantly less in Canterbury with an annual rainfall of 648mm whilst Auckland’s rainfall is almost double that at 1240mm.

All the regional figures highlight subtle differences and overlaying those differences is also people's awareness of sustainability in relation to housing and the way we live. Although there have been no formal studies, it is likely the awareness of sustainability and, more specifically, energy efficiency is much greater in Christchurch and the Canterbury region due to the Clean Heat (http://www.ecan.govt.nz/CleanHeat/chp.html) initiative that has been running for three years and the colder winter temperatures, than in areas like Auckland where transport is seen as a key area of making the region more sustainable.



Rainfall Predictions for New Zealand Regions Consistent with 2-3°C Rise in Average Temperatures Expected with Climate Change

Change in Rainfall	Region
-10% to 0%	Auckland Waikato and Bay of Plenty Wellington
-20% to -5%	Canterbury
Sourced from the Ministry for the Environment/Megawatt Resources Ltd.	

Figure 18: Regional breakdown of house ownership and climate data for New Zealand

(2001 Statistics NZ Census)

4.1.2 *Owned with a mortgage*

The number of New Zealand households living with a mortgage over their home was 443,259 at the 2001 Statistics New Zealand Census. This is thirty-five percent of the total number of households which equates to just over half of all owner occupied houses so for this group a proportion of their income is for paying off the mortgage reducing the amount of disposable income for both maintenance and improvements to the homes . However, research has indicated that those who live in a home they own are more likely to retrofit their homes with sustainability measures than rented houses. This is not necessarily because they are interested in energy savings, per se, as there is some evidence that non-energy benefits, such as health, comfort and noise, are more valuable to occupants than energy savings[xviii].

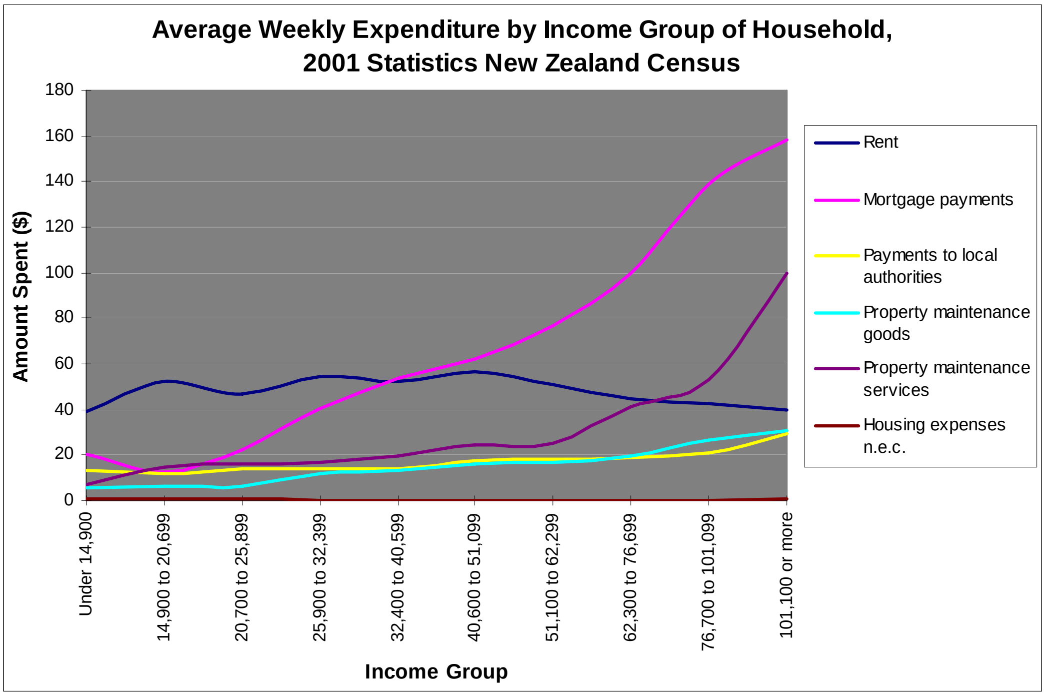


Table 12: Average weekly expenditure by the income group of households

(2001 Census, Statistics New Zealand)

Table 12 illustrates mortgage repayments increasing with income, with the exception of the income bracket of between $14,900 and $20,699 where repayments are less on average than for those on an income of less than $14,900 per year.

In 2001 the average amount of rent paid by households was $166.60, whilst the average amount paid per week by people with a mortgage was $210.90. As Table 13 shows, the household debt levels and house values rose more rapidly from 2001 to 2004 than had been witnessed over the previous 20 years. In fact, the amount of debt to income has continuously increased for New Zealand households since at least the 1980s[xix]. The prices of houses have become inflated compared to household wages, resulting in larger amounts borrowed in mortgages[xx]. Up to 10%

of indebted New Zealanders spend over 50% of their expendable income on servicing their debt, and the rate of savings is low compared to countries with similar mortgage levels[xxi].

All these factors point to a difficulty in saving or setting aside money to improve the sustainability of one's home, particularly as the straight cost-benefit analysis for the homeowner is typically not desirable due to either take-back of savings in comfort and non-quantifiable benefits or the up-front costs being too high, e.g. the average cost of solar hot water is $6000 with a payback period of up to 19 years (Stoecklein, 2005).

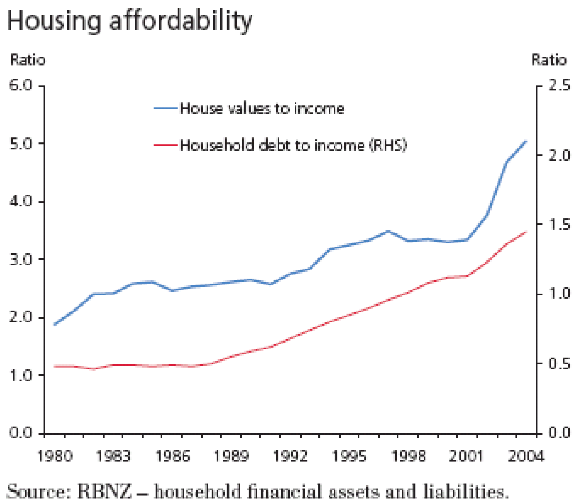


Table 13: The value of houses and accompanying debt levels compared to income in New Zealand to 2004

(Reserve Bank)

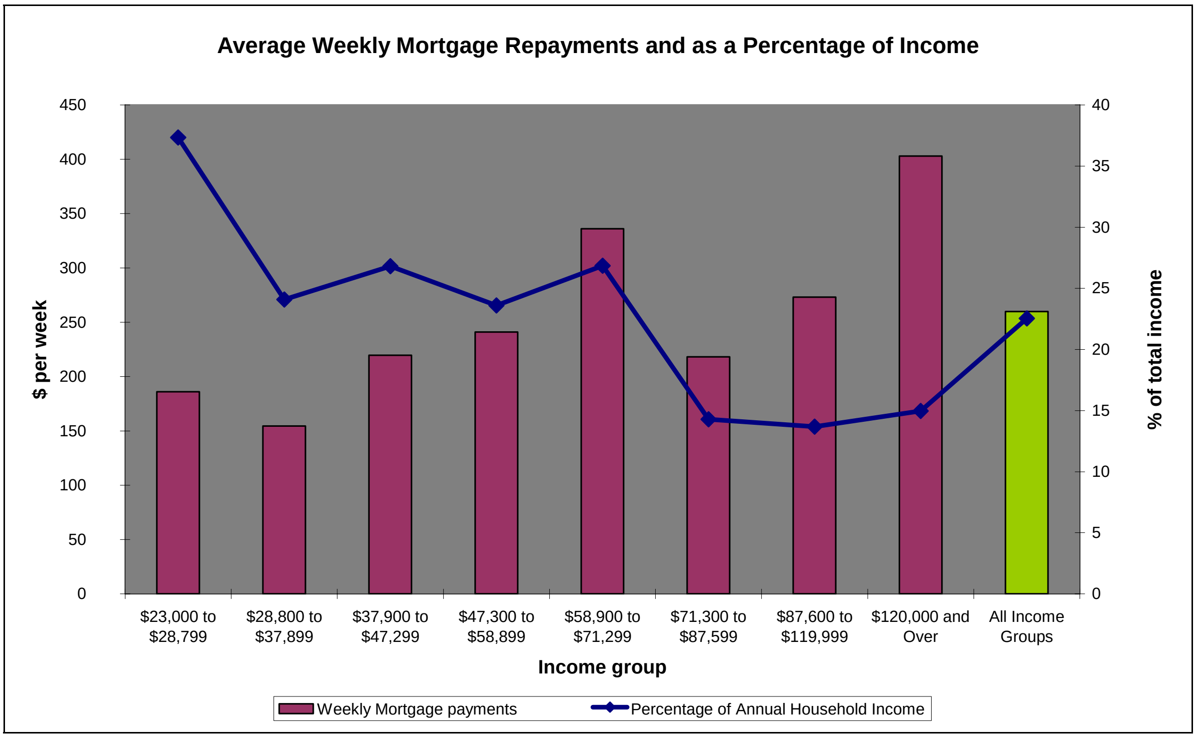


Table 14: Average weekly mortgage repayments plus percentage of income by group

(2001 Statistics NZ Census)

Further breakdown of weekly income spent to cover mortgage payments as a percentage shows it is highest for those in the lowest pay bracket with an annual household income of between $23,000 and $28,799, as can be seen in Table 14. The lowest percentage of weekly income spent on mortgages is by those earning over $71,300.

It is interesting to note, however, that the higher the income the more likely it is you will have a mortgage with 60% of households with an income between $50,000 - $70,000 having a mortgage and 68% of households over $70,000 (Table 15).

Providing that the ages of people earning the higher salaries are reflective of the height of the average wage by age in New Zealand, as seen in Table 18, it is likely that people begin to pay off their mortgages when they are between 40 and 54 years of age, the age group earning the highest salaries. This may also be due to being able to pay off the mortgage faster than those on lower incomes. Another factor may be that people over the age of 40 years may have held their mortgage for a longer period of time, with the mortgage decreasing in size as their incomes increased.

Although those with higher incomes are only a small fraction of the total population they have lower expenditure on mortgages by percentage. Therefore have the most expendable money to spend on home maintenance and retrofits, often this is not long before retirement age begins. Educating the wider public on the lifestyle and health benefits of modernised houses may encourage this sector to implement measures such as insulation, and encourage buyers to seek these homes, possibly pushing up the resale value.

4.1.3 *Freehold households*

The number of New Zealand households living in freehold houses stood at 413,460 at the 2001 Statistics New Zealand Census,

Just over 76% of New Zealanders aged over 65 years live in freehold homes (see Figure 17), however this portion of society earns some of the lowest annual incomes, as seen in Table 18 and is reflected in the table below through the households with income between $1 to $20,000 owning the largest number of households freehold and the second lowest income grouping having the second largest number of freehold houses.

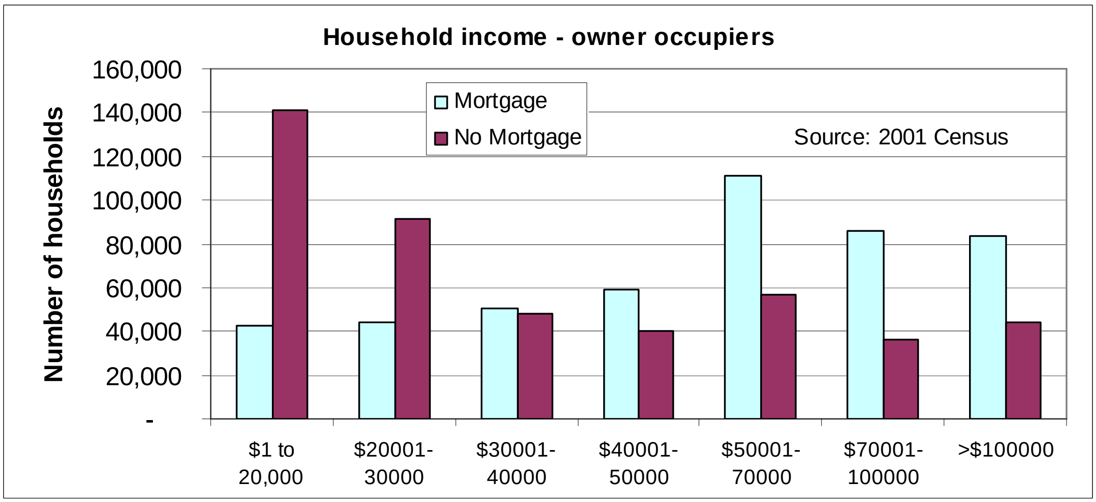


Table 15: Household income of owner-occupiers

(2001 Statistics NZ Census)

Therefore this relationship between freehold households being people on lower incomes, who have less disposable money to improve their homes, complicates the potential drivers for the different market segments. It cannot be assumed that, because a household is mortgage free, the owners will have disposable income to improve their homes.

Table 16 shows the houses owned by households in the income brackets of below $50,000 had higher percentages of houses in poor condition than those in higher income groups. The difference between freehold and houses with a mortgage in the best category was just one percent indicating there is no strong bias towards freehold houses being better maintained.

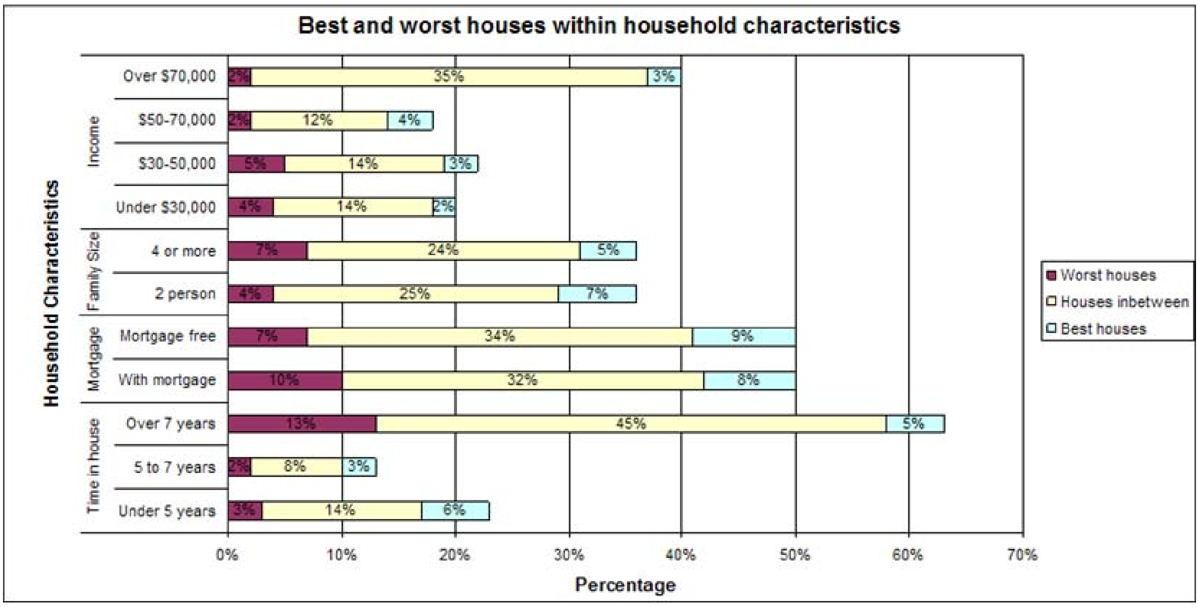


Table 16: The best and worst houses by household characteristics

(BRANZ House Condition Survey, 2005)

Lengthier amounts of time living in a house also appeared to negatively influence condition. Table 16 shows that houses that have had the same occupants for over seven years are the most likely to be in poor condition.

Therefore those freehold homeowners who are most likely to have homes in good condition are below retirement age, making those from the age of 45 to 65 years reasonable targets for encouragement for retrofits, with tow potential drivers; having teenagers in the family who use more energy or being close to retirement and a relating drop in income.

4.1.4 Rental properties

The number of people renting in New Zealand has increased to the highest level since around 1971 (see Table 10) and all indicators point to this trend or increasing numbers of rental properties continuing. At the 2001 Statistics New Zealand Census, 31.1% of New Zealanders were renting, up from 26.5% in 1991 Census with rental costs varying over the regions from an average of $101 per week in Southland to $223 in Auckland (Statistics NZ, 2001). From a tenant's perspective, the retrofit of rental homes is likely to increase efficiency of heating methods and create a more comfortable atmosphere and potentially provide a healthier home[xxii]. The concern for tenants is the cost of renting will increase with the improvements beyond any savings they may achieve.

From an investment point of view, retrofitting older homes is likely to be more expensive and have a longer payback period for landlords than it would be to do a superficial redecoration exercise. Also, with the weighted interest rate made upon rental properties falling from 1993 to 2005, as seen in Table 17, it is less likely that landlords will spend money on upgrading their rental properties unless there is a significant incentive to do so. At this stage however The Residential Tenancy Act (1989) does not require any minimum level of sustainability, whether this be an overarching definition or for specific areas such energy efficiency, comfort and there are no current incentives at a national level and very few at a regional level e.g. Environment Canterbury offer a subsidy to rental property owners to replace outdated high emission wood-burners or open fires and upgrade insulation through the Clean Heat project.

However, through the ZALEH (Zero and Low Energy Houses) research carried out by BRANZ there is evidence to show that rental properties that are insulated cost less to keep tenanted due to longer turnover periods (Stoecklein, 2006)[xxiii] and, although the landlord does not benefit from any reduced energy costs, the combined cost of energy savings with the reduced costs of needing to re-tenant can payback the cost of upgrading within an allowable period (e.g. less than five years). Therefore, in order for this to be implemented throughout New Zealand, rental property owners would need confidence in choosing good long term tenants, and those renting would need to understand the benefits of paying slightly above-market rates but with reduced ongoing operational costs provided they don't change behaviour.

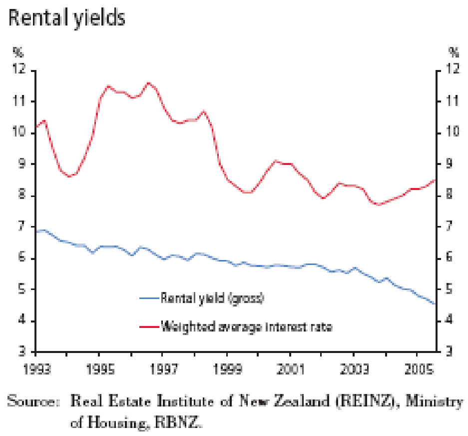


Table 17: Rental yields compared to the weighted average interest rate for New Zealand dwellings from 1993 to 2006

(Reserve Bank[xxiv])

Some benefits, aside from longer tenancy periods, that landlords may experience after retrofitting their homes with insulation include less maintenance required to remove mould or to redecorate where necessary due to damage or stains left from mould. Also, with the development of a national home energy rating scheme, it is possible insulation may be a marketing point for rental properties, and eventually houses will be more likely to sell for higher prices than uninsulated equivalent properties. Whilst this does not address all the sustainability areas that Beacon can incorporate into their high standard of sustainability, it is at least one of the key areas.

4.1.5 *Income factors*

It is anticipated people's income will have an effect on their house ownership status and the likelihood of being able to afford (by the way of having enough discretionary income to choose) sustainably retrofitting and their houses. However already the analysis of freehold houses has shown that income group with the largest proportion of free houses is between $20,000 - $30,000.

4.1.5.1 Income vs age group

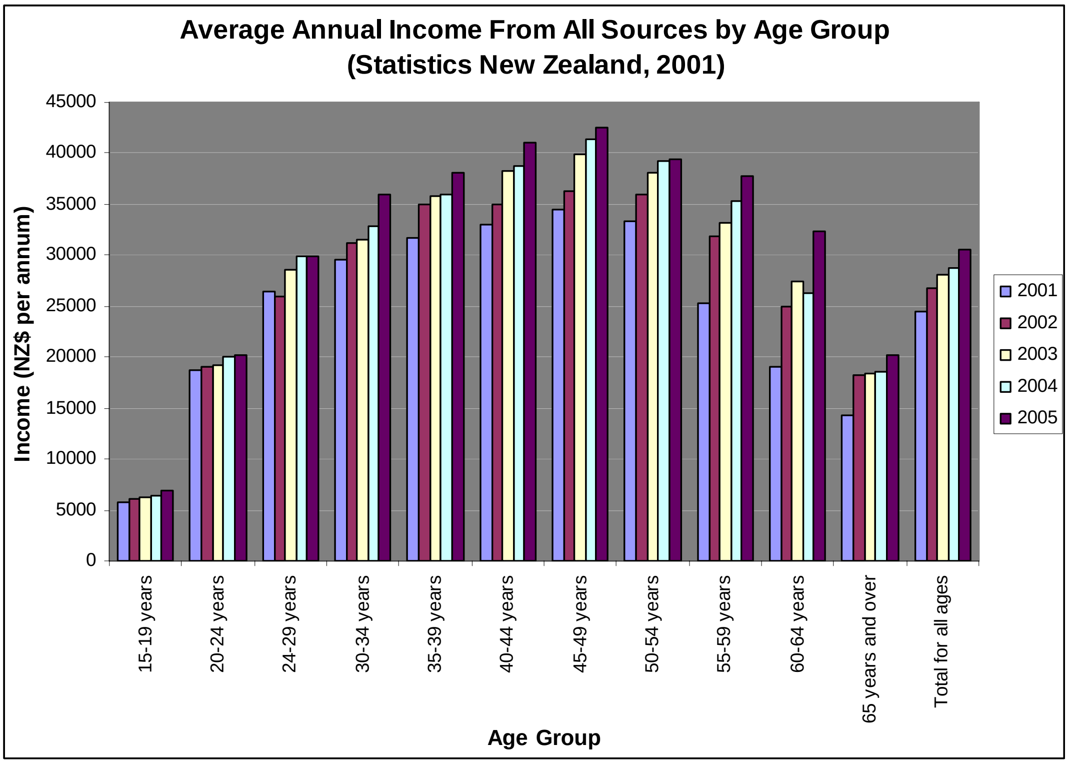


Table 18: The average annual income from all sources by age group in New Zealand (Statistics NZ 2001)

Table 18 shows that the elderly (those aged over 65 years) earn the least of any age group past school and university age (15-19 year olds), confirming the relationship with freehold homes, retired people and low income. Their income has increased the slowest apart from 15-19 year olds and 20-24 year olds since 2001. 24 to 29 year olds experienced the only dip in income in 2002, and exhibit relatively low wages with many of them having student loans to pay off, making them likely to save the least and buy homes and have families later.

4.1.5.2 Income vs house age group

Household incomes by house age group BRANZ 1999 HCS												
	Percentage											
Decade start	Pre 1900	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	All
<$10,001	0	5	0	0	0	0	3	1	3	5	8	2
10,001-20,000	0	5	9	9	4	11	7	12	3	5	4	7
20,001-30,000	0	5	9	16	8	17	10	16	9	15	4	12
30,001-40,000	13	5	13	12	16	11	13	12	12	15	8	12
40,001-50,000	0	11	3	11	4	9	10	11	8	0	0	8
Over 50,001	75	63	53	47	56	40	45	41	57	58	68	51
Refuse	0	0	9	2	4	6	9	5	7	3	4	5
Don't know	13	5	3	4	8	6	1	1	3	0	4	3
	100	100	100	100	100	100	100	100	100	100	100	100
Number in sample	8	19	32	57	25	35	67	81	76	40	25	465
Average income ($000)	61	52	49	46	52	43	46	43	52	48	53	48

Table 19: The average income of occupants by age of the dwelling

(1999 NZHCS)

Using the last house condition survey, it is possible to see if there are any trends in come and age of house (Table 19). The variation in income across the house age groups is minimal with the lowest average being 1940 and 1960 decades at an average of $43,000 and the highest average income being for those houses built (at least originally built) in the 1900's. This shows there are no particular decades and relating styles of houses that can be targeted because they are classified as having high income owners and therefore more likely to have a greater disposable income.

4.2 The relationship between income and energy use

There appears to be some evidence supporting the theory that the more a household's income is, the more they spend on domestic fuel and power.

As can be seen in Table 20, the expenditure of domestic fuel and power (the red line) rises slowly from approximately $17 per week for those households earning less than $14,900 per year, to just over $30 for those earning between $76,700 and $101,099. However, those earning over $101,100 use slightly less fuel than the previous income bracket.

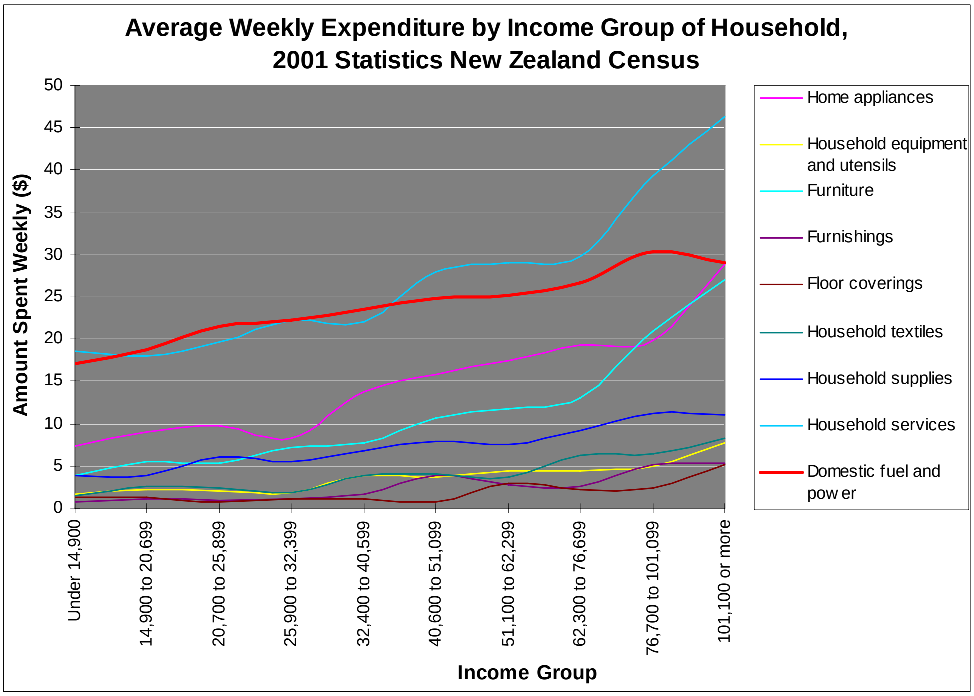


Table 20: Average weekly expenditure by income group of household

(2001 Census, Statistics NZ)

The graph shows an itemised account of weekly expenditure by income group – 2001 Statistics New Zealand Census. There may be several factors influencing expenditure on domestic fuel and power. There is a high proportion of elderly earning annual household incomes of below $20,699 (see Table 18), and these happen to be the segment of the population who are disproportionately represented in the lowest fuel use quintile (see Figure 19).

4.2.1 Life stage vs energy use

Analysis from the HEEP data (HEEP Year 9 report, 2005) indicates there is a relationship between energy use and life stage. First, households whose youngest member is aged five to 14 years tended to be over-represented among the higher total fuel users while, by way of contrast, households whose members are all in excess of retirement years were over-represented among the lowest quintile of total fuel users.

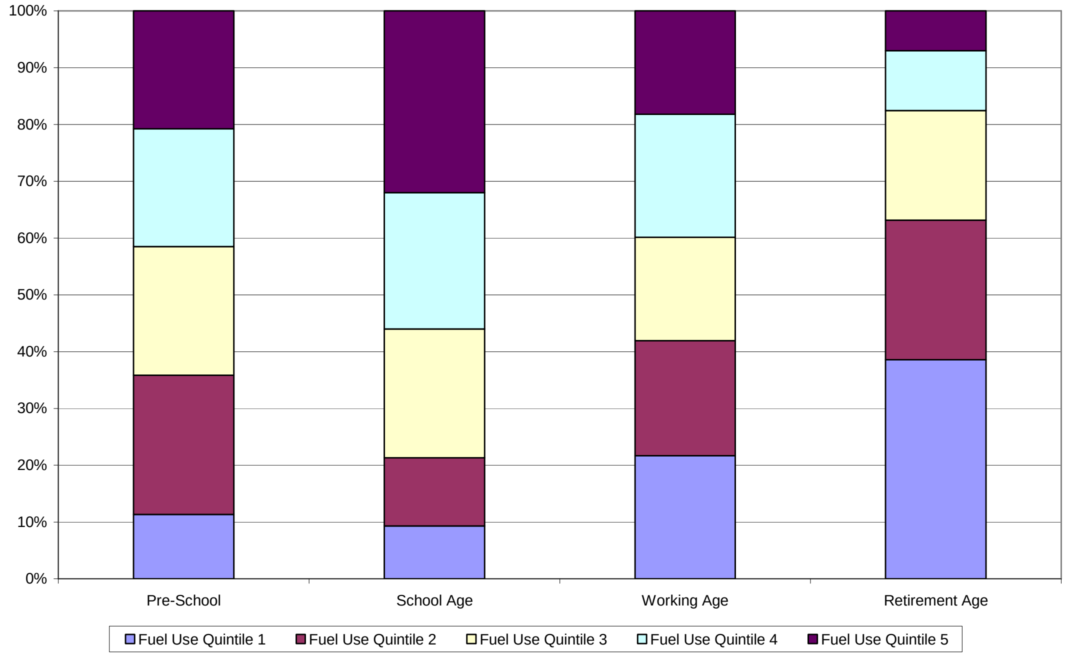


Figure 19: Total fuel use by age of youngest household member of HEEP households. (HEEP Year 9 report)

Income appears to have a slight negative effect on the amount of energy used for space heating in New Zealand households, however it is not significant. This, along with a tendency for the elderly to use little energy for heating, suggests that living in the cold is habitual rather than through virtue of low incomes.

4.2.2 Designing for future needs – ageing population

The face of New Zealand is changing. The typical age of New Zealanders, as well as household size and household makeup, is shifting. As a result, housing needs to be upgraded in such a way that it is flexible to allow for the needs of the population in the future.

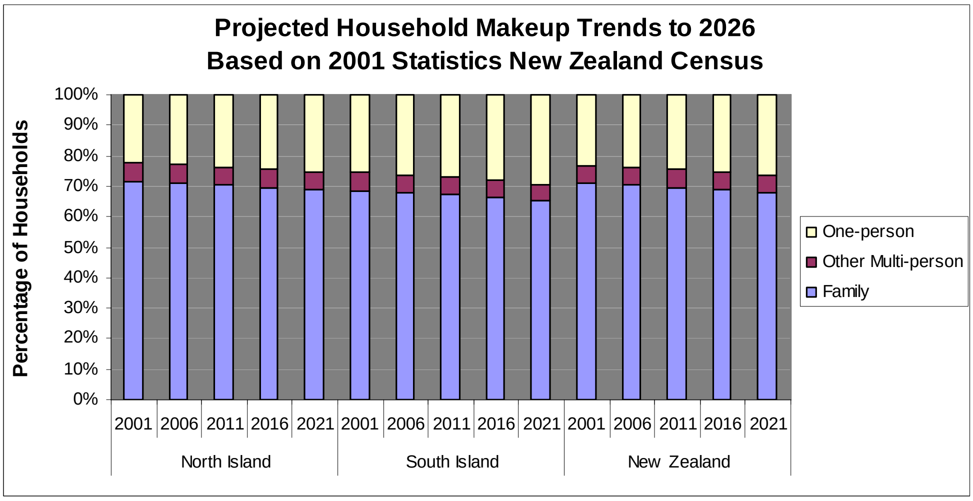


Table 21: Projected household makeup to 2026

(Statistics NZ)

The number of one-person households is expected to increase in both the North and South Islands over the coming years. Meanwhile the numbers of family households are expected to decrease in both the North and South Islands, and multi-person households remain a relatively steady percentage of total households through to 2021, as can be seen in Table 21.

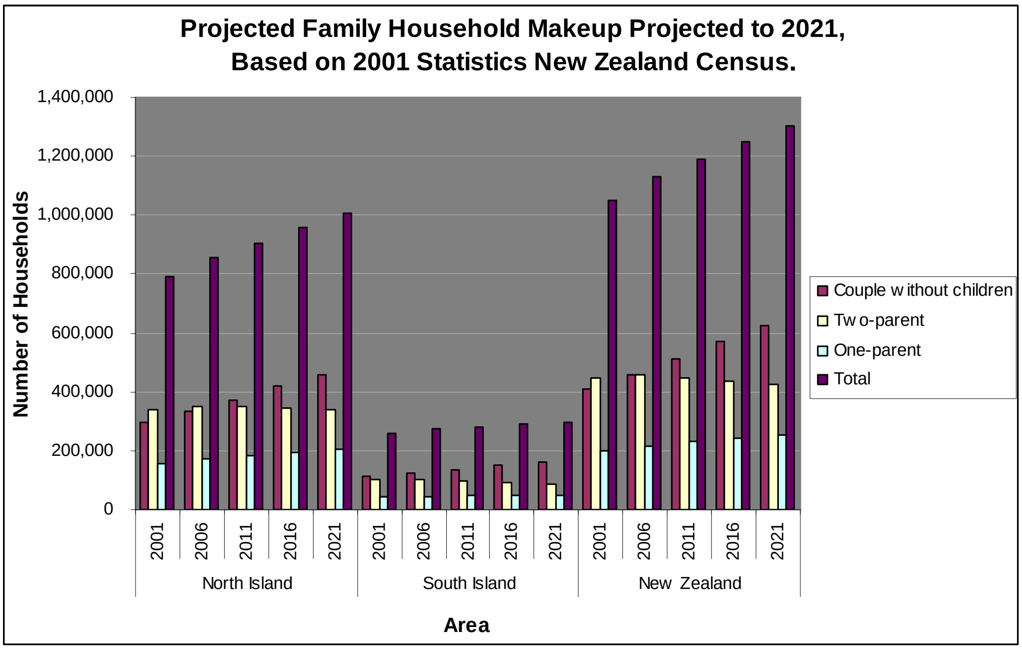


Table 22: The projected household makeup of New Zealand based on a medium forecast based on 2001 census figures from Statistics New Zealand

The number of households is projected to increase more rapidly in the North Island than in the South Island, however the numbers of the types of households are projected to change in both in a similar pattern.

Of any type of household, couples without children are forecast to experience the most growth. This is reflective of the low birth rate and ageing population, as displayed in Table 22. The face of the family is also expected to change, with a rise in the number of one parent families and decline in two parent families.

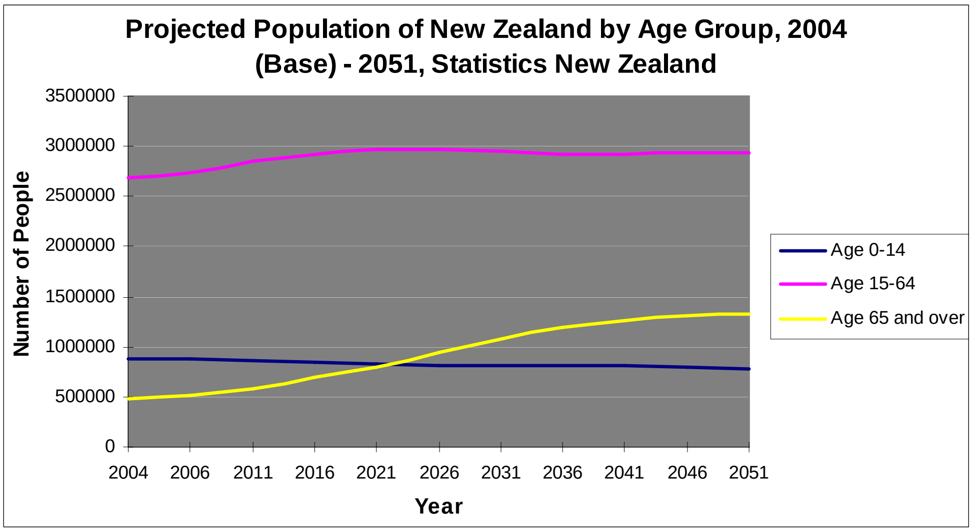


Table 23: The projected population of New Zealand by age group from 2004 (base) to 2051 (Statistics NZ)

New Zealand's population is ageing. With an ageing population, the need for housing suited to elderly occupants is increasing. Elderly and children are the two sectors of society most affected by the living conditions of the homes they reside in. Cooler temperatures have been shown to put physiological stress on the elderly (Howden-Chapman et. al, 1999).

With the number of elderly increasing to above the number of working-age New Zealanders, the issue of falling tax revenue will become an issue. Superannuation payments are likely to remain relatively static whilst the real value falls in order to cope with the sheer number of pensioners. Each working-age New Zealander, assuming that superannuation exists for every elderly member of society, will be supporting more than one pensioner. This is likely to mean reduced capability of elderly to upgrade their homes if the current trend of "asset-rich, cash-poor" elderly continues.

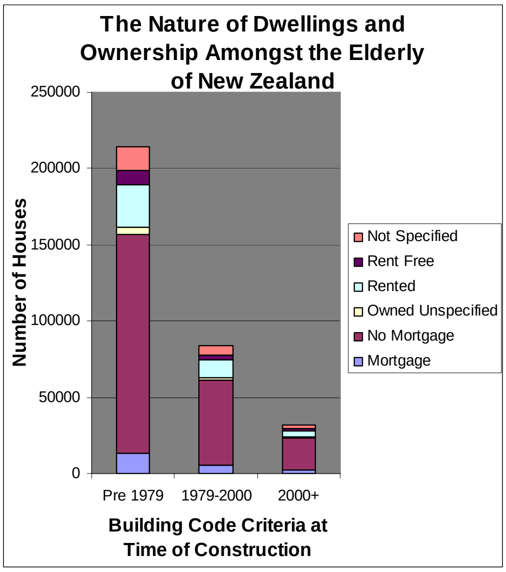


Table 24: The nature of dwellings and homeownership amongst New Zealand's elderly population

(Statistics New Zealand 2001 Census)

The proportion of elderly living in houses built before insulation became mandatory is close to twice that of elderly living in houses with some form of insulation, and nearly seven times that of elderly living in houses built to 2000 Building Code insulation requirements. Approximately 214,000 elderly, many of them living alone, have an average wage of just over $20,000 per year, as can be seen in Table 18, suggesting they have a lesser ability to upgrade their houses than those going mortgage-free just before retirement when incomes are generally higher (see Figure 17 and Table 18).

Through to 2021 the average household numbers of all regions in New Zealand are expected to decline as the population ages.

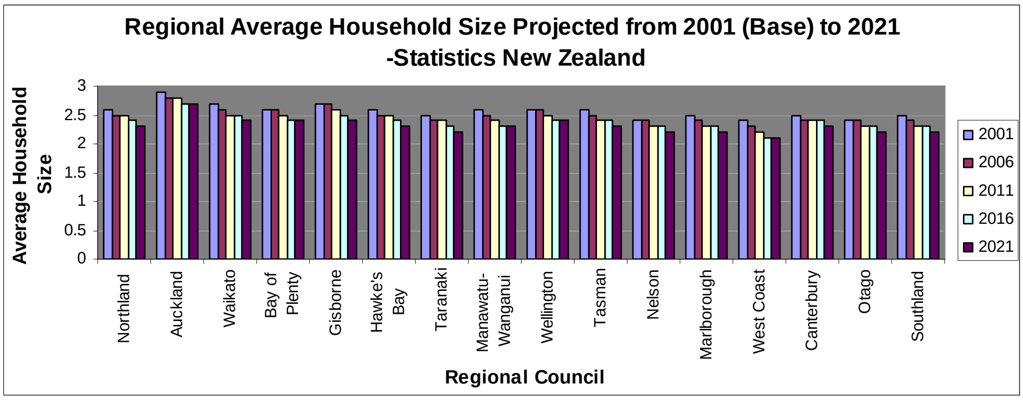


Table 25: The average household size in New Zealand by region projected to 2021 based on the 2001 Statistics New Zealand Census

As can be seen in Table 25, the Auckland and Canterbury regions are expected to see a smaller overall decline than the Wellington region, likely to reflect the higher growth rate of Auckland and Christchurch compared to Wellington. Gisborne is expected to decline, yet retain a relatively high average household size more comparable to the metropolitan regions, however all other regions are expected to see more rapid decline in household numbers as the rural to urban shift continues.

4.3 The housing market

As can be seen in Table 26, there has been a clear upward trend in the number of consents issued throughout New Zealand in recent times. However, it is possible this may decline along with house sales with 2004 providing a high point.

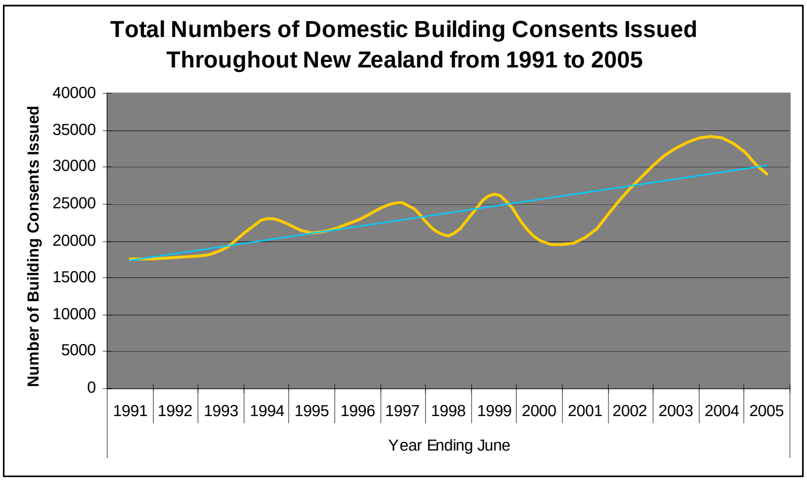


Table 26: The total numbers of domestic building consents issued throughout New Zealand from the year ending June 1991 to June 2005

(Statistics New Zealand, 2005)

The rate of the issue of consents increased from approximately 17,500 in the year ending June 1991, to just over 34,000 in the year ending June 2005. Table 26 also displays fluctuations in the numbers of consents issued from year to year, and clearly displays a dip from 2000 to 2001 during the Asian Financial Crisis. The number of new houses being built in most regions has remained relatively static, however the number of houses being constructed in Auckland has increased rapidly in comparison, as can be seen in Table 27.

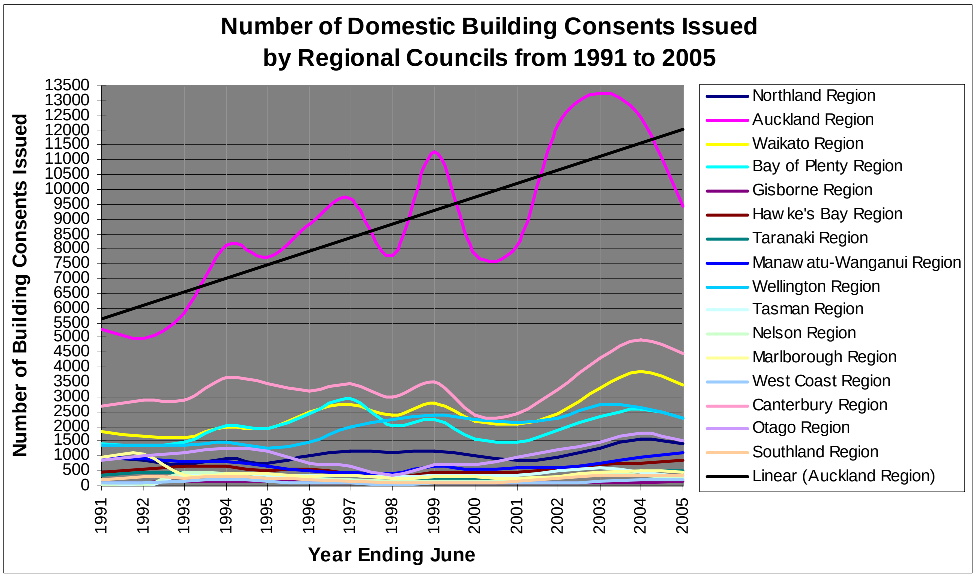


Table 27: Number of domestic building consents issued by regional councils, 1991-2005

The number of building consents granted in Auckland has been increasing steadily over the past ten years. In 2002, the councils in the Auckland region issued over twice the number of building consents for new residential buildings than had been issued in 1991. The dip from 2000 to 2001 was especially evident in Auckland, and coincided with the 2000 to 2001 Asian Financial Crisis.

New Zealand's house sales peaked in 2004, with over 130,000 houses and flats sold in that year, as seen in Table 28.

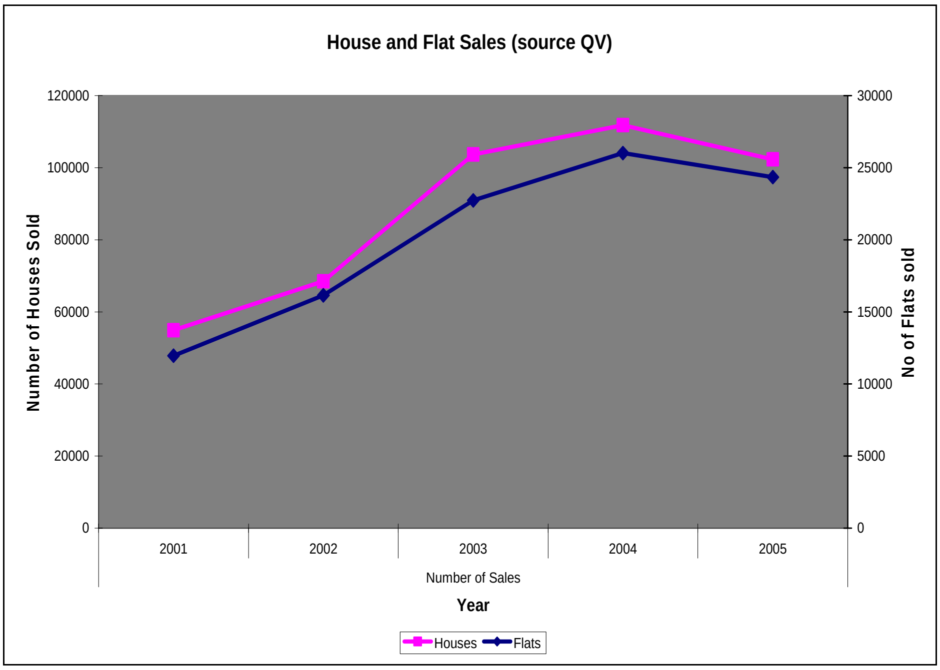


Table 28: Number of houses and flats sold over the last five years, including new housing (QV)

For the estimated 1.6 million dwellings in New Zealand at 130,000 sales per year, it would take an average of just over 12 years for each house to come up for sale at least once. This provides an opportunity for the condition of houses up for sale to be monitored or changed in accordance to needs of the time. However, those preferring to remain in their homes for long periods of time may miss this opportunity.

4.4 New housing and alterations and additions

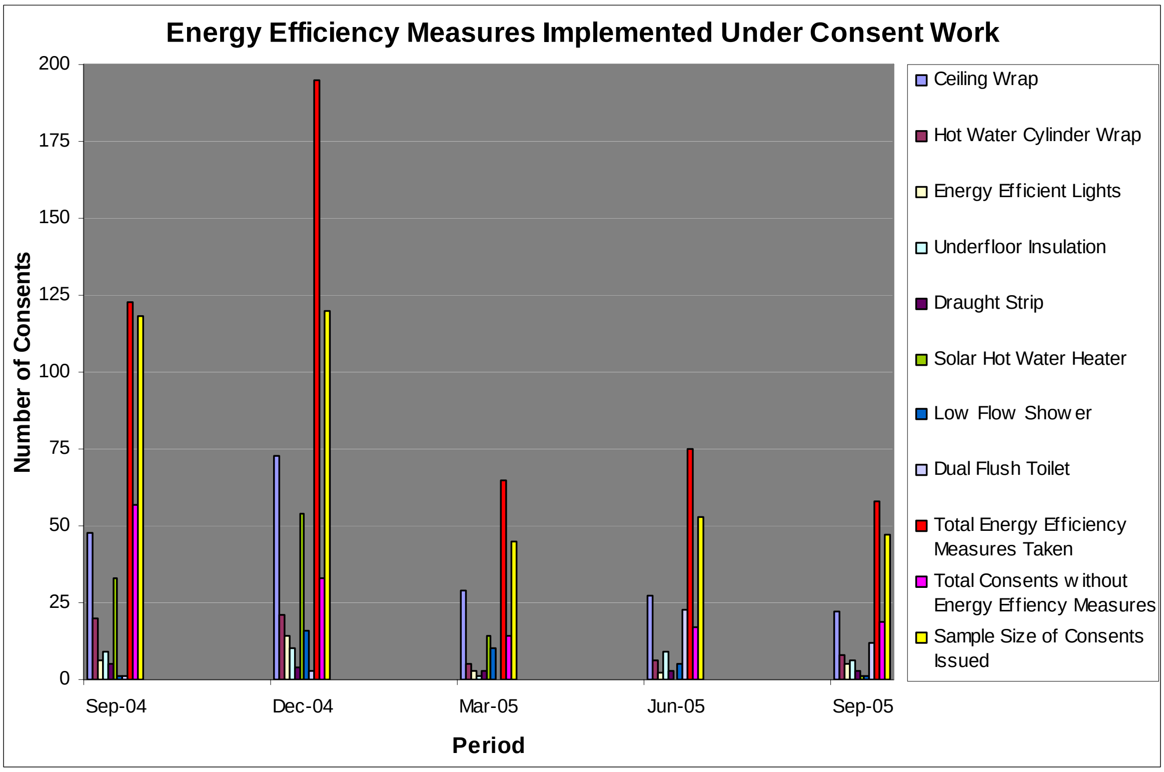


Table 29: The number of energy efficiency measures implemented under consented work throughout New Zealand

(BRANZ consent surveys, 2005-2006)

The low numbers of dual flush toilets reported as 'green' measures in the consent process is low, as can be seen in Table 29. Table 32 shows that dual flush toilets are likely to have been retrofitted into over a quarter of pre 1950s houses, and more than an eighth of 1950 to 1970s houses. This may be due to the market accepting dual flush toilets as the norm upon installation or replacement, thereby not considering them a deliberate environmental decision.

4.4.1 Current domestic-scale additions and alterations

Many New Zealand houses have been added to or altered over their lifetimes. Over a million alterations and additions have been consented in New Zealand's dwellings since 1979, exceeding the number of new houses constructed each year through this period, as can be seen in Table 30.

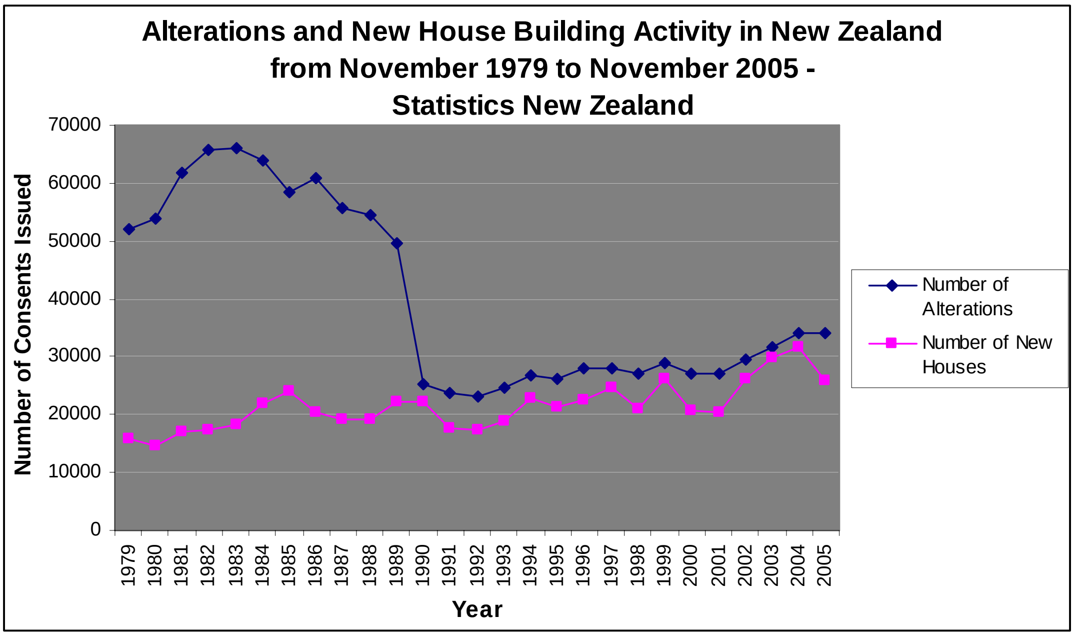


Table 30: The number of alterations compared to new houses in New Zealand from November 1979 to November 2005

(Statistics NZ)

The numbers of additions and alterations not requiring consent, such as retrofits, are likely to be of a considerable number.

The Taylor Nelson Sofres Pty. (TNS) survey picks up work carried out without the need for consent, including decoration, landscaping, repairs, bathroom and kitchen renovations among others[xxv]. As shown in Table 31, by far the most predominant form of home improvements in New Zealand is interior renovation.

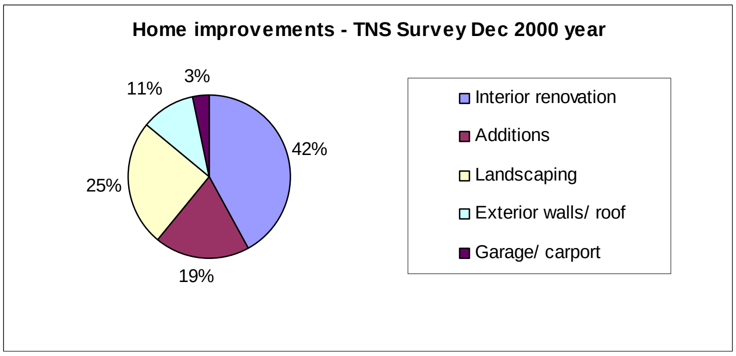


Table 31: The percentage shares of home improvement groupings

(Taylor Nelson Sofres Pty's (TNS) survey 2000)

Houses built between the 1950s and 1970s appear to be slightly less likely to have had some form of retrofit done to them than houses built before 1950 according to the 2005 NZHCS (see Table 32).

Percentages	Percentage incidence	
	Pre 1950s	1950s to 1970s
No retrofits	9	14
Ceiling insulation	38	37
HWC wrap	13	14
Energy efficient lights	4	6
Draught stripping	9	8
Underfloor insulation	0	2
Solar water heater	0	2
Low flow shower	2	4
Dual flush toilet	26	14
	100.0	100.0

Table 32: The percentage incidence of energy efficiency measure

(2005 NZHCS)

This is consistent with income distribution figures by age of dwellings in Table 19. People with the lowest average incomes reside in the homes least likely to be insulated in disproportionately high numbers.

5 Key findings and opportunities for Beacon

When combining the high level analysis from both the physical characteristics of our homes with the market trends and social factors, four key market segments emerge as shown in Figure 20 and overlapping all four segments are alterations and additions. For each section different drivers can be identified to develop options for policy initiatives where Beacon could lobby government, market awareness and education for consumers and opportunities for industry solutions. Each section is discussed in detail below.

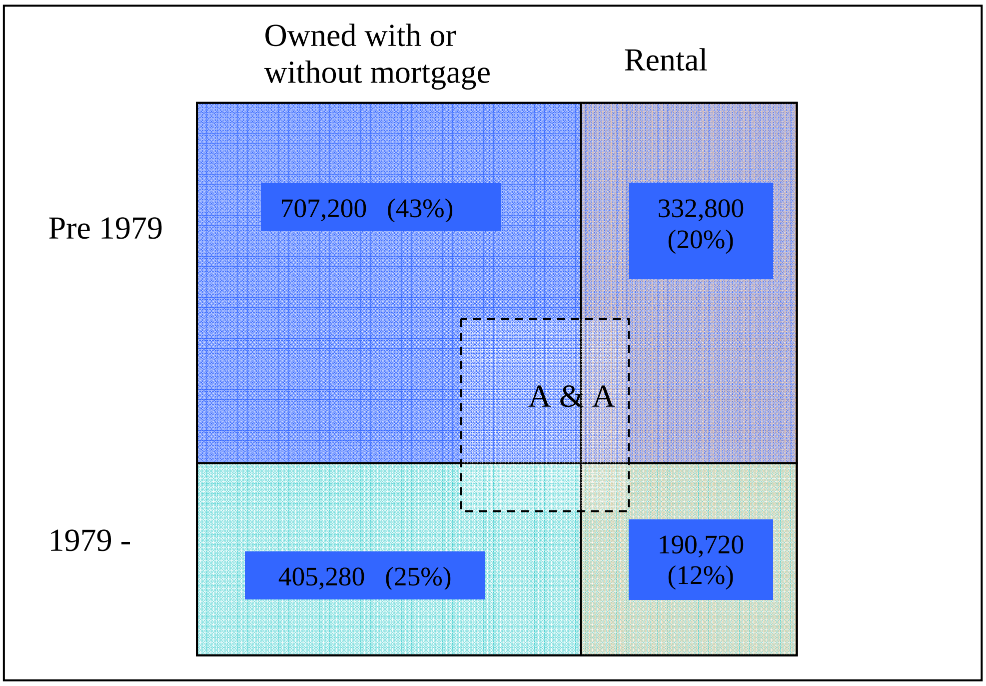


Figure 20: Key market segments for Beacon

5.1 Owning a home

The analysis has shown that a freehold house does not necessarily equate to a higher disposable income so further breakdown between owning a house with or without a mortgage is not necessary. The opportunities tend to be more determined on life stage more than ownership category. The following life-stage categories and opportunities can be integrated into all four market segments:

- *Family with young children*: With young children the desire to ensure the house is kept to a comfortable warm level to prevent sickness it likely to be greater and there is a higher chance of people being at home during the day increasing particularly the heating use over winter.

- *Teenage Children*: It has been long assumed and documented in the early days of HEEP (Pollard, 2002) monitoring the relationship between teenagers (particularly female) and higher energy use. This is a key driver for families either with teenage children or more importantly children who will soon be teenagers to make their home more sustainable, specifically in terms of energy and water use.
- *Retirement age*: The analysis shows at retirement, although it is more likely a person will have a freehold home, their income is reduced significantly. Therefore an opportunity arises for those pre-retirement to sustainably retrofit their homes, providing a home for retirement that has lower operational costs and can provide the desired comfort and amenity. Given the ageing population, the greater likelihood of having a freehold or near to freehold house there is significant opportunity in this segment.

5.1.1 Pre 1979 homes- owned with or without mortgage

As mentioned earlier, the main difference between pre 1979 homes and those built from 1979 onwards is that before this date there was no requirement for houses to be insulated. It is also more likely (purely due to the age) that these houses will require more maintenance so, as a market segment, they are houses with the greatest opportunity to improve and the largest segment (assuming rental properties are equally distributed between pre 1979 houses and those built form 1979 onwards).

5.1.2 Post 1979 homes- owned with or without mortgage

People who have homes built in the last twenty or so years assume, because they are new, they do not need improving, particularly because there is an awareness in New Zealand of old homes being cold and uninsulated. This is likely to be a significant barrier for this market segment but, in reality, these homes are not built with a sustainability focus and, even in the area of energy efficiency, many homes in the segment may not meet Beacon's high standard of sustainability. In terms of water efficiency, there has been little change in our housing stock so potential upgrades for people owning their homes is not age determined.

Both the need to maintain a home and family life-age will be essential drivers to engage with this market segment, which will be necessary if Beacon is going to reach its goal of making 90% of homes sustainable.

5.1.3 Rental homes

This segment of the market is the most challenging of all the segments because the owners will not necessarily reap the ongoing benefits of the improvements directly. In particular owners will be reluctant to upgrade rental homes built after 1979 because of the relative young age of the homes and perception that they are new. Therefore, for Beacon to engage in increasing the sustainability of this market segment, influencing government will be a key factor. This includes encouraging:

- Department of Building and Housing to include minimum levels of sustainability in the Residential Tenancy Act OR
- Setting minimum acceptable levels with the HERS scheme under development
- Requiring landlord to display the HERS rating (or a similar sustainability rating if developed) when advertising a property for rent.
- Look at opportunities to partially subsidise sustainability improvements to take into account the benefits that are passed onto the occupiers of the rental properties to kick-start improvement of this segment.
- For government at all levels to ensure they are upgrading their own rental properties to set a good example to the 'single rental' property landlords.

Information to property owners showing the benefits of improving their properties, including longer tenancy periods and properties being easier to rent, are key for increasing the sustainability of properties in this segment.

5.2 Beacon's key sustainable initiatives

5.2.1 Energy efficiency

Encouraging the upgrade of insulation in pre-1979 homes provides a significant step in increasing the sustainability of the homes by increasing thermal comfort, improving the internal environment quality via improved comfort and reduction in humidity. In upgrading the energy efficiency, there are options available that could be tie in with maintenance if homeowners are aware of them. For example:

- Installing insulating in a skillion roof;
  - when the roof needs replacing to install insulation or
  - when painting the roof consider the costs of lifting the roofing to install insulation and relaying it. This would require up skilling roofers to ensure that, when replacing the roofing nails, they are well sealed to prevent leaks.
- For insulating walls;
  - When redecorating, consider relining to install insulation into the walls

In order for sustainability retrofits to occur, it is essential that homeowners become more aware of the ongoing maintenance requirements of their homes and automatically incorporate sustainability improvements as part of this maintenance.

For these homes, choosing insulation products to meet Beacon's high standard of sustainability should be relatively straightforward as they will typically have little or no insulation in the homes so the question of 'whether they need the extra insulation on top of the current level' will not often arise.

EECA's EnergyWise Home Grant's Scheme for low income homeowners and the development of a Home Energy Rating Scheme (HERS) are two key initiatives the government are currently undertaking specifically aimed at improving the energy efficiency of this market segment. If the HERS scheme becomes mandatory, it has the potential to become an effective way of showing how energy efficient a home is, at point of sale, and placing a dollar value on energy efficiency. Whilst the HERS scheme could become a very useful vehicle for improving the energy efficiency of a home, it will not promote the other areas of sustainability. Nevertheless Beacon should look to promote this type of scheme but acknowledging to the appropriate government parties that it provides only one part of a wider need to improve the sustainability of New Zealand homes.

For some houses in the pre 1979 market segment, the cost and ability to improve them to meet a high standard of sustainability may be too high. This could be due to many factors but, in particular, poor maintenance and the age of the house. This leads to the question about when demolition (recycling and reusing material where appropriate) should be considered. At the moment in New Zealand it is not clear how many houses are demolished each year and the reason for it, however, it is anticipated to be as low as 2000 houses per year. Further work and analysis on the cost of building versus maintaining and upgrading homes to the high standard of sustainability would be needed to determine the potential option for changing the rate of demolitions to improve the overall sustainability of our homes.

The drivers and opportunities to improve houses built after 1979 are the same as water efficiency – see below.

5.2.2 Water efficiency

Options Beacon should be promoting and encouraging to improve water efficiency include installing:

- Rain water tanks (apart for the 10% where town supply is not available)
- Grey water systems
- Water efficient appliances and tap ware, shower roses etc

To encourage improvement of water efficiency of all homes, Beacon needs to work with local councils, encouraging them to promote the use of rainwater tanks and grey water systems. Beacon has an opportunity to educate councils so they have an understanding of the concerns surrounding grey water, the solutions to mitigate those concerns, and include installing a grey water system or rainwater tank as part of the normal consenting process.

It will be easier to engage with those councils that charge for water by metering, as they already not only recognise the cost of water but are encouraging homeowners to be responsible for the amount of water they use. Beacon should also encourage councils to look at ways of subsidising the installation of water tanks to increase the uptake rate

Within central government, the Ministry for the Environment has a campaign to make people more aware of water being a resource that needs to looking after. Beacon can encourage government to continue these campaigns and look at further opportunities to make people aware of ways to become more water efficient and potential subsidy options.

5.2.3 Indoor environment quality

The quality of the indoor environment is a culmination of heating, ventilation and moisture and, for many homes, the improvement in energy efficiency will lead to an improvement in the indoor environment. However Beacon should also develop education and awareness information on ways to improve the internal environment including:

- Installing extractor fans in bathrooms and kitchens (range hoods) where there is excessive water vapour.
- For a small number of homes built after 1979 with poor indoor air quality, it is possible they are airtight so would need extra ventilation by either:
    - A mechanical system (using a heat exchanger for efficiency) to increase the air change rate.
    - Putting security locks that allow windows to be partially opened but secure during the day (this is not advisable)

From a policy perspective, Beacon should:

- Consider lobbying government to ban portable LPG heaters (analysis on fuel poverty and the impact on low incomes is advisable).
- Encourage more specific requirements in the Building Code to ensure good ventilation is built into homes at the design stage.

5.3 Regional specific opportunities

Regional differences in both climate, perceived awareness and attitude to sustainable practice and size of region also offer another option to divide the current market with the key focus being the largest regions, Auckland and Canterbury. Canterbury is the second largest region and has the greatest awareness due to energy efficiency campaigns and potential water shortages.

5.3.1 Auckland

Auckland is by far New Zealand's largest region, containing the largest numbers of pre-1979 houses. Therefore it is feasible to consider singling out Auckland as a key market segment and look at specific actions and research needs for this area. This would likely be more cost effective than using nationwide information and dissemination of knowledge as engaging Auckland is essential and, with the warmer climate, it is likely they will perceive nationwide information "as not needed in Auckland". This has certainly happened in the past with energy efficiency campaigns (e.g. ECNZ HERO scheme, 1995

The warmer climate in Auckland and Northland indicates that it is likely that insulating homes in these regions will save less energy and money compared to more southern regions due to the climate being warmer. Invercargill, on average, requires 10 times the amount of space heating (typically around 1/3 of total energy used in New Zealand houses) as homes in Auckland to attain the same level of comfort. This means that homeowners in Auckland and Northland have a longer payback period, where the savings from the insulation measures slowly cancel out the cost of insulating in the first place. This is a disincentive for homeowners wanting to make substantial savings, especially in Auckland considering it was the 69th most expensive city in the world to live in during 2005 according to the Mercer Cost of Living Rankings[xxvi] .

5.3.2 Christchurch

Christchurch is New Zealand's second largest city, with a projected population for 2006 of 527,400. A cooler climate means houses retrofitted with insulation in the region are likely to experience more savings due to higher energy use, and therefore a shorter payback period than that of Auckland.

In Christchurch both local council initiatives with their own rental properties and energy efficiency programmes and the regional government initiatives with the Clean Heat programme and water issues in Christchurch may make the population more receptive than other areas to installing sustainability measures on a voluntary basis. For this reason Christchurch/Canterbury region should be seen as a key region for Beacon research as it is more likely to provide a "forefront" to the uptake of sustainability compared to other areas.

5.3.3 The rest of the country

Wellington is the third biggest target due to the considerable proportion of the population living there, its relatively cool climate (see Figure 15), propensity to high wind speeds due to its position[xxvii] by the Cook Strait, and slow but consistent growth predicted through to 2026. The slow growth suggests that a large proportion of the population of Wellington will live in pre-1979 houses as new house production slows.

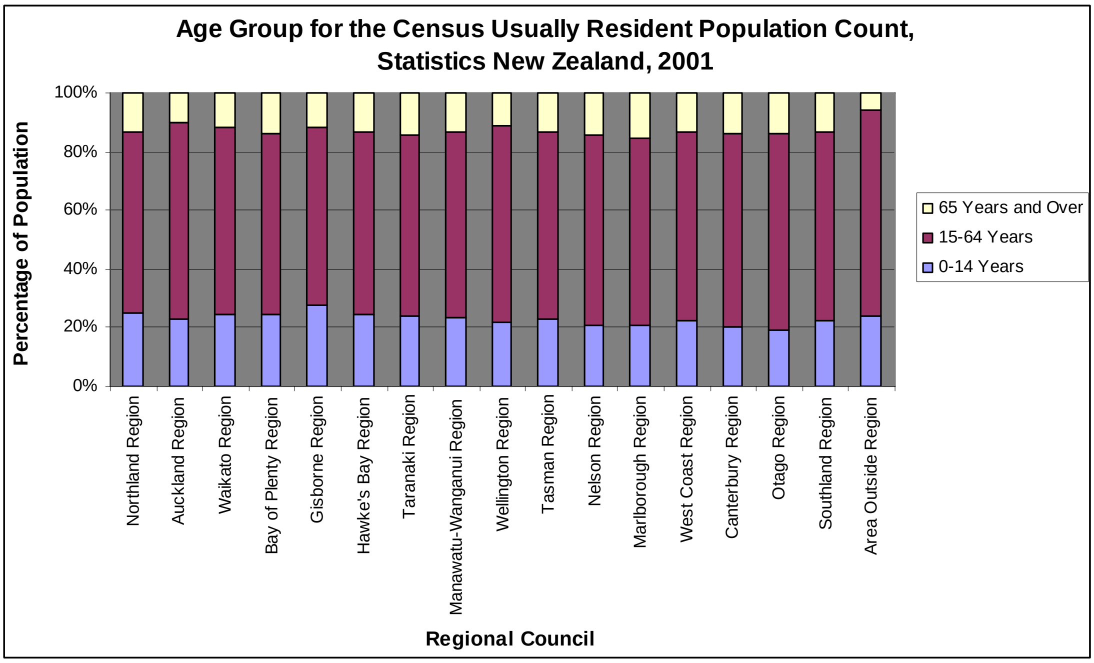


Table 33: Proportions of usually resident population according to age at the 2001 Census by Statistics New Zealand

Other targets include areas with larger proportions of over 65 year olds in their populations, such as Marlborough (15.5%), Nelson (14.3%), Taranaki (14.2%), and Otago (14.0%). This is because retirees are a group of society vulnerable to ill-health influenced by environmental factors. Older people have a greater risk of accidental hypothermia, respiratory disease, and coronary events[xxviii], and are more susceptible to cold stress due to possessing poorer judgement of temperatures than young people[xxix].

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